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NSFC 2015 ANNUAL REPORT

2015 NSFC ANNUAL REPORT

National Natural Science Foundation of China

Add: 83 Shuangqing Road, Haidian District, Beijing.

100085, China

<http://www.nsfc.gov.cn>



National Natural Science Foundation of China

Foreword

Under the robust leadership of the CPC Central Committee and the State Council, the National Natural Science Foundation of China (NSFC) thoroughly implemented the spirit of the Third, Fourth and Fifth Plenary Sessions of the Eighteenth Central Committee of CPC as well as the series of speeches of Xi Jinping, General Secretary of the CPC Central Committee, and worked up to the high standards and strict requirements of the thematic education of “Three Stricts and Three Steadies” in the year 2015 by abiding by the law of basic research, strengthening excellence management, carefully nurturing the atmosphere of original innovation, and focusing on fostering the capacity for original innovation. Throughout the year, NSFC received 173,017 research proposals under various categories of programs from 2,362 research institutions and approved 40,668 awards with a total budget of 21.88 billion yuan, with all planned work making new advances and achievements.



Yang Wei, President
National Natural Science Foundation of China

Stable support was ensured for innovative research, and the innovation capacity was increasingly enhanced. The General Program granted 16,709 awards, accounting for 41% of the total number of awards, and an increase of 1,709 over the previous year. The funding for direct costs of General Program totaled 10.24 billion yuan, accounting for 47% of NSFC's total funding. The average funding rate of General Program was 22.88 %, which effectively supported free exploration in diverse scientific disciplines. The Key Program granted 625 awards with a total funding of 1.788 billion yuan for direct costs and an average funding amount of 2.86 million yuan per award. The Major Program granted 20 awards with funding of 318 million yuan for direct costs. The Special Fund for Research on National Major Research Instruments approved 81 freely applied projects with a total funding of 503 million yuan for direct costs, as well as 5 department-recommended projects with a total funding of 369 million yuan for direct costs.

Innovative talents were selected for cultivation so as to steadily build up the future research team. In furtherance of the role of talents as the first resource, NSFC continued to improve the funding instrument for talent training. The Young Scientists Fund granted 16,155 awards, accounting for 40% of the total number of NSFC awards, with a total funding of 3.195 billion yuan for direct costs, which constituted 15% of NSFC's total funding. The granted projects played a key role in stabilizing and nurturing reserve forces of research. The Fund for Less Developed Regions granted 2,829 awards with a total funding of 1.096 billion yuan for direct costs, making up 5% of

NSFC's total funding, and the funded projects effectively promoted the stability and fostering of research talents in underdeveloped regions. The Excellent Young Scientists Fund funded 400 projects; the National Science Fund for Distinguished Young Scholars funded 198 new projects; and the Science Fund for Creative Research Groups funded 38 projects, promoting the growth of research talents and teams.

The funding scheme was orderly expanded by strengthening strategic coordination. Due attention was paid to the coordination with relevant departments, industries, enterprises and local governments with a view to building strategic alliances in the field of basic research. Cooperation agreements were signed between NSFC and Liaoning Province, Zhejiang Province, Guizhou Province, and Shanxi Province to strongly enhance regional innovation capability by taking into consideration the regional characteristics and developmental needs. The Science Center on Big Data was jointly funded by NSFC and Guangdong Province, and joint funds were launched between NSFC and China Association of Automobile Manufacturers and other eight auto companies. Besides, cooperation agreements were renewed between NSFC and the Civil Aviation Administration of China and Chinese Academy of Sciences. In 2015, all together 716 projects were funded under varied joint funds, with a total funding of 860 million yuan for direct costs.

The profile of NSFC was further raised internationally by steadily deepening cooperation and exchanges. NSFC has so far signed 78 cooperation agreements or memoranda of understanding with 78 science foundations or research funding agencies in 39 countries and regions across the globe. Two major international cooperation initiatives were launched between NSFC and the Natural Environment Research Council(NERC) as well as the Medical Research Council(MRC) of the United Kingdom to co-fund joint research on critical zone observatory research and air pollution and human health. The joint funding pool was constituted by around 100 million yuan from NSFC and around 10 million pounds from NERC and MRC. The collaboration with the UK Royal Society also made substantive breakthroughs by jointly funding the Newton Advanced Fellows who were selected from the grantees of the National Science Fund for Distinguished Young Scholars and the Excellent Young Scientists Fund. The Key International (Regional) Joint Research Program funded 105 projects with total funding of 252 million yuan for direct costs. The Research Fund for International Young Scientists financed 90 new foreign young scholars to carry out research in China and approved 17 foreign young scholars for renewed funding. The scientific and technological cooperation were steadily enhanced between the mainland and Hong Kong, Macao and Taiwan regions.

Strategic planning was substantially completed for future development. By implementing the concept of innovative, coordinated, green, open, and shared development, highlighting the goal of Three Parallels, NSFC accurately grasped its own strategic positioning, clarified development

mandates and safeguard policies, and scientifically outlined the blueprint of NSFC's 13th Five-Year Development Plan. Advice and comments were widely sought from relevant State Council departments, universities, research institutions and academic groups and submitted to the Party Group (Enlarged) Meeting of NSFC for in-depth discussion.


Policies and regulations continued to be bettered by deepening the reform of institutional mechanisms. Firstly, the funding mechanisms were improved to better stimulate innovation. The funding period of the National Science Fund for Distinguished Young Scholars was extended from four years to five years, and the funding period of the Science Fund for Creative Research Groups was changed from the pattern of "3+3+3" years to the pattern of "6+3" years. Secondly, the funding instruments were optimized by revising management regulations. In tandem with the Ministry of Finance, NSFC released the *Regulations on the Management of Grants Awarded by the National Natural Science Foundation of China* which was intended to ensure accurate and practical reform on fiscal funds. Thirdly, the system of departmental regulations was bettered. NSFC revised, developed and released seven regulations, further bettering the regulatory system of NSFC with the *Constitution of the National Natural Science Foundation of China as its core*.

The system of review and supervision was improved and the professional level of management continued to be raised. Firstly, the review system was improved. Efforts were focused on building a scientific, standardized, comprehensive, dynamically updated, secure and reliable expert review system. Secondly, the supervision on review was strengthened. The Code of Conduct for Review Experts and regulations on conflict of interest and confidentiality were released. The information of reviewers for Major Programs, Science Fund for Creative Research Groups and Special Fund for Research on National Major Research Instruments was released before the panel review meetings and the reviewer information for other programs was announced to the public in a week after the panel review meetings. Supervision groups were continued to be sent to all panel review meetings. Thirdly, research integrity was advocated. After scrupulous investigation, serious punishments were conducted to 72 persons responsible for research misconducts by withdrawing 47 approved awards, and the appropriated funds for 41 awards were recovered. In-depth investigation was conducted into the retractions by international journals of articles authored by Chinese scientists, and the *Five Do Nots in Publishing Academic Articles* were jointly released by NSFC and other seven related departments. Fourthly, supervision was strengthened on the use of NSFC funds. Random audit was further normalized and institutionalized by NSFC to strengthen the supervision of granted project funds.

The year of 2016 marks the start of the implementation of the 13th Five-Year Plan, and NSFC will further implement the concept of innovative, coordinated, green, open, and shared development by clearing its own positioning, adhering to overall support, upgrading the pattern of development, and guiding original innovation. Oriented by the strategy of focusing on prospective planning, scientific

breakthroughs, and accurate management, NSFC will launch the 13th Five-Year Development Plan by reforming and bettering management mechanisms, making overall funding plan in consideration of the ideas, talents, instruments and interdisciplinary research, and actively pushing on with relevant pilot implementation of management policies, with a view to promoting NSFC's management to a new level.

The year of 2016 is a crucial year for further implementation of the innovation-driven development strategy. We shall follow the major decisions and plans of the CPC Central Committee and the State Council on the development of science and technology, comprehensively nurture the capability of original innovation, and vigorously explore and create a favorable environment for innovation, so as to enhance China's overall level of basic research and original innovation capability, lay a solid scientific foundation for building China into an innovative country, cultivate new driving force for future development, and make due contribution to early achieving the goal of building China into an innovative country and the China dream of the rejuvenation of the Chinese nation.



Yang Wei
Jan. 2016

Contents

Table of Contents

Foreword

PART I: NSFC Major Events in 2015..... 1

PART II: Project Review..... 11

2.1 Chinese Scientists Discovered the Most Luminous Object with the Most Massive Black Hole in the Early Universe.....	12
2.2 Chinese Scholars Achieve Important Scientific Breakthroughs in the Research of Weyl Fermions.....	13
2.3 Chinese Scholars Found a Novel Low-Frequency Combustion Instability in Scramjets	14
2.4 Chinese Scientist Have Succeeded to Synthesize the First Artificial Photosynthetic Water-Splitting Catalyst in the World.....	15
2.5 Chinese Scientists Made Breakthrough in Assembling Molecular Fractals at Surface...	16
2.6 Chinese Scientists Have Made New Progresses in Epigenetic Regulation of Human Primordial Germ Cells.....	17
2.7 Chinese Scientists Uncovered Membrane Protein <i>COLD1</i> as the Sensor for Cold Signals in Plants.....	18
2.8 Chinese Scholars Revealed for the First Time that Peroxisome Mediates Intracellular Cholesterol Transport.....	19
2.9 Highlighted Progress: Iron Biogeochemical Cycles Coupling with Critical Environmental Processes in Red Soil Area of China.....	20
2.10 Breakthroughs Made on the Research of the Middle Atmosphere —— Lower Ionosphere/Lower Atmosphere Coupling Based on the Ground-Based and Spaceborne Observations.....	22
2.11 Scientists Revealed Nonlinear Interactions Among Internal Tides in the South China Sea.....	23
2.12 The Milestone of Lightning Protection Technique Associated with Power Grid in China.....	24
2.13 Microwave Metallurgical Theory Promotes Reactors Industrialization.....	26
2.14 Tuning and Improvement for the Life-Cycle Performance of Concrete Structures in Marine Environments.....	27
2.15 Key Progress Made on Preparation and Microstructure Control of Photocatalytic Materials.....	28
2.16 Chinese Researcher Made Important Progress in Novel Ultralow-Power Device Technology.....	29
2.17 Research Progress on the Mechanism of the Multifunctional Phototherapy for Cancer	30
2.18 Big Data Revealed Patterns of Human Behavioral Change After Natural Disasters...	31
2.19 Making the Conservation Profitable: the Implementation of Relocation Program in the Concentrated Poverty Area.....	32
2.20 Ad5-EBOV Vaccine, the First Abroad Vaccine Clinical Trials Outside China.....	34

2.21 China Stands at the Forefront of the Research in Clinical Psychiatric Imaging·····	35
2.22 Chinese Scholars Revealed New Regulatory Mechanism in Innate Immunity and Inflammation·····	36
PART III: Introduction on Selected PIs of the Science Fund for Creative Research Groups·····	37
3.1 Lv Caidian, PI of the Creative Research Group in 2015·····	38
3.2 Zhu Xiping, PI of the Creative Research Group in 2015·····	39
3.3 Chen Peng, PI of the Creative Research Group in 2015·····	40
3.4 Jiang Yunbao, PI of the Creative Research Group in 2015·····	41
3.5 Jin Li, PI of the Creative Research Group in 2015·····	42
3.6 Chen Hualan, PI of the Creative Research Group in 2015·····	43
3.7 Wang Dongxiao, PI of the Creative Research Group in 2015·····	44
3.8 Wang Yanxin, PI of the Creative Research Group in 2015·····	45
3.9 Fu Zhengyi, PI of the Creative Research Group in 2015·····	46
3.10 Ma Yuguang, PI of the Creative Research Group in 2015·····	47
3.11 Wang Ruzhu, PI of the Creative Research Group in 2015·····	48
3.12 Ji Xinsheng, PI of the Creative Research Group in 2015·····	50
3.13 Chen Jian, PI of the Creative Research Group in 2015·····	52
3.14 Wei Yiming, PI of the Creative Research Group in 2015·····	53
3.15 Liu Xinbao, PI of the Creative Research Group in 2015·····	55
3.16 Ge Junbo, PI of the Creative Research Group in 2015·····	56
3.17 Qiao Jie, PI of the Creative Research Group in 2015·····	57
3.18 Shen Hongbing, PI of the Creative Research Group in 2015·····	58
PART IV: Introduction on Selected Grantees of the National Science Fund for Distinguished Young Scholars·····	59
4.1 Lu Chaoyang, Gratee of the Fund in 2015·····	60
4.2 Sun Binyong, Gratee of the Fund in 2015·····	61
4.3 Gong Jinlong, Gratee of the Fund in 2015·····	62
4.4 Li Ang, Gratee of the Fund in 2015·····	63
4.5 Li Guohong, Gratee of the Fund in 2015·····	64
4.6 Tian Zhixi, Gratee of the Fund in 2015·····	65
4.7 Yang Yueheng, Gratee of the Fund in 2015·····	66
4.8 Wang Kaicun, Gratee of the Fund in 2015·····	67
4.9 Shan Zhongde, Gratee of the Fund in 2015·····	68
4.10 Xiong Lihua, Gratee of the Fund in 2015·····	69
4.11 Yu Rong, Gratee of the Fund in 2015·····	70
4.12 Wu Ligang, Gratee of the Fund in 2015·····	71
4.13 Zhang Yongdong, Gratee of the Fund in 2015·····	72
4.14 Shu Jia, Gratee of the Fund in 2015·····	73
4.15 Huo Baofeng, Gratee of the Fund in 2015·····	74

4.16 Ju Zhenyu, Grantee of the Fund in 2015.....	75
4.17 Shu Yuelong, Grantee of the Fund in 2015.....	76
4.18 Zhao Qiang, Grantee of the Fund in 2015.....	77
PART V: Financial Statistics of NSFC's Funding in 2015.....	78
5.1 Statistics of Financial Allocations for NSFC in 2015.....	78
5.2 NSFC Funding for Projects Approved in 2015.....	79
5.3 Funds for Research Programs.....	80
5.4 Funds for Talented Professionals.....	85
5.5 Funding of Environment Construction Programs.....	105
PART VI: Completion and Evaluation of NSFC Projects.....	114
6.1 Completion of General Program Projects.....	115
6.2 Completion of Key Program Projects.....	115
6.3 Completion of Major Program Projects.....	115
6.4 Completion of Major Research Plan Projects.....	116
6.5 Completion of Young Scientists Fund Projects.....	116
6.6 Completion of Projects of the Fund for Less Developed Regions.....	117
6.7 Completion of Projects of the National Science Fund for Distinguished Young Scholars...	117
6.8 Completion of Projects of the Science Fund for Creative Research Groups.....	118
6.9 Statistics of NSFC's Support to Awardees of the State Natural Science Award of 2015...	118
6.10 Statistics of NSFC's Support to Awardees of the State Technological Invention Award of 2015.....	128
6.11 Statistics of NSFC's Support to Awardees of the National Science and Technology Progress Award of 2015.....	128
PART VII: International (Regional) Cooperation and Exchange.....	136
PART VIII: Organizational Structure and Personnel of NSFC.....	148
PART IX: Supervision and Auditing Work of NSFC.....	152
PART X: Other Work of NSFC.....	155



PART I

NSFC Major Events in 2015

January

Jan. 5 A democratic life meeting was held by the NSFC CPC Leading Group. The meeting was chaired by Yang Wei, Secretary of the NSFC CPC Leading Group. Wang Zhengfu, Head of the 28th Central Steering Group, attended the meeting and made remarks.

Jan. 5 President Yang Wei met with Dr. Guillaume Long, Ecuador's Minister of Knowledge and Human Talent, and René Ramirez, Ecuador's National Secretary of the National Secretariat of Higher Education, Science, Technology and Innovation (SENESCYT). The two sides signed the *Memorandum of Understanding on Scientific Cooperation between NSFC and SENESCYT*.



NSFC-SENESCYT MoU signed in Beijing

Jan. 9 President Yang Wei and Vice President Yao Jiannian attended the National Science and Technology Awards Ceremony of 2014.

Jan. 12-14 President Yang Wei and Vice President He Minghong attended the 5th Plenary Session of the 18th CPC Central Commission for Discipline Inspection.

Jan. 13-15 NSFC held a National Natural Science Fund management training meeting in Beijing.

Jan. 15-16 The interview meeting for "Thousand Talent Program for Young Scholars" of 2014 was held in Beijing. President Yang Wei attended the opening ceremony and made remarks. Vice President Gao Ruiping attended the meeting.



National Science Fund Management Training Meeting for Host Institutions held in Guiyang

Jan. 16 The *NSFC-CAS Agreements on Joint Fund of Research on Major Science Facilities (the 3rd phase)* and *Joint Fund of Astronomy (the 4th phase)* were signed by President Yang Wei and Professor Ding Zhongli, Vice President of Chinese Academy of Sciences.

Jan. 29 President Yang Wei attended the First Meeting of the China-Israel Joint Committee on Innovation Cooperation co-chaired by Vice Premier Liu Yandong and Israel's Foreign Minister Avigdor Lieberman.

February

Feb. 10 The thematic training meeting for secretaries of grass root party organizations to implement main responsibilities of building a clean and honest party was held. President Yang Wei attended the meeting and made a mobilization speech. Wu Haiying, Deputy Secretary of the Commission for Discipline Inspection of Central State Organs, made a training report. The meeting was chaired by Vice President Gao Ruiping. Heads of NSFC departments and bureaus, members of NSFC party committee, members of NSFC commission for discipline inspection attended the meeting.



The thematic training meeting for secretaries of grassroot party organizations to implement main responsibilities of building a clean and honest party held at NSFC

March

Mar. 3-13 Vice President Gao Wen attended the Third Session of the 12th CPPCC National Committee.

Mar. 5-15 President Yang Wei, Vice Presidents Shen Yan and Yao Jiannian attended the Third Session of the 12th National People's Congress.

Mar. 9 The *NSFC-Zhejiang Province Agreement on the Joint Fund for the Integration of Industrialization and Informatization* was signed by President Yang Wei and Li Qiang, Governor of the People's Government of



The NSFC-Zhejiang Province Agreement on the Joint Fund for the Integration of Industrialization and Informatization signed Zhejiang Province. Vice Presidents Yao Jiannian, He Minghong, Gao Wen and Gao Ruiping attended the signing ceremony.

Mar. 16 President Yang Wei chaired the meeting to convey the spirits of the Third Session of the 12th CPPCC National Committee and the Third Session of the 12th National People's Congress to all NSFC staff. Vice President Yao Jiannian conveyed the essence of the Third Session of the 12th National People's Congress and Vice President Gao Wen conveyed the essence of the Third Session of the 12th CPPCC National Committee.



President Yang Wei chairing the meeting to convey the spirits of the Third Session of the 12th CPPCC National Committee and the Third Session of the 12th National Peoples' Congress to all NSFC staffs

Mar. 19 President Yang Wei and Vice Presidents He Minghong and Gao Ruiping paid an inspection visit to



President Yang Wei, Vice Presidents He Minghong and Gao Ruiping at the receiving site for applications in 2015

the receiving site for applications in 2015.

Mar. 20 NSFC annual application closed and a total of 165,598 applications were received.

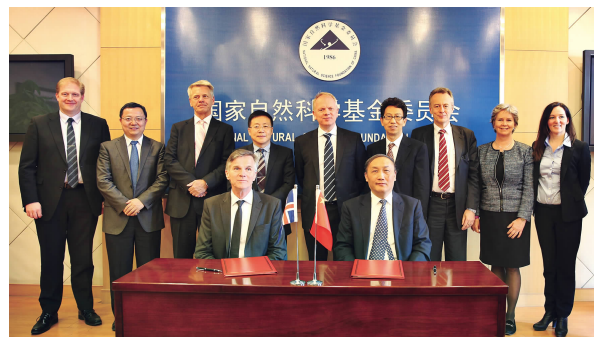
Mar. 24 The Third Plenary Session of the 7th NSFC General Assembly was held in Beijing. All members of the 7th NSFC General Assembly attended the meeting, together with members of the 4th Supervision Committee of NSFC and heads of all NSFC departments and bureaus. All NSFC staff listened to the plenary reports.



The Third Plenary Session of the 7th NSFC General Assembly held in Beijing

Mar. 24-25 The Sixth Plenary Session of the 4th Supervision Committee of NSFC was held.

Mar. 25 President Yang Wei and Vice President Liu Congqiang met with Mr. Illugi Gunnarsson, Minister of Education, Science and Culture of Iceland. President Yang Wei and Dr. Hallgrimur Jonasson, General Director of the Icelandic Center for Research (RANNIS), signed the *Memorandum of Understanding on Cooperation between NSFC and RANNIS*.



President Yang Wei and Minister of Education, Science and Culture of Iceland signing the MoU between NSFC and RANNIS

Mar. 26 The Xiangshan Science Conference on Strengthening Basic Research and Indigenous Innovation was held. President Yang Wei attended the conference and delivered a keynote presentation. Vice President Gao Ruiping attended the conference.

Mar. 31 President Yang Wei met with Arkin Tuniyazi,

Standing Committee member of the CPC Xinjiang Uygur Autonomous Region Committee and Vice Chairman of the People's Government of the Xinjiang Uygur Autonomous Region. Vice President Gao Ruiping chaired the meeting.

April

Apr. 7 The Symposium and Signing Ceremony for the *Agreement of Joint Fund of Innovation for China Automobile Industry* was held at China Hall of Science and Technology. President Yang Wei attended the symposium and signing ceremony. Vice President Gao Ruiping, Executive Vice Chairman Dong Yang of the China Association of Automobile Manufacturers and representatives from eight automobile enterprises signed on the agreement.



Agreement of Joint Fund of Innovation for China Automobile Industry signed in Beijing

Apr. 9 The *NSFC-Shanxi Province Agreement on the Joint Fund of Coal-Based Low-Carbon Technology* was signed by President Yang Wei and Li Xiaopeng, Governor of the People's Government of Shanxi Province. Vice Presidents Yao Jiannian, Gao Ruiping and Zhang Fuming, Vice Governor of Shanxi Province, attended the signing ceremony.



The *NSFC-Shanxi Province Agreement on the Joint Fund of Coal-Based Low-Carbon Technology* signed

Apr. 15 NSFC and Ministry of Finance jointly issued the *Methods of the Management of Grants for NSFC-Funded Projects*.

Apr. 23 NSFC held a National Science Fund management training meeting in Guiyang.

May

May 12 *Methods of the Management of Appeal of National Science Fund Projects, Methods of the Avoidance of Conflicts of Interests and Confidentiality in the Evaluation of National Science Fund Projects, Methods of the Management of Major Research Plan Program of the National Science Fund* were approved by the 5th NSFC Executive Committee meeting.

May 13 President Yang Wei gave a thematic lecture on the Three Stricts and Three Steadies to all NSFC staffs. Vice Presidents He Minghong and Gao Ruiping attended the meeting.

May 14 Vice President Gao Ruiping attended the first plenary meeting of the Inter-Ministerial Liaison Meeting on the Management of National Science and Technology Plans (Special Program or Funds).

May 20 The Basic Research Knowledge Database of National Natural Science Fund was officially online. The database currently provides open access to 135,100 articles published by NSFC-funded projects, covering over 9,700 journals and including over 200 thousands authors and 1,300 research institutions.

May 23 The *NSFC-Guangdong Province Agreement on Joint Funding of the Research Center on Big Data* was signed by President Yang Wei and Zhu Xiaodan, Governor of the People's Government of Guangdong Province. Vice Presidents Gao Ruiping, Han Yu, Director-General of the NSFC General Office, and Chen Yunxian, Vice Governor of Guangdong Province, attended the signing ceremony.



The *NSFC-Guangdong Province Agreement on Joint Funding of the Research Center on Big Data* signed

May 25 The NSFC-Guizhou Province Agreement on Joint Funding of the Scientific Research Center on Karst Science was signed by President Yang Wei and He Li, Vice Governor of the People's Government of Guizhou Province.



The NSFC-Guizhou Province Agreement on Joint Funding of the Scientific Research Center on Karst Science signed

May 25–28 A delegation led by Vice President Liu Congqiang attended the 4th Annual Meeting of the Global Research Council held in Tokyo, Japan. The meeting endorsed the *Statement of Principles for Funding Scientific Breakthroughs* and the *Statement of Approaches: Building Research and Education Capacity*.



Vice President Liu Congqiang attending the 4th Annual Meeting of the Global Research Council

May 30–Jun. 7 President Yang Wei paid a visit to Brazil and Argentina, attended the 4th World Conference on Research Integrity and visited the Federal University of Rio de Janeiro and the Brazil National Institute for Pure and Applied Mathematics. President Yang Wei also signed the *Memorandum of Understanding on Scientific Cooperation between NSFC and National Scientific and Technical Research Council of Argentina*.

June

Jun. 9 The NSFC CPC Leading Group held the first thematic symposium on Three Stricts and Three

Steadies. Secretary Yang Wei chaired the symposium.

Jun. 15 The Working Meeting on the Implementation of *Methods of the Management of Grants of NSFC-Funded Projects* was held at Beijing Conference Center. President Yang Wei attended the meeting and made remarks. Vice President Gao Ruiping chaired the meeting. To promote the implementation of the *Methods of the Management of Grants of NSFC-Funded Projects*, NSFC organized a circuit of training to six regions from Jul. 2 to Sep. 15.



President Yang Wei delivering the speech titled *Making Good Use of the Natural Science Fund and Jointly Promoting the Prosperity of Science*

Jun. 16 Vice President Gao Ruiping attended the second plenary meeting of the Inter-Ministerial Liaison Meeting on the Management of National Science and Technology Plans (Special Program or Funds).

Jun. 17–23 A delegation led by Vice President He Minghong paid a visit to Russia and Sweden. Vice President He Minghong attended the Workshop jointly held by NSFC and Russian Foundation for Basic Research to celebrate the 20th anniversary of bilateral cooperation and delivered a keynote presentation. He also signed the *Working Plan between NSFC and STINT* jointly with Andreas Gothenberg, Executive Director of the Swedish Foundation for International



Vice President He Minghong signing the *Working Plan between NSFC and STINT* jointly with Andreas Gothenberg, Executive Director of the Swedish Foundation for International Cooperation in Research and Higher Education

Cooperation in Research and Higher Education (STINT).

Jun. 19 The 4th Meeting of the NSFC-CAS Joint Leading Group of Strategic Research on Disciplinary Development was held in Beijing. Academician Chen Yiyu, Head of the Joint Leading Group, chaired the meeting. Vice President Yao Jiannian, Deputy Head of the Joint Leading Group, attended the meeting and made remarks.

Jun. 28–29 A delegation led by Vice President Liu Congqiang attended the 2nd China-EU High Level Dialogue on Innovation Cooperation held in Brussels. Witnessed by Premier Li Keqiang and the President of European Commission Jean-Claude Juncker, Vice President Liu Congqiang and Mr. Carlos Moedas, European Commissioner for Research, Science and Innovation, signed the *Implementing Arrangement between NSFC and the European Commission for Chinese Researchers hosted by the European Research Council Grantees in Europe*.



Implementing Arrangement between NSFC and the European Commission for Chinese Researchers hosted by the European Research Council Grantees in Europe signed

July

Jul. 1 President Yang Wei attended the 14th meeting of the Central Leading Group for Comprehensively Deepening Reforms.

Jul. 1 President Yang Wei attended the thematic party lecture on Three Stricts and Three Steadies chaired by Vice Premier Liu Yandong.

Jul. 1 NSFC held a thematic Party Day activity of “keeping the history firmly in mind and strengthening faith” at the Anti-Japanese War Memorial Hall at Pingxi Fangshan. A team of party members and applicants for party membership led by Vice President Gao Ruiping participated in the activity.

Jul. 2 NSFC held a National Science Fund management training meeting in Qingdao.

Jul. 7 The NSFC CPC Leading Group held the 2nd thematic symposium on Three Stricts and Three Steadies. Secretary Yang Wei chaired the symposium.

Jul. 7 The 7th NSFC Executive Committee meeting (enlarged session) approved the launching of two Major Research Plan Programs: “Catalysis Science on the High-Efficiency Conversion of Coal-Based Energy” and “Research on Big Data-Driven Management and Decision-Making”.

Jul. 7 *Methods of the Management of Major Program of National Natural Science Fund, Methods of the Management of Works Related to Reviewers of the National Natural Science Fund Projects, Implementing Regulations of the Registration of Host Institutions and Implementing Regulations of the Management of Regional Liaison Network of the National Natural Science Fund* were approved by the 8th NSFC Executive Committee meeting.

Jul. 22–24 The 2015 panel meeting for the Special Fund for Research on National Major Research Instruments (free application) was held at Jinma Mansion. President Yang Wei and Vice President Gao Ruiping attended the meeting.

Jul. 27–28 The 2015 panel meeting for the Special Fund for Research on National Major Research Instruments (department recommended) was held at Xijiao Hotel Beijing. President Yang Wei and Vice President Gao Ruiping attended the meeting.

Jul. 29 Vice President Gao Ruiping attended the 3rd plenary meeting of the Inter-Ministerial Liaison Meeting on the Management of National Science and Technology Plans (Special Program or Funds).

Jul. 29 The 4th session of the Joint Leading Group of NSFC-CAE Strategic Research on Mid- and Long-Term S&T Development was held at CAE. As the Heads of the joint leading group, President Yang Wei and CAE President Zhou Ji attended the meeting and made remarks. Vice President Gao Wen, Deputy Head of the joint leading group, chaired the meeting.



The 4th session of the Joint Leading Group of NSFC-CAE Strategic Research on Mid- and Long-Term S&T Development held

August

Jug. 6–7 The 2015 Joint Working Meeting of the NSFC-Guangdong Joint Fund, the NSFC-Yunnan Joint Fund, NSFC-Xinjiang Joint Fund, and the Joint Fund to Promote Cross-strait Scientific and Technological Cooperation was held in Beijing. President Yang Wei, Vice President Gao Ruiping, members of steering committees and administrative offices of the joint funds, heads and coordinators of relevant departments attended the meeting.

Jug. 21 NSFC held a press conference on the progress of project funding of 2015. President Yang Wei and Vice President Gao Ruiping briefed the progress and new features of the evaluation and funding of National Natural Science Fund projects in 2015. Vice President He Minghong chaired the press conference.



Press conference on the progress of project funding of 2015 held

Jug. 31–Sep. 1 The 2015 panel meeting and steering committee meeting of the Joint Fund to Promote Cross-strait Scientific and Technological Cooperation was held in Putian, Fujian. President Yang Wei, Vice President Gao Ruiping, members of the steering committee and administrative office of the joint fund, heads and coordinators of relevant departments attended the meeting.

September

Sep. 3 President Yang Wei, Vice Presidents Yao Jiannian and Liu Congqiang attended the military parade to commemorate the 70th anniversary of the victory in the Chinese People's War of Resistance against Japanese Aggression and the World Anti-Fascist War.

Sep. 8 The NSFC CPC Leading Group held the 3rd thematic symposium on Three Stricts and Three Steadies. Secretary Yang Wei chaired the symposium.

Sep. 8 The 10th NSFC Executive Committee meeting approved the *Methods of the Management of*

Joint Funds of National Natural Science Fund and the Methods of the Management of Research Outputs of NSFC-Funded Projects.

Sep. 9–10 The 7th Plenary Session of the 4th NSF Supervision Committee was held in Beijing. Academician Chen Yiyu, President of the Supervision Committee, chaired the meeting. Vice President He Minghong and all members of the Supervision Committee attended the meeting.



The 7th Plenary Session of the 4th NSF Supervision Committee held in Beijing

Sep. 9–12 The 2015 panel meeting and steering committee meeting of the NSFC-Guangdong Joint Fund, the NSFC-Yunnan Joint Fund and the NSFC-Xinjiang Joint Fund was held in Kunming. President Yang Wei, Vice President Gao Ruiping, members of the steering committees and administrative offices of the joint funds, heads and coordinators of relevant departments attended the meeting.



The 2015 panel meeting of the NSFC-Guangdong Joint Fund, the NSFC-Yunnan Joint Fund and the NSFC-Xinjiang Joint Fund held in Kunming

Sep. 15 NSFC held a lecture on the education of Three Stricts and Three Steadies. President Yang Wei chaired the lecture.

Sep. 15 President Yang Wei and Li Xiaojie, Vice Minister of Culture and Director-General of State Administration of Cultural Heritage (SACH), signed the *Strategic Cooperation Agreement Between NSFC and*



Strategic Cooperation Agreement Between NSFC and SACH signed

SACH. Han Yu, Director-General of NSFC General Office, presided over the signing ceremony.

Sep. 16 Vice President He Minghong attended the 2015 Education and Lecture Meeting on Scientific Ethics and Building of an Honest Learning Atmosphere of Higher Education Institutions in Beijing.

Sep. 16–23 A delegation led by Vice President Liu Congqiang paid a visit to the United Kingdom and Russia. In the UK, Vice President Liu Congqiang attended the 3rd meeting of China-UK High Level People to People Dialogue co-chaired by Vice Premier Liu Yandong and UK's Secretary of State for Health Jeremy Hunt, signed the *NSFC-STFC (Science and Technology Facilities Council) Memorandum of Understanding* with STFC's Executive Director Andrew Taylor and attended the joint panel meeting on NSFC's new initiative for Major International Cooperation Programs. In Russia, Vice President Liu Congqiang met with RFBR President Professor Vladislav Panchenko and Vice President Vladimir Kvardakov.

Sep. 18 The 1st meeting of the expert committee of NSFC-Guangdong Scientific Research Center on Big Data was held in Beijing. Vice President Gao Wen chaired the discussion meeting on the guide to the 2015 Program of Scientific Research Center on Big Data.

Sep. 25 The review committee meeting of 2015 National Science Fund for Distinguished Young Scholars was held in Beijing. President Yang Wei attended the meeting and made remarks. Vice President Gao Ruiping attended the meeting.

Sep. 29 Vice President Gao Ruiping attended the fourth plenary meeting of the Inter-Ministerial Liaison Meeting on the Management of National Science and Technology Plans (Special Program or Funds).

October

Oct. 13 The 11th NSFC Executive Committee meeting (enlarged session) approved the launching of Major Research Plan Program "Runoff Change and Adaptive Use of Resources of Riverhead Regions in Southwest China".

Oct. 15 The NSFC CPC Leading Group held a study meeting of the Leading Party Group and the Central Party Group (enlarged session). Secretary Yang Wei chaired the meeting.

Oct. 19 The Signing Ceremony of the *Agreement of the NSFC-Henan Joint Fund (the 2nd phase)* was held in Zhengzhou. President Yang Wei, Vice President Gao Ruiping, Governor Xie Fuzhan and Vice Governor Xu Jichao of Henan Province and heads of relevant departments from both sides attended the signing ceremony. Vice President Gao Ruiping and Vice Governor Xu Jichao signed the agreement on behalf of NSFC and the People's Government of Henan Province.



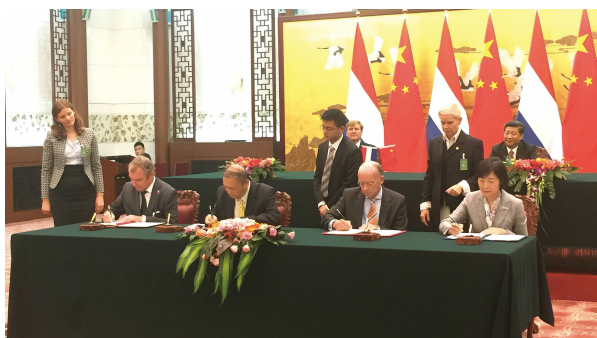
The Agreement of the NSFC-Henan Joint Fund (the 2nd phase) signed in Zhengzhou

Oct. 19 Vice President Shen Yan attended the annual meeting of the Grand Challenges program of the Bill & Melinda Gates Foundation and signed the *Memorandum of Understanding on Cooperation Between NSFC and Bill & Melinda Gates Foundation*.



Memorandum of Understanding on Cooperation Between NSFC and Bill & Melinda Gates Foundation signed

Oct. 26 President Yang Wei signed the *Memorandum of Understanding on Scientific Cooperation and Exchange Between NSFC and the Netherlands Organization for Scientific Research* (NWO) with NWO President Jos Engelen. President Xi Jinping and the king of the Kingdom of Netherlands Willem-Alexander witnessed the signing ceremony.



Memorandum of Understanding on Scientific Cooperation and Exchange Between NSFC and the Netherlands Organization for Scientific Research signed

Oct. 27–28 The 2015 Assessment Meeting of the Science Fund for Creative Research Groups was held. Vice President Gao Ruiping attended the meeting and made remarks.

Oct. 29 The Mid-Term Assessment Meeting for the 1st Group of Major Research Plan Projects during the “12th Five-Year Plan” Period was held in Beijing. Vice President Gao Ruiping attended the meeting.

Oct. 30 NSFC held a meeting to convey and learn the spirits of the 5th Plenary Session of the 18th CPC Central Committee. Secretary of the NSFC CPC Leading Group Yang Wei chaired the meeting. Members of the NSFC CPC Leading Group, Shen Yan, He Minghong, Liu Congqiang, Gao Wen and Gao Ruiping attended the meeting.



The meeting to convey and learn the spirits of the 5th Plenary Session of the 18th CPC Central Committee held

November

Nov. 3–6 The Enlarged Meeting of NSFC CPC Leading

Group was held in Beijing. The theme of the meeting is to learn and implement the spirits of the 5th Plenary Session of the 18th CPC Central Committee and make in-depth discussion of the “13th Five-Year Plan” for the Development of the National Natural Science Fund. President Yang Wei made a speech entitled “Funding of Basic Research in the Transition Period: the Approach to Promote Basic Research of China during the 13th Five-Year Plan Period”.



The Enlarged Meeting of NSFC CPC Leading Group held in Beijing

Nov. 17 President Yang Wei met with Dr. Low Teck Seng, CEO of the National Research Foundation (NRF) of Singapore. The two parties signed the *Memorandum of Understanding Between NSFC and NRF*.



Memorandum of Understanding Between NSFC and NRF signed

Nov. 17 Vice President Liu Congqiang and Ms. Ettore Francesco Sequi, Italian Ambassador to China, signed the *Memorandum of Understanding on Cooperation Between NSFC and the Ministry of Foreign Affairs and International Cooperation of Italy*. Vice President Liu Congqiang also met with Ms. Stefania Giannini, Italian Minister of Education, University and Research.

Nov. 25 NSFC held a lecture on the *Chinese Communist Party Standards on Integrity and Self Discipline and the Chinese Communist Party Disciplinary Regulations*. Members of the NSFC CPC Leading Group He Minghong, Gao Wen and Gao

Ruiping attended the lecture. The lecture was chaired by Gao Ruiping.

Nov. 25 Workshop on the Performance Assessment of National Natural Science Fund Projects was held in Beijing. Vice President Gao Ruiping attended the meeting.



Workshop on the Performance Assessment of National Natural Science Fund Projects held in Beijing

Nov. 26–27 The interview meeting for “Thousand Talent Program for Young Scholars” of 2015 was held in Beijing. Vice President Gao Ruiping attended the opening ceremony and made remarks.

Nov. 30–Dec. 3 The panel meeting and steering committee meeting of the NSFC-Zhejiang Joint Fund for the Integration of Industrialization and Informatization, the NSFC-Shanxi Joint Fund for Coal-Based Low-Carbon Technology and the NSFC-Liaoning Joint Fund of 2015 was held in Hangzhou. Vice President Gao Ruiping, members of the steering committees and administrative offices of the joint funds, heads and coordinators of relevant departments attended the meeting.

December

Dec. 4 The 14th NSFC Executive Committee meeting approved the registration of 254 institutions as host institutions and approved the drop-out mechanism for host institutions which have no application funded in 5 consecutive years.

Dec. 10 NSFC held a National Science Fund management training meeting in Beijing.

Dec. 11 The 2015 Meeting of the Management of National Natural Science Fund was held in Beijing. Vice President Gao Ruiping attended the meeting and made remarks.

Dec. 16–17 The panel meeting and steering committee meeting of the Joint Fund of Innovation for China Automobile Industry of 2015 was held in Beijing. Vice President Gao Ruiping, members of the steering committee and administrative office of the joint fund,

heads and coordinators of relevant departments attended the meeting.

Dec. 23 The Training of the Management of National Natural Science Fund for NSFC Staff of 2016 was held at NSFC. Vice President Gao Ruiping attended the meeting.

Dec. 25 The NSFC CPC Leading Group held a democratic life meeting themed on Three Stricts and Three Steadies. The meeting was chaired by Secretary Yang Wei. Shen Yan, He Minghong, Liu Congqiang, Gao Wen and Gao Ruiping attended the meeting. Representatives from Unit 3 of the Commission for Discipline Inspection of the Central Committee of the CPC, No. 4 Bureau of Cadres of the Organization Department of the Central Committee of the CPC and the United Front Work Department of State Organs Work Committee were invited to the meeting.



Secretary of the NSFC CPC Leading Group Yang Wei chairing the democratic life meeting themed on Three Stricts and Three Steadies

Dec. 25 Vice President He Minghong attended the Grand Ceremony of Science and Technology: the Award Ceremony for Annual CCTV S&T Innovation Characters of 2015, and gave award to General Chen Wei, Director of Institute of Biological Engineering, Academy of Military Medical Sciences.



Vice President He Minghong giving award to General Chen Wei



PART II

Project Review

2.1

Chinese Scientists Discovered the Most Luminous Object with the Most Massive Black Hole in the Early Universe

Based on the initial observations from a domestic telescope and the follow-up ones from several telescopes outside China, an international team led by Professor Xuebing Wu from Peking University announced the discovery of an ultra-luminous object with the most massive black hole in the early Universe. It locates at a distance of 12.8 billion light-years from the Earth, and has the power 430 trillion times higher than the power of the Sun. In the center of this object, there is a giant black hole with a mass of 12 billion solar masses. The paper was published in *Nature* on Feb. 26, 2015 (Wu et al., *Nature*, 2015, 518: 512–515), and was highlighted as one of the four cover-featured papers. *Nature* has issued a news press entitled “Young black hole had monstrous growth spurt” on Feb. 25, 2015, and invited a German scientist to write an article *Young Black Hole Had Monstrous Growth Spurt* in the column “News and Views” of the same issue to introduce the discovery. Hundreds of news media, including CNN, Time, Washington Post, LA Times, National Geographic, Discovery Channel, Scientific American in the US, Reuters and Guardian in the UK, Spiegel and Bild in Germany, as well as CCTV, Xinhua Net, People’s Daily, Guangming Daily, China Daily and China Science Daily, all reported this discovery as an important news.

This object belongs to a class of quasars, which look very similar to the stars in our Milk Way in optical morphology, but are actually very distant and luminous objects. Their huge power comes from the released gravitational energy of the matters surrounding the massive black holes in the center of quasars. In recent years, a team led by Professor Wu has developed a new method to select candidates of quasars with redshifts higher than 5 based on optical and infrared photometric data, and discovered many high-redshift quasars by spectroscopic observations with several telescopes. Among them, SDSS J0100 +2802, is a quasar with the highest redshift in their program. The first spectrum of it was took on Dec. 29, 2013 with the 2.4 m Lijiang telescope at Yunnan Observatory, Chinese Academy of Sciences, and it was identified as a quasar at redshift higher than 6.2.

Follow-up observations done with the MMT, LBT, Gemini and Magellan telescopes outside China confirmed that it is a quasar at redshift 6.30. Using the spectroscopic data, the team estimated that the luminosity of this new quasar is 430 trillion times higher than the solar luminosity, and is 7 times higher than the luminosity of the most distant known quasar (at a distance of 13 billion light-years from the Earth). The central black hole mass was estimated to be 12 billion solar masses, making it to be the most luminous quasar with the most massive black hole in the early Universe. The discovery of this ultra-luminous object provides us a unique chance to study the structure of the early Universe. The existence of such a black hole with a mass of 12 billion solar masses at redshift 6.3 presents challenges to the theories of black hole formation and growth and the evolution of galaxies in the early Universe.

This work is supported by the NSFC key and general grants, the pilot-B program of Chinese Academy of Sciences, and the 973 program of the Ministry of Science and Technology in China.

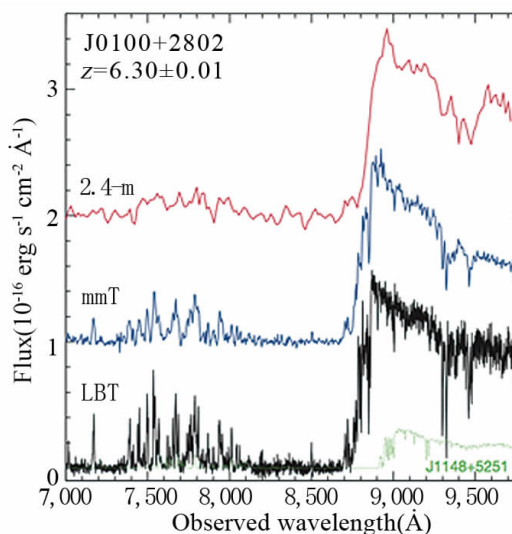


Fig. 1. The comparisons of the spectra of the new quasar, taken by the 2.4 m Lijiang telescope of Yunnan Observatory, MMT and LBT, with the spectrum of the most luminous high redshift quasar previously known, J1148+5251 (the spectra of 2.4 m and MMT are shifted up with 2 units and 1 unit respectively).

2.2

Chinese Scholars Achieve Important Scientific Breakthroughs in the Research of Weyl Fermions

In 1928, Dirac proposed Dirac equation describe to relativistic electronic states. In the next year, Weyl pointed out that the massless Dirac equation describes a pair of overlapped particles with opposite chirality, which are called Weyl fermions, which satisfies Weyl equation. The degree of freedom of Weyl equation is half of massless Dirac equation. The probability of left chiral state and right chiral state is equal, because electron has time reversal symmetry and space inversion symmetry in vacuum. According to the research of quantum field, the chiral anomaly will happen when a special system only allows the existence of specific chiral fermions. That is to say, under certain gauge field with parallel E and B field, the fermions will be generated continuously. But in the past 80 years, Weyl fermions have not been observed.

In 2011, Professor Xiangang Wan of Nanjing University, Professor Sergey Savrasov of UC Davis and Professor Ashvin Vishwanath of UC Berkeley proposed the first Weyl fermion, $\text{Y}_2\text{Ir}_2\text{O}_7$ with pyrochlore structure, in theory. They further suggested that Weyl fermions have another surprise characteristic except chiral anomalous. It has non-closed Fermi surface in the surface of material, "Fermi arc". In the same year, the team of

Professor Xi Dai and Professor Zhong Fang from Institute of Physics, Chinese Academy of Sciences(IOP, CAS) proposed that HgCr_2Se_4 is another magnetic Weyl semimetal. After this, Weyl semimetal becomes a hot research topic of condensed matter physics in the world. But for the experimental study, many characteristics of these two magnetic materials, like chiral anomalous and Fermi arc, cannot be observed because of domain, thus looking for non-magnetic Weyl semimetal is important.

From 2012 to 2013, Professor Zhong Fang, Xi Dai, Hongming Weng and their collaborators predicted that Na_3Bi and Cd_3As_2 are Dirac semimetals in theory. The low energy excitation is massless Dirac fermions. In 2014, they observed three-dimensional (3D) Dirac cone with their partners, and this confirmed the theoretical predictions. This is the first time to find the "3D graphene", and makes it possible to separate chiral electrons. Subsequently, many theoretical and experimental works carry out quickly and become a hot research topic in this field. In 2014, this research team predicted that TaAs, TaP, NbAs and NbP could realize the separation of two chiral electrons by breaking the protection of center inversion symmetry. This series of

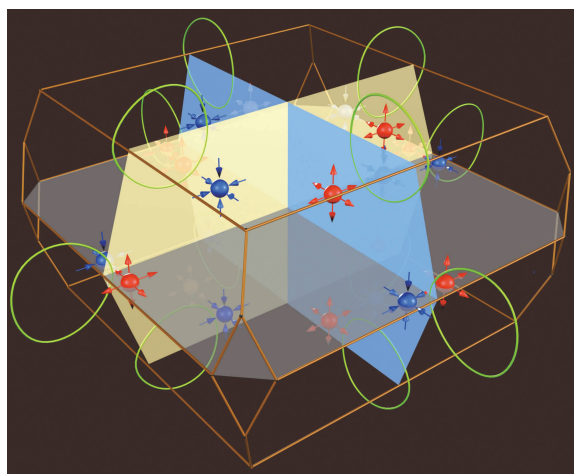


Fig. 1. The distribution of Weyl fermions in reciprocal space of TaAs crystal. The blue balls and the red balls represent different "chiral" Weyl fermions.

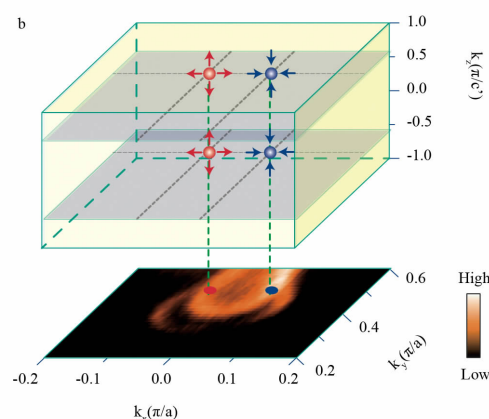


Fig. 2. The Weyl Fermi arc in the surface of semimetal TaAs. (Below) The Fermi arc is connected with the surface projection of Weyl fermions (the color balls above).

material can synthesize naturally without doping, and this is convenient to experiment. This attracted the attention of the experimental physicist immediately. Chinese scholars made another important achievement in experimental studies again. The group of Professor Genfu Chen from IOP, CAS and the group of Professor Shuang Jia from Peking University prepared the bulk TaAs crystal with atomically flat surface almost simultaneously. Then, the group of Professor Hong Ding in IOP, CAS first obtained the angle resolved photoemission spectroscopy (ARPES) by using the “dreamline” synchrotron radiation in Shanghai, and they can observe the surface Fermi arc directly. The Weyl fermions are first shown to scientists after 80 years. At the same time, the group of Professor Hassanat from

Princeton University cooperated with the group of Shuang Jia, and also confirmed the existence of Weyl fermion by using ARPES for the first time. In the following works, the group of Yulin Chen in Shanghai Technology University confirmed the existence of Weyl fermion in NbP and TaP. In addition, the group of Genfu Chen and the group of Shuang Jia found the longitudinal negative magnetic resistance caused by chiral anomaly.

The semimetal with chiral Weyl fermion might be useful to achieve the electronic transmission with low energy consumption. At the same time, Weyl fermion might also be useful in the field of topological quantum computation. All the works mentioned above are supported by the National Natural Science Foundation and other projects.

2.3

Chinese Scholars Found a Novel Low-Frequency Combustion Instability in Scramjets

The research team of Professor Zhenguo Wang in National University of Defense Technology found a novel low-frequency combustion instability in scramjets via abundant experiments, calculations and theoretical analyses. The low-frequency instability was found to be triggered by periodical flame flashbacks. The results were first released in the 35th International Symposium on Combustion and later published in the top combustion journal, *Proceedings of the Combustion Institute* (2015, 35: 2137–2144).

Combustion instability is not only a very important issue in the combustion area but also a difficulty often encountered in the engine development process. In the traditional rocket engines and ramjets, the main stream in the combustor is subsonic and combustion takes place in the subsonic stream. The heated subsonic

stream is then accelerated via a physical throat to become supersonic so that thrust can be generated. Under these conditions, acoustic perturbations can propagate upstream to couple with the heat release process, and combustion instability may appear. Unlike the rocket engines and ramjets, scramjets let the airstream enter the combustor supersonically and organize combustion in the supersonic stream. There is no physical throat downstream of the combustor in the scramjets, which may introduce different instability mechanisms. Though recent studies have verified the existence of combustion instabilities in scramjets, the related mechanisms are still far from well understood.

The team of Professor Zhenguo Wang developed a series of facilities for scramjet ground experiments, many advanced techniques for laser diagnostics, such

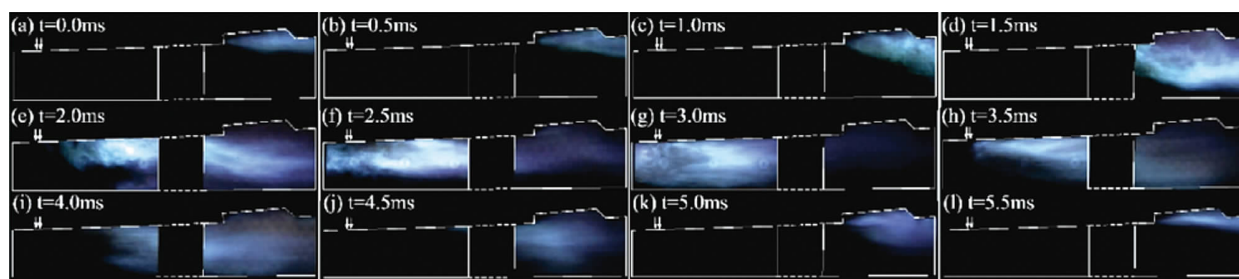


Fig. 1. Typical luminosity movie of flame flash-forward and blow-off event between cavity stabilized location and injection location.

as NPLS, PIV and PLIF, etc., and a set of methods for high-resolution simulations of supersonic combustion and flow. They utilized experiments and simulations to investigate the unsteady combustion physics in scramjet combustors. The experimental results suggest that, for the cases with a transient thermal throat, if a fuel/air premixed region from the injection to the cavity flameholder exists, the cavity pilot flame could reignite the fuel/air mixture and undergo a process similar to deflagration-detonation transition (DDT). This process couples with the flame quenching upstream of the

injection location, and a DDT-type low frequency oscillation can be formed. Combined with numerical and theoretical analyses, a mathematical and physical model for this instability is developed. This research uncovers a novel low-frequency combustion instability in scramjets and constructs a corresponding theoretical framework, which is meaningful to the understanding of supersonic combustion and the design of scramjets.

This work was supported by a grant from the National Natural Science Foundation of China.

2.4

Chinese Scientist Have Succeeded to Synthesize the First Artificial Photosynthetic Water-Splitting Catalyst in the World

The team of Dr. Chunxi Zhang in the Institute of Chemistry, Chinese Academy of Sciences has been devoting to work on photosynthetic water-splitting catalyst for about 20 years under the support of National Natural Science Foundation in China. Recently, his team has succeeded to synthesize the photosynthetic water-splitting catalyst in laboratory, which was reported by Science on May 8, 2015. The first author of this paper is Chunxi Zhang, and other authors are Changhui Chen and Hongxing Dong (from Harbin Engineering University), Jian-Ren Shen (from Okayama University), Holger Dau (from Free University Berlin) and Jingquan Zhao (from ICCAS).

Using solar energy to split water to produce hydrogen and/or electricity has been considered as an ideal method to solve the energy and environment problems of our society. In nature, the oxygen-evolving center (OEC) in photo system II (PSII) of photosynthetic organisms is a unique biological catalyst, which can efficiently and safely split water into O_2 , protons and electrons by using sun light. It has been found that the core of this catalyst is comprised by one calcium, four manganese ions and multiple bridged-oxygen anions, forming an asymmetric Mn_4Ca -cluster. The peripheral ligands of the OEC are mainly provided by carboxylate groups and water molecules. This biological catalyst serves as a blueprint for the development of efficient and cheap artificial catalysts for water-splitting reaction. Because of broad fundamental interests in natural

photosynthesis and potential applications in artificial photosynthesis, the artificial mimicking of this catalyst is one of the most important scientific fronts and has attracted many attentions. However, it is of a great challenge to synthesize the whole structure of the OEC in laboratory mainly due to several reasons: i) It is difficult to incorporate Ca^{2+} into Mn_4 -cluster; ii) It is hard to introduce biological ligands in the Mn-cluster; iii) The asymmetric structure is believed to be difficult to be made; iv) It is unknown if the high oxidizing Mn_4Ca -cluster can be stabilized in chemical system.

Since the late 1990s, many groups in the world have tried to synthesize the biological OEC in laboratory, but failed to make the whole Mn_4Ca -cluster as observed in PSII. Therefore, some people even thought it could be impossible to synthesize the asymmetric Mn_4Ca -cluster in laboratory.

Dr. Chunxi Zhang has been devoting to work on the structure and mechanism of the biological OEC in PSII since 1997, and succeeded in predicting the binding mode of calcium — one of key cofactors of the OEC in 1999. Recently, his team has joined the field of artificial photosynthesis, and with the help of enriched knowledge of biological OEC, his team has succeeded to synthesize the first asymmetric Mn_4Ca -cluster in laboratory. This artificial Mn_4Ca -cluster displays remarkable structural similarity as that of the OEC in nature in respects of the asymmetric Mn_4Ca core

structure and peripheral ligands. Like the biological OEC, the artificial Mn_4Ca -cluster can undergo four redox transitions and display similar paramagnetic properties and chemical properties as the natural catalyst. Importantly, it has been found that the artificial Mn_4Ca -cluster can serve as a catalyst for water-splitting reaction as well. This work has been considered a milestone of the artificial photosynthesis. This artificial Mn_4Ca -cluster and its future variants may provide new insights into structural determinants of the biological OEC and the mechanism of the water-splitting reaction, and open new avenues to develop new generation of artificial catalysts for photo water-splitting reaction from earth-abundant and non-toxic chemical element to produce clean energy in future.

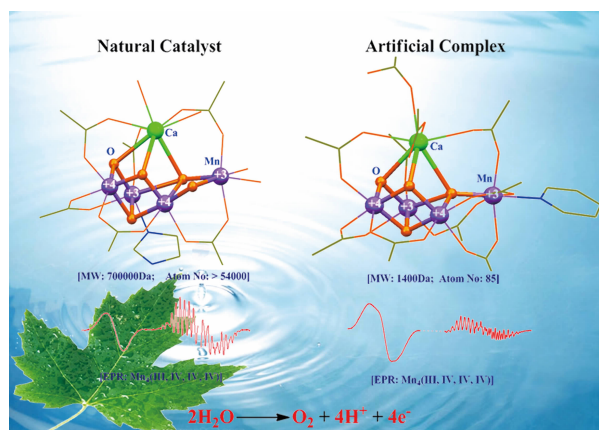


Fig. 1. Structural and functional comparisons of the Mn_4Ca -cluster in natural photosynthesis and artificial photosynthesis.

2.5

Chinese Scientists Made Breakthrough in Assembling Molecular Fractals at Surface

Supported by National Natural Science Foundation of China, Ministry of Science and Technology of China and other institutions, a joint team led by Professors Kai Wu and Yongfeng Wang from Peking University and its collaborators from Philipps-Universität Marburg, Germany, has made a major breakthrough in assembling a whole series of defect-free molecular fractals, i.e., Sierpiński triangles (STs), on Ag (111) at cryogenic temperatures. Their results were published in *Nature Chemistry* as a cover article, with a “News and Views” article in the same issue, entitled *Surface Chemistry: Self-Assembling Sierpiński triangles* by Professor Steven L. Tait from Indiana University, USA.

Fractals, being “exactly the same at every scale or

nearly the same at different scales” as defined by Benoit B. Mandelbrot, are complicated yet fascinating patterns that are important in aesthetics, mathematics, science and engineering. Scientists have been struggling to build molecular fractals through various strategies, but only scattered and even fragmented untenable molecular fractals could be obtained via strong intermolecular interactions such as covalent or coordination bonds in synthetic chemistry.

To tackle the challenge, two aromatic bromo compounds, 4,4''-dibromo-1,1':3',1''-terphenyl and 4,4''-dibromo-1,1':3',1''':4'',1'''-quaterphenyl (B4PB), were designed and synthesized to serve as building blocks. Synergistic halogen and hydrogen bonds

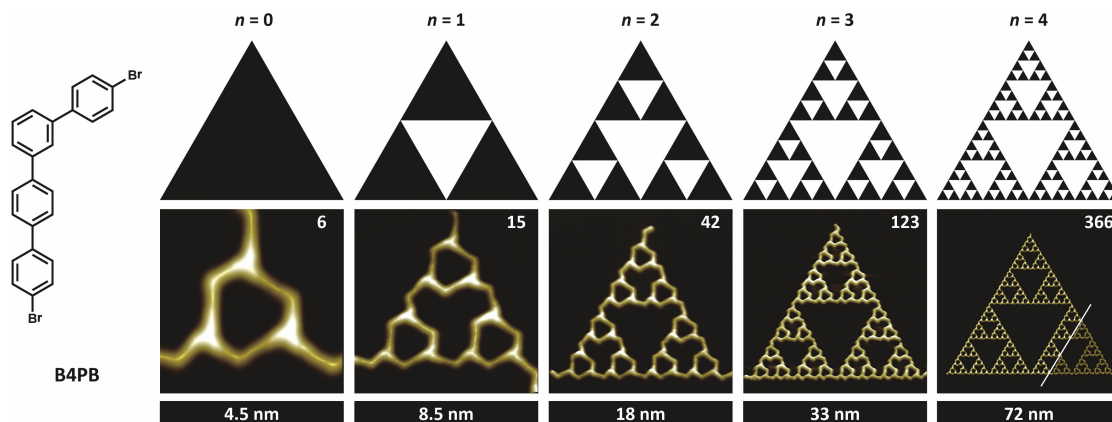


Fig.1. Molecular structure of the B4PB molecule (left) and a whole family of self-assembled defect-free molecular STs (right).

between these molecules are the driving forces to successfully assemble the whole series of defect-free molecular ST fractals on Ag (111) below 80 K. The fractals were characterized at sub-molecular level with the aid of ultra-high vacuum low-temperature scanning tunneling microscope (STM). A “box-counting” method was used to measure the Hausdorff dimension of the molecular STs, which well agrees with theoretical predictions. Furthermore, several critical governing principles for the preparation of the supramolecular Sierpiński triangles were explored experimentally and revealed

explicitly. Based on these principles, similar planar molecular ST fractal via pure hydrogen bond or metal-ligand coordination has also been successfully constructed at surfaces.

This work reports for the first time the fabrication of a whole series of defect-free molecular fractals at surface, which provides new access to rational design and controllable construction of molecular fractals, laying the foundation to realistically explore the properties of the prepared fractals.

2.6

Chinese Scientists Have Made New Progresses in Epigenetic Regulation of Human Primordial Germ Cells

A group from Peking University, Jie Qiao's team and Fuchou Tang's lab, for the first time, plotted the transcriptome and DNA methylome landscapes of human primordial germ cells at single-cell and single-base resolutions, which was published in the journal *Cell* in 2015.

It is widely recognized that DNA methylation is associated with numerous biological processes, including transposable element silencing, genomic imprinting and X chromosome inactivation, which play a crucial role in the epigenetic regulation of mammalian embryonic development. The most dramatic genome-wide changes of the methylome in mammals occur in primordial germ cells and during pre-implantation development. However, its dynamic patterns have not been analyzed at the genome scale in human preimplantation embryos and human primordial germ cells (PGCs) due to technical difficulties and the scarcity of required materials.

In 2014, this group systematically profiled the methylome of human early embryos from the zygotic stage through to post-implantation by reduced representation bisulphite sequencing and whole-genome bisulphite sequencing, which was published in the journal *Nature*.

Based on the above study, this group further analyzed the transcriptome of human primordial germ cells (PGCs) from the migrating stage to the gonadal stage at single-cell and single-base resolutions. They found that human PGCs show unique transcription patterns involving the

simultaneous expression of both pluripotency genes and germline-specific genes, with a subset of them displaying developmental stage-specific features. Furthermore, the DNA methylome of human PGCs was observed and global demethylation of genomes was found. Approximately 10–11 weeks after gestation, the PGCs are nearly devoid of any DNA methylation; with only 7.8% and 6.0% of the median methylation levels in male and female PGCs, respectively. This work indicates that these repetitive elements still highly methylated when the global DNA methylation is minimal in PGCs, which suggests a basis for potential trans-generation inheritance of epigenetic memory.

Germ cells are vital for transmitting genetic information from one generation to the next and for maintaining the continuation of species. This research with the other two studies about PGC development was published in *Cell* on the same day. On the same issue of *Cell*, Meyenn and Reik gave a comment, entitled *Forget the Parents: Epigenetic Reprogramming in Human Germ Cells*. These two epigenetic experts thought that these excellent works provided detailed maps of the transcriptional and epigenetic events that are fundamental for resetting genomic potential, erasing epigenetic memory, and establishing the human germline. This knowledge will help to better understand the epigenetic regulation of human development.

This work was supported by the National Natural Science Foundation, with awards including Key Program, Excellent Young Scientists Fund and General Program.

2.7

Chinese Scientists Uncovered Membrane Protein *COLD1* as the Sensor for Cold Signals in Plants

A research group from Institute of Botany, headed by Professor Kang Chong, uncovered *COLD1* as the gene underlying rice chilling-tolerant QTL, revealed its role as the sensor for cold signals, and unveiled the artificial domestication of chilling tolerance through genetic, physiological, molecular and evolutionary biological analysis. This work was published as cover story article in *Cell* on Feb. 26, 2015. Their collaborators in this study include groups led by Professor Qian Qian from China National Rice Research Institute, CAAS, Professor Song Ge from Institute of Botany, CAS and Professor Wen Wang from Kunming Institute of Zoology, CAS.

Rice, a crop that feeds more than half of the world's population, evolved in tropical and subtropical areas and is sensitive to chilling stress. To expand rice production into new northwards areas with lower yearly temperatures, high chilling tolerance is the basic requirement. On the other hand, global climatic change makes cold waves occur frequently, which threatens rice production in various regions. To improve rice chilling tolerance, thus, is in urgent need for maintaining rice production. Although the TRP membrane protein family has been uncovered as temperature sensors in animals, no counterpart is found in plants. Little is known about the sensor of temperature in plants. Professor Chong's Lab has revealed genes encoding transcriptional factors, such as *OsMYB3R-2*, *OsbHLH001*, *OsbHLH002*, *OsCOIN*, and important active proteins, such as *OsBURP6*, *OsUGE-1* and *OsRAN2*, involved in chilling stress response with more than one decade of hard work. Recently, this group found the cold sensor gene *COLD1*, encoding a membrane protein that can sense cold signals and elicit Ca^{2+} signaling in rice.

The two major subspecies of Asian cultivated rice, *japonica* (*Oryza sativa* ssp. *japonica*) and *indica* (*O.*

sativa ssp. *indica*), exhibit significantly different cold tolerance, the *japonica* cultivars have stronger tolerance than *indica* cultivars generally. The researchers identified one of 7 SNPs, SNP2 which confers cold tolerance in *japonica* rice, based on the sequencing of full-length *COLD1* gene from 127 accessions of rice. SNP2, originated from Chinese *Oryza rufipogon*, is responsible for the ability of *COLD1*^{jap^{ind}} to confer chilling tolerance, supporting the importance of *COLD1* in plant adaptation. Both Single Segment Substitution (SSSL) and overexpression lines of *COLD1* exhibit significantly enhances chilling tolerance, whereas the knock-out or knock-down lines of *COLD1*^{jap} are sensitive to chilling. *COLD1* encodes a 53-kD protein containing nine transmembrane domains and localizing on plasma membrane and endoplasmic reticulum. It can interact with the G-protein α subunit (RGA1) to accelerate its GTPase activity and activate Ca^{2+} channel leading to Ca^{2+} influx into cytoplasm to mediate cold signaling. Then, downstream reactions, including transcriptional factor activation, were activated to respond to cold stress.

This is the first report for the sensor of temperature in plants, uncovering a novel mechanism that chilling-adaptive QTL *COLD1* and human selection SNP confer cold tolerance in *japonica* rice. *COLD1* alleles can potentially be used for improving rice chilling tolerance of 93-11, one of the parent lines for Super Hybrid Rice, as well as other *japonica* species to expand the planting regions of rice and guarantee food security. Comments were made on this work, with landmark significance, by a series of journals, such as *Cell*, *Science Signaling*, *Faculty 1000*, *National Science Review*, *Molecular Plant*, *Journal of Genomics & Genetics*, and *Science China*.

This work was supported by the Science Fund for Creative Research Groups of National Natural Science Foundation of China and the National Science Fund for Distinguished Young Scholars.

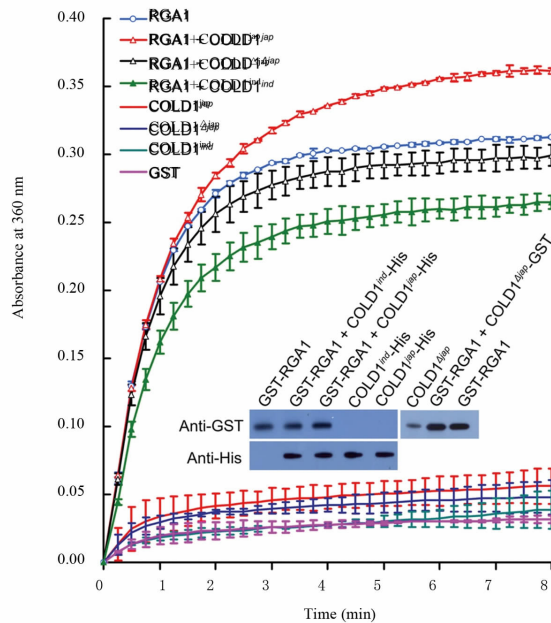


Fig. 1. *COLD1* Interacts with the α subunit of G-protein (RGA1). The *COLD1*^{jap} from *japonica* accelerated the GTPase activity of RGA1, whereas *COLD1*^{ind} from *indica* inhibited the GTPase activity of RGA1.

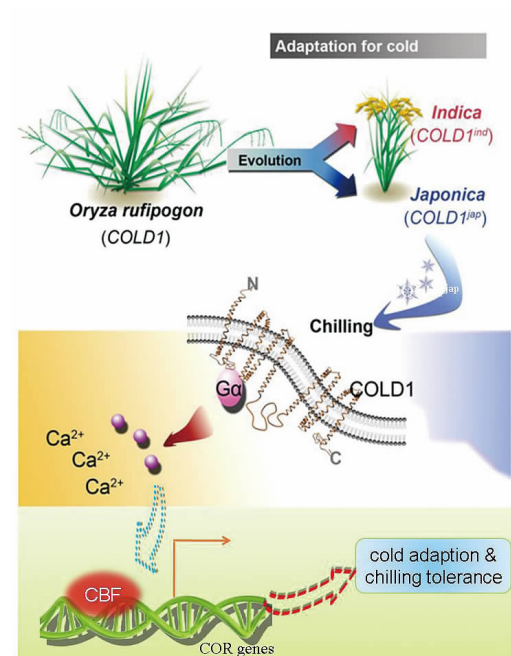


Fig. 2. Human selection of *COLD1*, the sensor of low temperature in plants. Through artificial domestication and human selection, *COLD1*^{jap} from Chinese *Oryza rufipogon* was maintained in *japonica* rice. *COLD1* can interact with G-protein α subunit (RGA1) to accelerate its G-protein GTPase activity and activate Ca^{2+} signaling to elicit the expression of down-stream genes involved in cold stress response, and therefore confers higher cold tolerance in *japonica* rice.

2.8

Chinese Scholars Revealed for the First Time that Peroxisome Mediates Intracellular Cholesterol Transport

Dr. Baoliang Song from College of Life Sciences at Wuhan University discovered for the first time that cholesterol transports through lysosome-peroxisome membrane contact (LPMC), and that cholesterol accumulation in lysosome may contribute to peroxisomal disorders (PD). This work was conducted for five years under the support of the National Natural Science Foundation of China and others. These results were published in *Cell* (2015, 161 (2): 291–306). The article was highlighted as one of the “Leading Edge in This Issue” and commented in a separate Preview by the peers. This work answers a fundamental question in cell biology with far-reaching significance in elucidating

the mechanism and therapeutic potential of human genetic diseases.

Cholesterol is an essential lipid highly enriched in eukaryotic cells. It is unevenly distributed in cellular membrane structures and dynamically transported in cells. These characteristics confer cholesterol pivotal roles in many cellular processes. In order to answer an important question in cholesterol homeostasis and also a basic one in cell biology—how cholesterol is transported within cells, Song and his colleagues designed an elegant genome-wide shRNA screen and identified over 300 genes involved in cholesterol trans-

port. They further demonstrated that lysosome forms transient lysosome-peroxisome membrane contact (LPMC) with peroxisome where cholesterol can be transported to the latter. In addition, they identified that lysosomal protein synaptotagmin 7 (synt7) and peroxisomal lipid PI (4,5)P₂ are two molecules bridging LPMC. Mutations in the peroxisomal genes have been intimately implicated in PD, which are characterized by developmental and neurological deficits. There is no effective treatment for PD so far. Song and his colleagues observed dramatic cholesterol accumulation in human patient cells and mouse models of PD. Intriguingly, cholesterol accumulation occurs long before the manifestation of neurological phenotypes, suggesting that intracellular cholesterol accumulation might be a cause of PD symptoms. The significance of this work include: 1) unveiling a previously unappreciated pathway for cholesterol transport; 2) ascribing a novel function to peroxisome and 3) underscoring cholesterol trafficking blockage may underlie the pathological mechanism of PD and providing novel strategies for diagnosis and treatment of these diseases.

Dr. Song focuses on cholesterol homeostasis. He has delineated cholesterol-regulated HMG-CoA reductase degradation pathway and uncovered the mechanism of intestinal cholesterol absorption. The study published on

the *Cell* uncovers an unexpected intracellular cholesterol transport and has great basic and clinical relevance.

This work was supported by the Key Program and General program of the National Natural Science Foundation of China (NSFC) and the National Science Fund for Distinguished Young Scholars.

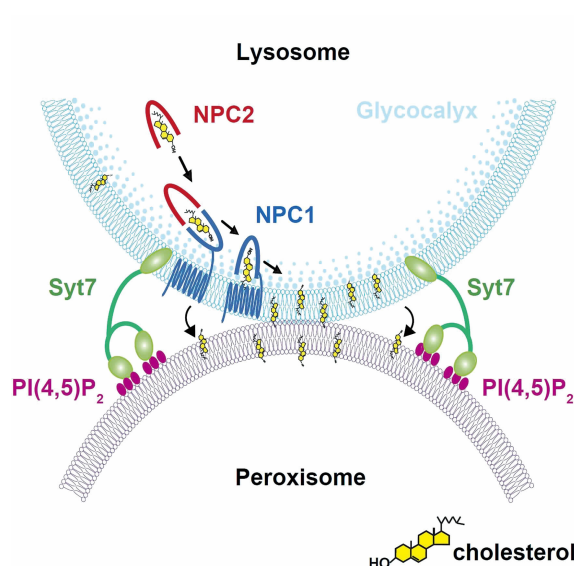


Fig. 1. Legend: Lysosome forms dynamic membrane contacts with peroxisome, and cholesterol is transported from lysosome to peroxisome.

2.9

Highlighted Progress: Iron Biogeochemical Cycles Coupling with Critical Environmental Processes in Red Soil Area of China

Red soil area covers 2.18 million km², which is 21% of the total area in China. Since 1980s, due to the fast economic development and urbanization, farmland has been suffered from extensive and heavy contamination in this area. And the food safety became a serious problem. It is necessary to develop some innovative techniques for soil pollution control. Engineering techniques of soil remediation might have a low feasibility to be applied at a large scale. On the view of elemental biogeochemistry, it would be a new insight into heavy metals immobilization and then the decrease in their bioavailability, and enhancement the

detoxification and mineralization of organic pollutants for soil pollutant control. Iron is most important transition metal with a higher abundance (5%) in Earth surface. There have been a series of iron (hydro)oxide minerals with very complicated crystal structure with high biogeochemical reactivity. Iron biogeochemical cycles play a pivot role in linking with carbon/nitrogen/sulfur cycles, and the transformation of organic and inorganic contaminants. The coupled mechanisms of iron biogeochemical cycles and C/N cycles and pollutants transformation have been a highlighted scientific issue on the view of both soil chemistry and soil microbiology.

As one of Distinguished Youth Scholars, Dr. Fangbai Li from Guangdong Institute of Eco-Environmental and Soil Sciences was funded by NSFC and has been focusing on the above mentioned highlighted scientific issue, involving in iron biogeochemical cycles coupling with dechlorinating of chlorinated compounds, and As(III) oxidation. The critical processes include:

- (1) The interaction between iron redox cycling and the reductive dechlorination of chlorinated compounds. It is found that the weathering indices of studied soils were linearly correlated with Fe (III) and pentachlorophenol reduction rate constants under anoxic condition. Oxalate-extractable Fe was likely one of the most active iron sources for Fe (III) reduction in soils. The results of microbiological community by using pyrosequencing method revealed *Clostridium*, *Rhodospirillum*, *Burkholderia*, *Rhodocyclus* and *Desulfuromonas* were dominant iron (III) reducers, which undergoing actively iron reduction and pentachlorophenol dechlorination in paddy soil of pearl river delta region.
- (2) The biogeochemical mechanism of Fe (II) oxidation coupling with As (III) oxidation and immobilization. It is found that the contents of adsorbed Fe(II) and oxalate-extracted Fe (II) in soil were a function of the bioavailability of cadmium and arsenic in rice grain. The abundance of Fe(II) oxidizers and As(III) oxidizers had a significantly negative relationship with arsenic content in rice plant. The functional bacteria responded for As (III) oxidation on rice root was dominated by *Acidovorax* and *Pseudomonas* (Fig. 1).

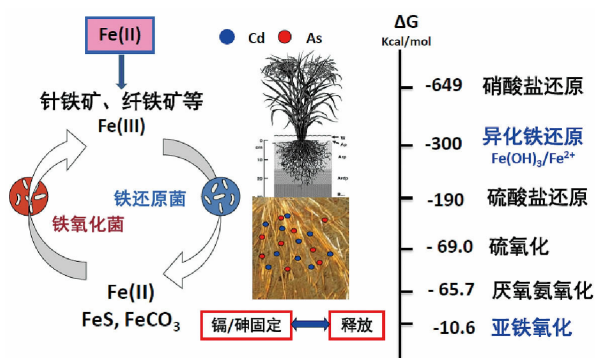


Fig. 1. The Fe/S/N redox cycles coupling with Cd/As fate and reductive dechlorination of organic chlorines.

- (3) The humic acid-mediated electron shuttling process. It is found that the capability of humic acid mediated extracellular electron transfer of iron reducing bacteria was dependent on the electron-donating and electron-accepting capacities of the humic compounds. Humic substances and biochars can act as stimulator for the growth of dechlorinating and iron-reducing bacteria. The abundance of dechlorinating gene and iron-reducing bacteria was dramatically increased up to 3-5 orders of magnitude in the presence of humic substances.
- (4) The extracellular electron transfer mechanism between microbe and mineral. In the model system of iron reducing bacteria and iron oxides, the team studied the surface complexation mechanisms of the surface of iron oxides, the reductive dissolution mechanisms, and the electron transfer mediated by the conduction band of the minerals. The physicochemical processes in the microbe-mineral system were disclosed. The team developed the thermodynamic model on the basis of the outer-membrane cytochromes, and the kinetic model on the basis of interaction between the cytochromes and substances. And then the thermodynamic mechanism was further illustrated clearly, as shown in Fig. 2.

A series of above outcomes were published in the international known journals such as *Environmental Science & Technology*, *Soil Biology & Biochemistry*,

$$\text{热力学模型: } \Delta E = E_{\text{c-ct}}^0 - E_{\text{ES}}^0 - \frac{RT}{2F} \ln \frac{[c\text{-Cyt}_{\text{ox}}][\text{ES}_{\text{ox}}]}{[c\text{-Cyt}_{\text{red}}][\text{ES}_{\text{red}}]}$$

$$\text{动力学模型: } \frac{d[c\text{-Cyt}_{\text{ox}}]}{dt} = -\frac{d[c\text{-Cyt}_{\text{red}}]}{dt} = -\frac{d[\text{Fe(III)}]}{dt} = \frac{d[\text{Fe(II)}]}{dt} = k[c\text{-Cyt}_{\text{red}}][\text{Fe(III)}]$$

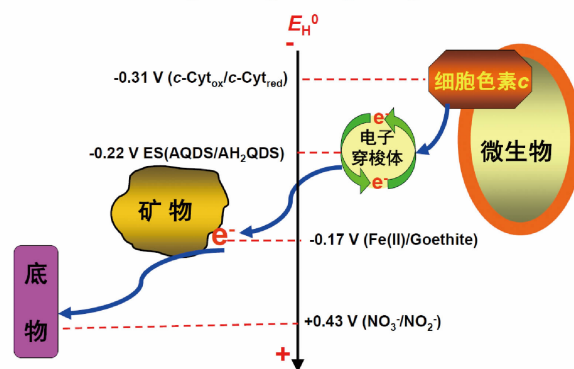


Fig. 2. Extracellular electron transfer mechanism between microbe and mineral interaction. Microbes: dissimilatory iron reducing bacteria, Electron shuttles: humic acid and AQDS, and Minerals: iron oxides.

Biosensors and Bioelectronics, *Soil Science Society of America Journal*. Dr. Fangbai Li was invited to be the guest editor of a special issue named “Red Soil in China” in the journal of *Soil Science*. Apparently, the above-mentioned investigation is characteristic of bioelectrochemical processes on the view of soil sciences. As compared with the international relevant studies focusing on sediments and wetland. The studies of the team focused on biogeochemical cycle of iron in

paddy soil for soil pollution control and the food safety. This investigation undertakes interdisciplinary research among soil science, microbiology, and geochemistry. Based on the above outcomes, some novel techniques for cadmium and arsenic pollution control in paddy soil were developed. Environmental application of iron biogeochemical cycles was extensively demonstrated at a large scale.

2.10

Breakthroughs Made on the Research of the Middle Atmosphere — Lower Ionosphere/Lower Atmosphere Coupling Based on the Ground-Based and Spaceborne Observations

The middle atmosphere is the transition region from the Earth atmosphere to the Space. The variability of the middle atmosphere is closely linked to the dynamical and chemical processes in the lower ionosphere, and is also driven by atmospheric waves propagated from the lower atmosphere. The research on the temporal/spatial variability in the middle atmosphere, as well as the related driving and coupling process is the hot issue in space physics.

Under the support of the National Natural Science Foundation of China, Professor Xiankang Dou's group in University of Science and Technology of China has focused on the electrodynamical coupling between the neutral middle atmosphere and the plasma in the ionosphere and the dynamical coupling between the middle atmosphere and lower atmospheric activities.

The deposited extraterrestrial material gives rise to layers of free neutral metal atoms or ions (e.g., Na, Fe, Ca, Ca⁺, etc.) in the mesosphere/lower thermosphere (MLT) region, which are deemed as the positive tracers of the atmospheric dynamical and chemical processes. One of the most interesting features in the metal layers is the sporadic metal layer, i.e., an abrupt increase in the metal density over the level of background layer. The formation mechanism of the sporadic metal layer is still an open question. Based on the sodium lidar observation with the high temporal and spatial resolution over Lijiang and theoretical analysis, the group verifies the chain between the sporadic sodium layer (SSL) and the ionospheric sporadic E (Es): the metal ions are

converged into Es layer by the tidal wind shear, and follow the downward phase progression of the tides to form SSL upon recombination. Meanwhile, the group (and co-authors in U.S.) first report the thermospheric sodium layers extend to 170 km over the low latitude region, and hypothesizes that the thermospheric sodium layers are formed through the neutralization of the converged sodium ions layers, which have been lifted through the fountain effect. These results confirm the effect of the ionospheric environment on the neutral middle atmosphere.

Impact of lower atmosphere activities on the middle and upper atmosphere background state is mainly controlled by the deposition of momentum and energy of atmospheric waves (gravity waves, tides, and planetary waves), which are excited in the lower atmosphere and propagate into the middle and upper atmosphere. By studying stratospheric sudden warming (SSW) phenomenon (mainly refers to the phenomenon of sudden warming of 40–50 K within a few days in the northern high latitudes lower stratosphere during winter), the group emphasized the SSW on the dramatic change of high latitudes atmospheric background state, a variety of wave propagation from the lower atmosphere, thereby the atmospheric circulation. During the SSW events, the group found that the SSW significantly modulates the gravity wave propagation direction in the Northern Hemisphere high latitudes. The group clearly sees the enhanced southward propagation of the gravity waves in the mesopause region during the SSW. The group also found a significant nonlinear interaction of

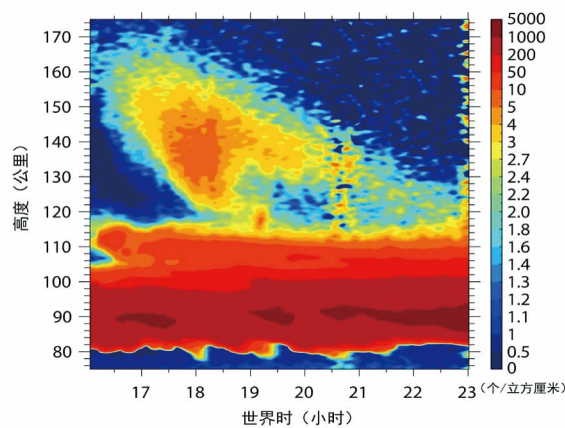


Fig. 1. The sodium lidar observation of the thermospheric sodium layer extended to 170 km on Apr. 10, 2012 over Li-jiang, China.

quasi-two-day waves in the Southern Hemisphere during the warming, likely induced by the southern hemisphere background middle and upper atmosphere change via inter-hemispheric coupling, and further strengthening the planetary wave propagation waveguide.

The above results were published in the world-known *Journal of Geophysical Research*, and these results successfully reveal the coupling process of middle and

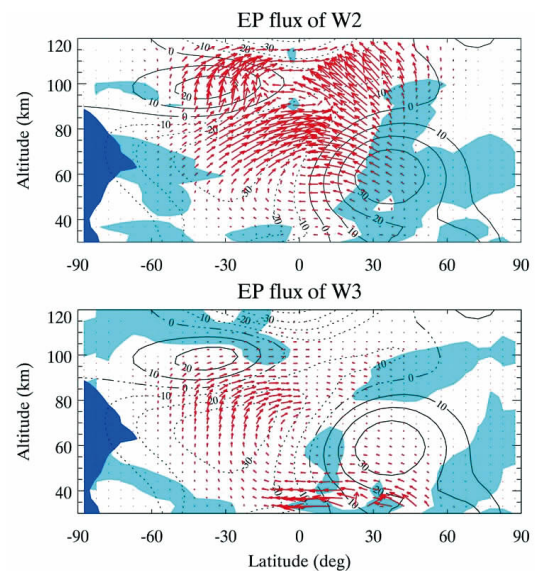


Fig. 2. The EP flux (red arrow) of the W2 (top) and W3 (bottom) QTDW and its positive divergence regions (light blue shades). The zonal mean zonal wind is overplotted with dotted (westward) and solid (eastward) lines. The potential baroclinic/barotropic instability region is overplotted with blue shades.

upper atmosphere, and are important to the improvement of model and forecast.

2.11

Scientists Revealed Nonlinear Interactions Among Internal Tides in the South China Sea

Internal tides (internal waves with tidal frequency) are ubiquitous in the ocean interior and ocean mixing induced by their breaking plays an important role in large-scale ocean circulation and global climate. At present, generation of internal tides has been well documented, but their dissipation is still poorly understood. Although low-mode internal tides are difficult to be directly applied to ocean mixing due to their large-scale features, nonlinear wave-wave interaction can transfer their energy to small dissipation scales directly available to turbulent mixing. Parameter subharmonic instability (PSI), one of dominant wave-wave interaction mechanisms in the ocean, can transfer directly energy of large-scale internal tides to small-scale waves available to mixing. Therefore, PSI can be important for understanding variation of ocean

environment and circulation.

In recent years, a research group led by Dr. Shang Xiaodong, supported by the Joint Funds of the National Natural Science Foundation of China, has made a series of research progresses in exploring the internal tidal PSI process in the South China Sea (SCS). By analyzing the mooring observational data obtained from the South China Sea (SCS), they found that the PSI of diurnal internal tides can transfer internal tidal energy to near-inertial waves at the bi-diurnal critical latitude ($\sim 14.5^\circ$; Fig. 1). In the SCS away from the diurnal critical latitude ($\sim 29^\circ$), they found that the PSI of semidiurnal internal tides can transfer internal tidal energy to diurnal subharmonic waves with high vertical wave-number. The classic PSI theory suggests that internal tidal

energy can be only transferred to subharmonic waves half internal tidal frequencies. However, based on moored current observations in the northeastern SCS, they found that the PSI of semidiurnal (D_2) internal tides can not only generate waves of frequencies close to $D_2/2$, but also excite near-inertial waves whose frequencies are different from $D_2/2$. Their recent observations suggested that the PSI of internal tides can be effectively enhanced in the reflection of internal tides from the boundary, with an energy transfer rate of ~ 2.5 days (Fig. 2). Furthermore, the reflection of internal tides from the boundary can also generate a mean flow.

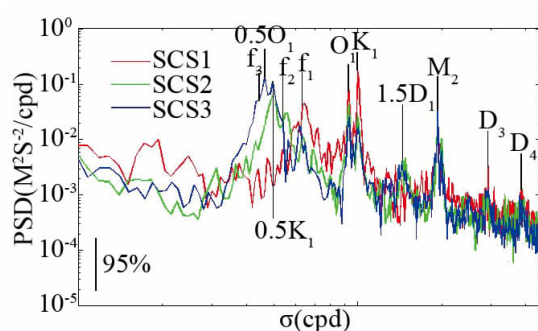


Fig. 1. Energy transfer between diurnal internal tides and near-inertial waves at critical latitudes in the South China Sea.

The above research results have been published in *Geophysical Research Letters* and *Journal of Geophysical Research*. These findings are important for further exploring nonlinear wave-wave interaction, ocean mixing and circulation in the SCS. Because of these important advances, Dr. Xiaodong Shang was invited by the Woods Hole Oceanographic Institution to give a presentation in the International Workshop on the South China Sea in 2015. A PhD student advised by him, Dr. Xiaohui Xie, won Excellent Doctoral Dissertation Award of Chinese Academy of Sciences in 2013.

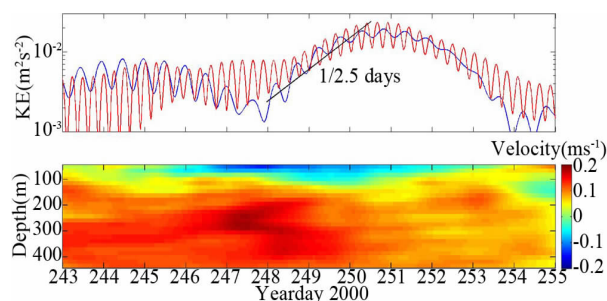


Fig. 2. (Upper panel) Energy transfer rate in PSI. (Bottom panel) Generation of the mean flow in the reflection of internal tides from the sea surface.

2.12

The Milestone of Lightning Protection Technique Associated with Power Grid in China

The research team led by Weijiang Chen, Vice Director of AC grid construction department of State Grid Corporation of China (SGCC) and the doctoral supervisor of China Electric Power Research Institute (CEPRI), has made a series of great breakthroughs in the aspects of the lightning discharge theory and the key technology of lightning protection and its engineering applications, and creatively established a technological system for power grid lightning protection, which is the integration of a theory model, two monitoring systems, complete protection devices and a series of technical standards. The research team, consisting of State Grid Corporation of China and other

5 institutes with Tsinghua University and other 2 universities, has devoted itself to lightning research for 12 years under the support of serial research projects including Key Program project and General Program projects from NSFC. Series of achievements obtained by the research team have been applied in the whole country and the total economic benefit is over 10 billion RMB.

Lightning stroke is the main cause of unscheduled trip-out of power system. Power grids in China suffer 350 thousand times lightning stroke each year, and failures caused by lightning occupy are as high as 47.6% of the

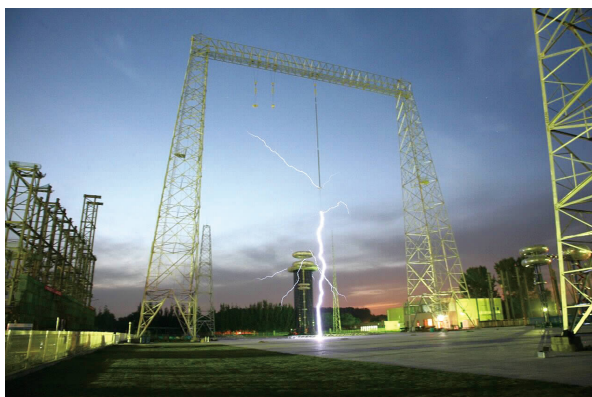


Fig.1. Process of 10 m long-gap lightning discharge.

total failures. Frequent lightnings do damage to power electric devices, lead to accident and seriously endanger the safe operation of power grid. For a long time, through continuous exploration and research at home and abroad, some progress has been made in the area of power grid lightning protection, but there are still problems in four aspects, i.e., lack of lightning parameters, imperfection of lightning risk assessment model, deficiency of present lightning AC short circuit arc protection method and low efficiency of present lightning fault recognizing techniques.

To solve solving the above-mentioned problems, the team led by Weijiang Chen achieved four outstanding innovations: (i) Full-waveform matching method for cloud to ground lightning flash recognition was firstly proposed, which can substantially promote the efficiency of low-amplitude lightning. The wide-area cloud to ground lightning flash monitoring system was set up; afterwards, the cloud to ground flash density map of China was firstly drawn to be the basis of lightning protecting design for the power grid. (ii) The team proposed experimental observation method of the light, electricity and sound during lightning and long-gap discharge. Then the space electric field step rising phenomenon caused by streamer initiation was revealed, furthermore, a 3D lightning leader progression model was built which can take the influence of space charge and complex terrain into account. This model effectively solved the problem that the lightning fault rate

for transmission line in mountain area or high towers calculated by EGM (Electric Geometry Method) was inaccurate. (iii) The lightning short circuit arc motion characteristics simulation mode was firstly constructed, and the motion characteristics was found, which laid the foundation of arc protection design. The team invented series protection devices for diverting or blocking arc, and the differentiation protecting method was proposed as standard technique for the power grid which is based on lightning distribution, terrain, construction of line, etc. The above devices and method effectively avoided damages caused by lightning. (iv) Methods of real-time line monitoring, lightning faults recognizing and fault points locating were presented, furthermore the transient current waveform monitoring terminal and the distributed lightning monitoring system were invented for the first time in the world, which tremendously reduced the cost of manual work.

The research was highly affirmed by organizations of international conference on lightning protection. The research work was supported by the National Natural Science Foundation of China and Science and Technology Project of State Grid Corporation of China. Some team members led the preparation of CIGRE WG C4.23 guide to procedures for estimating the lightning performance of transmission lines and greatly improve the international influence of China in the area of lightning protection. The research promotes the China's progress in the area of lightning science and lightning protection technology, and has significant value in the lightning disaster prevention associated with defense and critical civil infrastructures.



Fig. 2. Lightning discharge on Nanwang Mountain.

2.13

Microwave Metallurgical Theory Promotes Reactors Industrialization

Microwaves were first used in the communication fields, and the microwave energy has caused widespread concerns in the metallurgical fields along with the microwave oven being into the family. It has well been demonstrated by a large of small-scale investigations that microwave heating has characteristics of selective heating, interior heating and non-contact heating, which can lower the reaction temperature rapidly and shorten the reaction time, and has strengthening effect, realizing the metallurgical reactions with difficulties under the conventional conditions, improving the metallurgical efficiency and promoting efficient and clean utilization of resources. However, the application of microwave technology in the metallurgical fields is still in the laboratory stage, and there has been no breakthrough achievement in the world. The reason is due to the perplexity of tough problem of microwave reaction cavity multi-size enlargement, leading to a lack of large-scale microwave reactors, and restricting the development of microwave technology application.

In order to overcome the above mentioned questions, Professor Peng Jinhui has led Shimin Zhang, Libo Zhang, Shenghui Guo, Lei Xu, Hongying Xia and Binguo Liu, et al., to form a research team, and carried out systematical investigations on the basic theory of key problems of microwave metallurgical reactors engineering, which were supported by the National Natural Science Foundations of China. The main

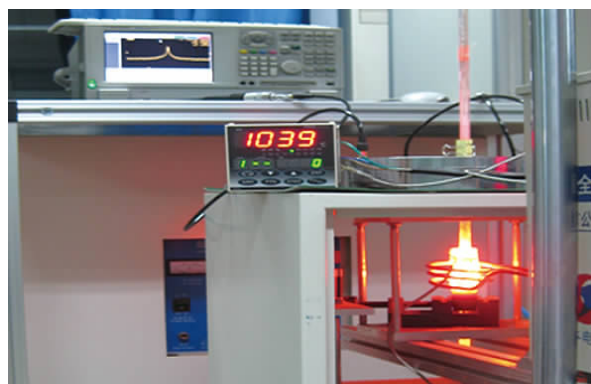


Fig. 1. The testing system of high temperature microwave dynamic electromagnetic characteristics.

achievements are as follow:

In the basic theory of microwave energy application, the temperature-rising rate equation(1)

$$\text{divgrad}T = \nabla^2 T = \frac{c}{k_e} \frac{\partial T}{\partial t} - \frac{P+W_e}{k_e} \quad \nabla^2 T = \frac{\partial^2 T}{\partial x^2} + \frac{\partial^2 T}{\partial y^2} + \frac{\partial^2 T}{\partial z^2} \quad (1)$$

of metallurgical materials in the microwave fields and transient state characteristic equation (2)

$$P_t = \frac{1}{2} E^2 \omega \varepsilon'' + \frac{E^2}{2} (\cos^2 \omega t \cdot \frac{\partial \varepsilon'}{\partial t} + \cos \omega t \cdot \sin \omega t \cdot \frac{\partial \varepsilon''}{\partial t}) \quad (2)$$

have been established, clarifying the interaction relationships of microwave power, loss factors, chemical reaction heat, temperature, time, electric field strength, thermal conductivity and frequency, describing quantitatively the interaction mechanism between microwaves and materials; developing the testing system of dynamic high temperature microwave electromagnetic characteristics (Fig. 1), and building up a database of electromagnetic characteristics of complicated materials, providing the basic theory data for the R&D of large-scale microwave reaction reactors.

In the microwave metallurgical reactors engineering, the distribution coupling method for the microwave reaction cavity with multi-source large power has been proposed in order to cope with the tough problems of multi-size enlargement of microwave reaction cavity (Fig. 2). Compared with the research method of conventional microwave reaction cavity, the present method introduced innovatively microwave dynamic electromagnetic characteristics of metallurgical materials as variables, revealing the influencing rules of locations of the microwave feed, directions, cavity size on the reflection coefficient and mutual coupling coefficient, realizing high power microwave sources and large resonator integration through the establishment of multi-in feed coupling mathematical models, breaking through the bottleneck of large-scale microwave metallurgical reactors

The achievement was reviewed as a highlight by *Nature*

China, and was ESI top 1% highly cited paper; the large-scale, continuous, automated microwave metallurgical reactors have been researched and developed for the first time based on the theory research, which have been used in the typical metallurgical applications engineering unit of roasting, calcining, reduction, leaching of the heavy non-ferrous metals, rare metals and precious metals, and solution purification. 86 items have been transferred to the universities, research institutes and enterprises both at home and abroad, and obtained the Second Prize of the National Technical Invention Award.

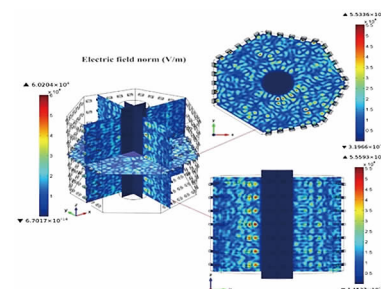


Fig. 2. The distribution coupling model of the multi-source microwave resonator cavity.

2.14

Tuning and Improvement for the Life-Cycle Performance of Concrete Structures in Marine Environments

Structures constructed in the marine environment are under high risks of corrosion, which may lead to significant economic loss and hinder the sustainable development of society. Hence, service life and reliability of the structures draw high attention from both the academia and industry. The research team, led by Professor Feng Xing, has involved in the study of this area for many years and developed an overall research strategy named as the Performance and Reliability Based Service Life Design (PRSLD) theory. Based on this strategy, the team established related sub-study areas, including the deterioration mechanism of marine concrete structures under simultaneous effects of mechanical loading and chemical attacking, and proposed feasible countermeasure method to guarantee the life-cycle feature by means of designs for high performance of concrete, self-healing concrete, intelligent control and enhancement technique combined Impressed Current Cathodic Protection (ICCP)-Structural Strengthening (SS).

Increase in performances of concrete enhances the durability of concretes. The team raises the theory of improvement for performances of ordinary concrete and develops the design method of high performance concrete; focuses on activating and coordinating compositions of concrete incorporating multiple and high dosage of industrial wastes, including high reaction efficiency between Ground Granulated Blastfurnace Slag (GGBS) and slag, active performance of fly ash by

using anhydrite, and controlling in reaction speed of mineral admixtures. These studies significantly increase the early strength of the concrete prepared with high volume industrial wastes and, also, coordinate the conflict between early strength and long term performances of concretes.

Focusing on the key scientific questions for durability of marine concrete structures, viz. cracking of concrete, ingress of aggressive ions and degradation of mechanical strength, the team has established a novel self-healing concrete, which integrates microencapsulation technique into the traditional concrete industry. In the worldwide, the team initiated the concepts of “chemical trigger” and “chemical self-healing” and has developed various types of microcapsules that are triggered by different ions, which offer concretes competence of environment recognition and self-regulation. These achievements overcome the limitation of traditional self-healing concretes that can only be triggered by mechanical damage, and effectively achieves the aim of enhance concrete immunity under the ionic erosion at marine environments.

Corrosion of the embedded reinforcement in concrete structure is the main reason for degradation of reinforced concretes. The research group proposes a novel technic named as ICCP-SS, which combines Impressed Current Cathodic Protection (ICCP) and Structural Strengthening (SS), to provide both steel

corrosion protection and improvement in load-carrying capacity to reinforced concrete structures. The ICCP-SS materials are designed to take the functions of both auxiliary anode and structure strengthener. Meanwhile, inorganic adhesive materials with self-healing capacity are developed to improve long-term system behavior against anodic acidification. Sensors are embedded in the composite for obtaining internal signal and real-time feedback for in situ concrete structures. Based on the system innovation, this research provides a new method to control the life-cycle performance of reinforced concrete structures.

With the financial supports from both government and industry, such as Major Program and Joint Research Program of National Natural Science Foundation of China, Professor Feng Xing and his research team have published 76 journal papers, and have been authorized 4 US patents, 2 Euro patents and 26 Chinese patents. Moreover, the achievements related to these studies have won the second prize of the National Technological

Innovation Award, the first prize of Technological Innovation Award of Chinese Ministry of Education and the first prize of Science and Technology in Guangdong province.

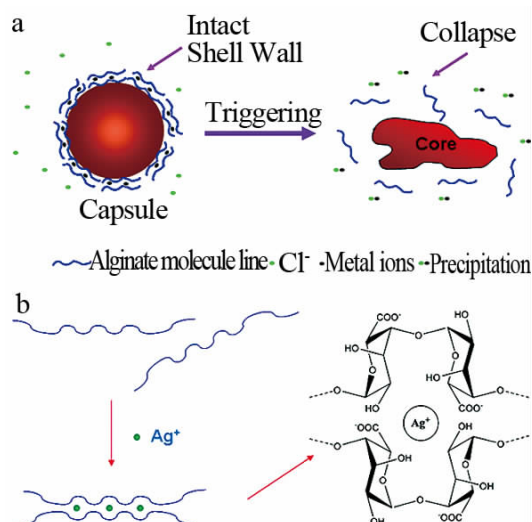


Fig. 1. a) Schematic of capsules triggered by Chloride ions; b) The structure of alginate chelated with Ag^+ .

2.15

Key Progress Made on Preparation and Microstructure Control of Photocatalytic Materials

TiO_2 has been recognized as one of the most important photocatalytic materials due to its widely potential applications in environment and energy. However, its low photocatalytic efficiency and limited visible-light absorption seriously restrict its practical application. The preparation of high-efficiency photocatalytic materials has been the hotspots and difficult points of photocatalytic research. Therefore, improving photocatalytic performance of TiO_2 and extending its visible light-response range are the two most important scientific problems in this field. In the past ten years, under the seriate financial support from the National Natural Science Foundation of China (NSFC), the group led by Professor Jiaguo Yu in Wuhan University of Technology mainly focuses on the preparation of photocatalytic materials and relationship between performance and microstructure. The main results obtained are as follows:

(1) A new “surface heterojunction” concept was first proposed on the basis of the density functional theory calculations to explain the difference in the

photocatalytic activity of TiO_2 nanocrystals with coexposed $\{001\}$ and $\{101\}$ facets. Because the position of conduction and valence band of $\{001\}$ facets is higher than that of $\{101\}$ facets, thus, the $\{001\}$ and $\{101\}$ surfaces can form surface heterojunction (see Fig. 1). This finding will provide new insight into the design and fabrication of advanced photocatalytic materials.

(2) A new fabrication method was first developed for preparation of inorganic hollow microspheres (such as TiO_2 and $\text{CuO/Cu}_2\text{O}$), namely, chemically induced self-transformation method, based on the in situ dissolution-

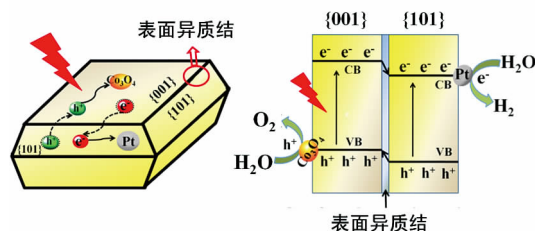


Fig.1. Surface (or facet) heterojunction of TiO_2 nanocrystal.

recrystallization and local Ostwald rippling mechanism of amorphous inorganic solid spheres in a solution system. Meanwhile, a selectivity photocatalysis new concept was proposed based on the prepared TiO_2 hollow microspheres with photocatalytic selectivity in decomposing azo dyes in water.

- (3) Many high-efficiency graphene-based H_2 -production photocatalysts were prepared using graphene as support due to enhanced electron transfer and separation rate (see Fig. 3). The prepared CdS-graphene composite photocatalyst exhibited a 22.5% apparent H_2 -production quantum efficiency at wavelength of 420 nm. Because of their excellent

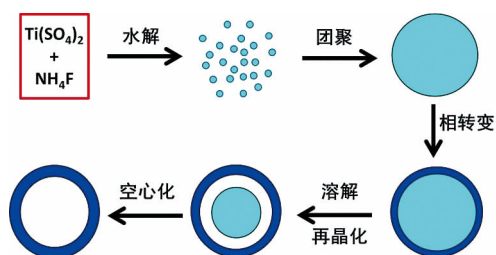


Fig. 2. Chemically induced self-transformation fabrication of anatase TiO_2 hollow microspheres.

works, many famous journals including *Chem Soc Rev*, *Angew Chem Int Ed*, *Adv Mater* and so on invited Professor Yu to write the related review articles.

Up to now, more than 100 papers were published in JACS and related international journals, which have been non-self-cited for more than 7000 times by SCI indexed papers. Their work won the second prize of Natural Prize for Natural Sciences in 2014. Professor Yu is one of the 2015 Highly Cited Researchers from Thomson Reuters in Materials Science, Engineering and Chemistry. He became a Fellow of the Royal Society of Chemistry (UK) and National advanced worker (China) in 2015. He is also the Editor of Applied Surface Science.

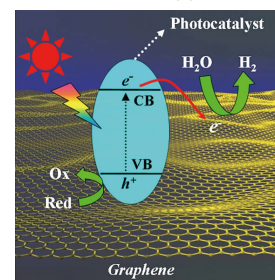


Fig. 3. Transfer and separation of electrons of graphene-based photocatalysts.

2.16

Chinese Researcher Made Important Progress in Novel Ultralow-Power Device Technology

Power dissipation is a fundamental issue and a key bottleneck in the development of modern integrated circuits. Recently, a significant progress has been made in the study of novel ultralow-power device technology by a research team led by Professor Ru Huang from the Institute of Microelectronics in Peking University. The team has proposed and experimentally developed a novel manufacturable multi-finger Schottky barrier tunnel transistor with a new adaptively-controlled hybrid switching principle proposed by Professor Huang's group, which opens up a new alternative and reliable way for future ultralow-power integrated circuits. The corresponding academic paper has been reported in the IEEE International Electron Devices Meeting (IEDM). The team has already built an intensive cooperation with Semiconductor Manufacturing International

Corporation (SMIC), which is the largest and most advanced foundry in mainland China, for in-depth development.

With the development of electronic systems, the fast-growing demands of portable and implantable chips, such as Internet-of-Things, bio-medical chips and wearable products, have occupied an increasingly high proportion of electronic products and put forward stringent requirements on overall system power dissipation, thus ultralow-power integrated circuits technology has attracted significant attentions recently. However, there is a theoretical limitation of subthreshold swing (the minimum value is 60 mV/decade at room temperature) in the metal-oxide-semiconductor field-effect-transistors (MOSFETs), which are the kernel

component of the mainstream chips. This limitation leads to severe challenges in supply voltage and power consumption reduction. To solve this problem, novel devices based on alternative operation principles have been proposed to achieve lower subthreshold swing. Tunnel field-effect-transistor (TFET), which is operated upon band-to-band tunneling mechanism, has generated a lot of interest because of its potential to obtain sub-60 mV/decade subthreshold swing. Nevertheless, the silicon-based TFETs have a small ON-current, and it is difficult to form abrupt tunnel junction for steep subthreshold swing experimentally. Although some works of TFETs utilizing narrow bandgap materials have enhanced the ON-current, the OFF-current and subthreshold swing severely degrade.

Professor Ru Huang and her team have dedicated to the research of advanced low-power devices and key technologies. They first proposed a new adaptively-controlled hybrid switching principle based on Schottky and tunneling mechanism, and proposed novel T-gate/multi-finger-gate Schottky barrier tunnel transistors which can solve the aforementioned problems that have been around for years. The proposed novel device can achieve high ON-current from the dominant Schottky current, effectively reduced OFF-current from the introduced self-depletion effect, and steep subthreshold swing from dominant band-to-band tunneling current with enhanced electric field simultaneously. This hybrid switching principle fundamentally addresses the issue of low drive current in conventional TFETs, and obtains higher ON-current and lower subthreshold swing while

maintaining ultra-low OFF-current. Based on the CMOS-compatible process, the fabricated multi-finger Schottky barrier tunnel transistor (MFSB-TFET) exhibits superior performance with subthreshold swing of 29 mV/decade which is the lowest value in silicon-based transistors ever obtained on record. The ON-current is also improved by 2.5 decades compared with conventional TFET, and large ON-OFF current ratio of more than 10^8 is achieved. It significantly alleviates the super-linear onset issues and reduces the Miller capacitance, delay, and noise level at low voltage. It demonstrates the best performance among current TFET designs. The tunneling device technology has been transferred to Semiconductor Manufacturing International Corporation, which will provide an important foundation for the development of ultra-low power integrated circuit technology with domestic autonomous intellectual property rights.

The research work was supported by the Science Fund for Creative Research Groups of the National Natural Science Foundation of China.

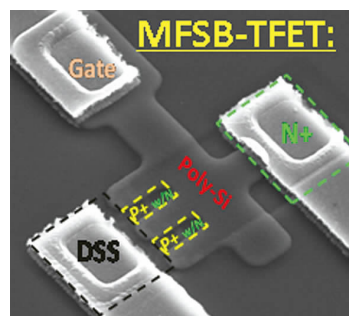


Fig. 1. The scan electron microscope (SEM) image

2.17

Research Progress on the Mechanism of the Multifunctional Phototherapy for Cancer

The selective therapy is one of the development tendencies of cancer treatment. Photodynamic therapy (PDT) has been applied in the clinical treatment. 5-ALA, one of the photosensitizers used in PDT, was approved for clinical use by FDA. However, the 5-ALA-PDT is limited by the low rate of ALA uptake into the neoplastic cells and/or its penetration through the tissue due to its amphiphilic property.

Professor Zhenxi Zhang's research team from School of Life Science and Technology, Xi'an Jiaotong University, has developed a new PDT modality assisted by Gold Nanoparticles (GNPs) based on their rich experiences on Photothermal Therapy (PTT) with GNPs. The new modality combined PDT with PTT, and the higher generation of singlet oxygen in the new modality comparing with the traditional PDT demonstrated that

GNPs could increase the efficiency of PDT due to its Local Field Enhancement (LFE) effect. In addition, the diagnostic imaging could also be improved by the LFE effect of GNP, which could be applied as the multimode diagnosis and inactivation for tumor cells. The research team further encapsulated the GNP-conjugated photosensitizers with liposomes for the intracellular delivery. It has puzzled the research community for many years that the macromolecular drugs were easy to be entrapped in the endosome after the cell uptake. Professor Zhang's research team disrupted the endosome and released the entrapped drugs into the cytoplasm using a photochemical strategy called Photochemical Internalization (PCI) and solved the problem. Furthermore, combining the GNP-assisted PDT modality and a variety of optical detection methods, they have established a detection platform for cavitation bubble in the optical perforation, an optical mapping system for measuring the cell membrane potential and a fast detection device for calculating the

photosensitizer concentration in tissues by the hyperspectral technique. On these platforms, a cavitation bubble caused by the photothermal effect of GNP with the size of 100 nm could be detected and the interaction effect between cavitation bubbles and cell membrane could be analyzed. The interaction effect could also be used to improve the efficiency of intracellular drug delivery. The mechanism of PDT-PTT therapy with GNP could also be studied on these platforms from the tissue and cell level to the nano level. These research results have been published on journals such as *Journal of Biomedical Optics*, *Optical Material*, *Molecular Pharmaceutics* and so on. Part of the methods and results have been converted to the product.

The research was supported by the Scientific Instruments, International (Regional) Cooperation, Key and General Projects of the National Natural Science Foundation.

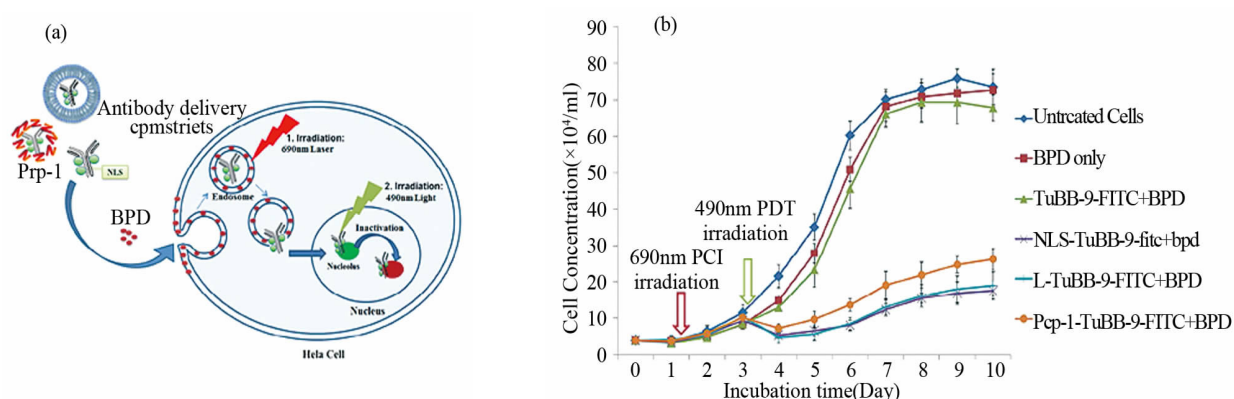


Fig. 1. The mechanism(a) and effect (b) of the improved intracellular delivery of drugs in PDT by Photochemical Internalization

2.18

Big Data Revealed Patterns of Human Behavioral Change After Natural Disasters

In a study led by Dr. Xin Lu, associate professor from the National University of Defense Technology, patterns of human behavioral dynamics after the Great East Japan earthquake were revealed with the use of big data from internet. The research was published on *Scientific Reports*, an online open-access journal by the Nature Publishing Group on Oct. 27, 2014.

The use of online social media for timely, precise, and systematic behavior analysis for populations affected by

extreme events is critical for emergency response. Due to the catastrophic damages resulted by severe disastrous events, useful information is usually difficult to obtain from the physic space. On the other hand, internet-based social networking platforms, such as Micro-blog, Wechat, Facebook, Twitter, etc., offer new opportunities for analyzing large-scale population dynamics and quantifying impacts of disastrous events. However, a list of difficulties exists for researchers to be able to extract valid information from online, such as

languages, races, etc.

In collaboration with Dr. Christa Brelsford, from the School of Sustainability at Arizona State University, the authors crawled tweets written in Japanese and English, and randomly extracted a global sample which included 7.4 million active users. Based on this data, they constructed the online social networks for twitter users right before and after the Great East Japan earthquake, and investigated the network structure, community evolution and conversation topics. They find that the earthquake not only triggered an increase of online posting activity, but also largely improved the number of interacting contacts, which implied an expansion of personal social networks. Dr. Lu and Dr. Brelsford proposed a new framework for analyzing communities in online social networks, through the process of community detection, dynamic analysis, and content extraction. “The framework is capable of analyzing any

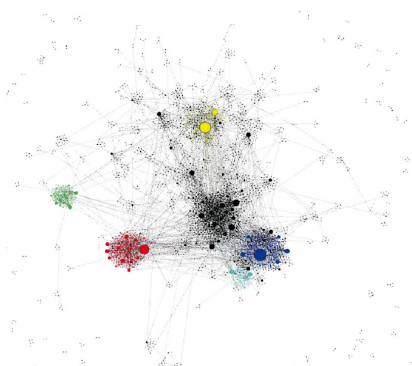


Fig. 1. Japanese twitter network before the earthquake.

kind of social change”, commented by Santa Fe Institute, which is heading the research for complex systems.

Dr. Lu’s group have made significant big data-driven studies for natural disasters, including the Haiti earthquake and outbreak of cholera (2010), the Bangladesh Cyclone Mahasen (2013), the West Africa Ebola outbreak (2014) and the Nepal earthquake (2015), etc. In addition to academic publications on *Nature*, *PNAS*, *PLOS Medicine*, *Scientific Reports*, etc., a large part of their work has been translated into public reports which assisted relief works in the field, and advocated by international media such as BBC, New York times, Science, etc. Their research on mobile phone data was listed among the “Ten breakthrough technologies 2013” by MIT Technology Review.

This study was funded by Natural Nature Science Foundation of China.

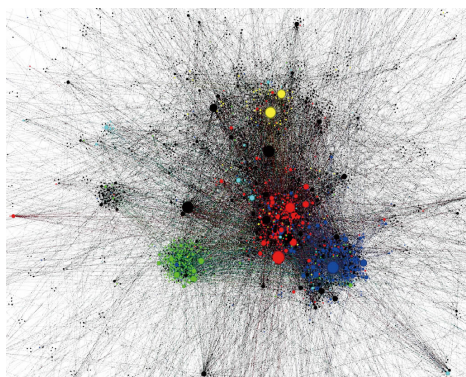


Fig. 2. Japanese twitter network after the earthquake.

2.19

Making the Conservation Profitable: the Implementation of Relocation Program in the Concentrated Poverty Area

A collaborating research led by Associate Professor Li Cong at Xi’an Jiaotong University assessed China’s largest ever resettlement program, the Relocation and Settlement Program of Southern Shaanxi Province (RSP). This research systematically assessed and projected the dynamic ecological and economic effects of RSP on stakeholders at different scales. It found that the RSP will not only bring benefit to poverty alleviation and livelihood improvement locally, but also ecosystem

services provision locally and globally, which makes the conservation profitable. This research group also includes Professor Hua Zheng and Professor Zhiyun Ouyang at Chinese Academy of Sciences, Professor Shuzhuo Li at Xi’an Jiaotong University, Professor Stephen Polasky at University of Minnesota, Professor Gretchen C. Daily and Professor Marcus W. Feldman at Stanford University. Their finding was online published at PNAS on Jun. 15, 2015.

It is very critical to coordinate different stakeholders during the implementation of conservation- and development-related policy. There is a conflict between publicity of eco-environmental resources and individual's pursuit of economic benefit. Without the support measure of economy, simple protection of ecological environment is more likely to exacerbate poverty of local people and hinders the advancement of policy. But if we overemphasize the private economic benefits, it will cause the ecological and environmental degeneration, which lead to a vicious spiral of people's development. Most of the eco-functional areas are the poor and less development area. The Southern Shaanxi Province is one of the most collective poor areas in China, the contradiction between human and nature is particularly prominent. If we unilaterally emphasize the economic development or conservation, it is hard to achieve the ideal expectations because of the neglect of the other side. The RSP aims to make conservation profitable by taking some measures to support economic development. Meanwhile, this kind of protection need the policy to be scientific designed, reasonably evaluated and efficiently implemented. The protection depends on the coordinating of the relationship between various stakeholder groups. As an important conservation and development policy, the key point is to make sure that the policy is scientifically designed, reasonably, evaluated and efficiently implemented by identifying the benefits and costs during the implementation of RSP. But it is hard to clarify where the cost and benefit occurred, how the dynamics



Fig. 1. Resettlement sites for immigrants (top) v.s. their old place of residence (down).

transformed and who is the beneficiary.

This research group used the RSP in Ankang Municipality, a primary water source conservation area for the South-to-North Water Transfer Project (SNWTP) — the largest water transfer project in the world — as a case to explore the costs and benefits for multiple stakeholders. They first identified the expected impacts of the RSP on land use and land cover (LULC) as well as assessed the value of ecosystem services by using the InVEST (Integrated Valuation of Ecosystem Services and Tradeoffs) model. Second, they adopted the household survey data from RSP participants and nonparticipants to better understand the immediate impacts of the Program on household well-being and livelihood activities, and its potential influences on the environment. Finally, they analyzed changes in the costs and benefits that reveal how the RSP is likely to affect different stakeholders in the short and long term. The results show that although the government's investment is far more than the benefit receiving in a short term, the implementation of RSP result in positive net benefits to the municipal government, and to cross-region and global beneficiaries over the long run along with environment improvement, including improved water quality, soil erosion control, and carbon sequestration. However, there are significant short-run relocation costs for local residents so that poor households may have difficulty participating because they lack the resources to pay the initial costs of relocation. Greater subsidies and subsequent supports after relocation are necessary to reduce the payback

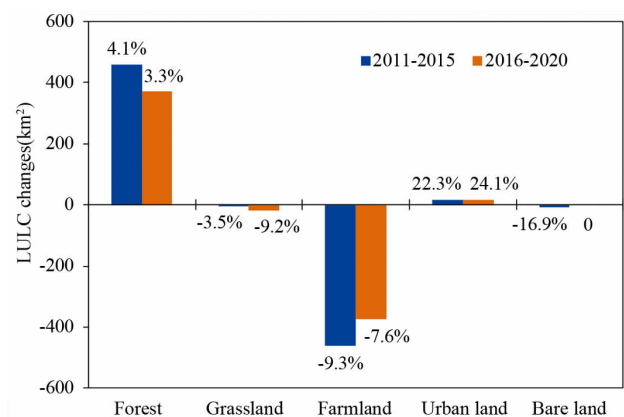


Fig. 2. Changes of land use and land cover during relocation policy implementation period.

period of resettled households in the long run. Compensation from downstream beneficiaries for improved water and from carbon trades could be channeled into reducing relocation costs for the poor and sharing the burden of RSP implementation. The effectiveness of the RSP could also be greatly strengthened by early investment in developing human capital and environment friendly jobs and establishing

long-term mechanisms for securing program goals. These challenges and potential solutions pervade ecosystem service efforts globally.

This research is supported by National Natural Science Foundation of China (Young Scientists Fund, General Program; Key Program) and the Gordon and Betty Moore Foundation.

2.20

Ad5-EBOV Vaccine, the First Abroad Vaccine Clinical Trials Outside China

The phase II clinical trial of the recombinant Ebola disease vaccine (Ad5-EBOV) developed by Professor Wei Chen in Institute of Biotechnology, Academy of Military Medical Science, was approved recently by Sierra Leone Ethics & Scientific Review Committee and Pharmacy Board of Sierra Leone. The clinical trial for Ad5-EBOV was launched on Oct. 10, 2015 in Sierra Leone, West Africa. This is the first time that the Chinese-developed vaccine was licensed a clinical trial approval, which ushered “zero” breakthrough in abroad vaccine clinical trial in China. The research team consisted of Dr. Lihua Hou, Shipo Wu and Qiang Guo from Institute of Biotechnology, Academy of Military Medical Science, Dr. Tao Zhu and Xuefeng Yu from Tianjin Cansino Biotechnology Co. Ltd., Dr. Fengcai Zhu and Jingxin Li from Jiangsu CDC, Dr. Junzhi Wang and Yuhua Li from National Institute of Food and Drug Control and Dr. Alie H. Wurie from Ministry of Health and Sanitation, Sierra Leone.

Thousands of people died in Ebola outbreak within a few months from Mar. 2014 in West Africa, to make it an “international health events”. Several well-known international institutes and major pharmaceutical companies started the Ebola vaccine research. Professor Wei Chen’s team began the development of Ebola vaccine from 2006 and focused on Ebola vaccine with the 2014 new Ebola virus genotype after Ebola outbreak in 2014. The Ebola vaccine’s protective efficacy on monkeys was validated in National Laboratory of Microbiology, Canada. The phase I clinical trial of Ad5-EBOV was approved on Dec. 12, 2014 in

China and started on Dec. 28, 2014 in Taizhou, Jiangsu, which was the first clinical trial of Ebola vaccine in China and the third clinical trial of Ebola vaccine in the world after Ebola outbreak in 2014. The phase I clinical trial results of Ad5-EBOV showed its good safety and immunogenicity and was published in *Lancet* in Mar. 2015.

There are three characteristics of Ad5-EBOV, comparing to other Ebola vaccines in clinical phase worldwide. (i) It is suitable for 2014 Zaire epidemic, the only Ebola vaccine developed according to 2014 Ebola virus genotype. (ii) It is convenient for storage and delivery. Ad5-EBOV is the first formulated lyophilized products which could be stored at 2–8°C. Preliminary stability results in 2 weeks at 37°C showed that all characteristics of Ad5-EBOV were all in line with product quality standards, which is suitable in African countries. (iii) Ad5-EBOV shows good safety and immunogenicity in clinical trial.



Fig. 1. The first vaccinated subject in phase II clinical trial of Ad5-EBOV in Sierra Leone.

The team reported the progress of Ad5-EBOV in WHO-Ebola vaccine International Congress in Geneva, Swiss in Mar. 2015 and started the application of the phase II clinical trial in Sierra Leone, the most affected country in West Africa. The license for the phase II clinical trial was approved after stringent intellectual property review, several rounds of review of technical information, meeting reply and site inspection. 500 Sierra Lionesses were enrolled and vaccinated during Oct. 2015. All subjects returned to the visit site for sample-taking 28 days after vaccination.

In the phase II clinical trial in Sierra Leone, Chinese team not only completed the first abroad vaccine clinical trial with great international influence according to high standards and high quality, but also summed up a set of assessment methods of vaccine clinical trial projects in a foreign country. These valuable experiences will play an important role in the internationalization process of clinical trials for Chinese vaccines.

The project was partly funded by the National Science Fund for Distinguished Young Scholars.

2.21

China Stands at the Forefront of the Research in Clinical Psychiatric Imaging

The joint research team from Sichuan University and Beijing Normal University led by Dr. Qiyong Gong from the Radiology Department at the West China Hospital of Sichuan University has successfully completed the project “Novel Magnetic Resonance Image Analysis with the Exploration of the Mechanism of Major Psychiatric Disorders” following their ten years of hard work. Recently the team has received the State Natural Science Award (second rank) for the year of 2015. The team members include Xueli Sun, Su Lui, Xiaoqi Huang from West China Hospital of Sichuan University and Yong He from Beijing Normal University.

The high morbidity and disability with low recovery rate of major psychiatric illnesses imposes substantial burdens to the individuals, their family and society. The clinical dilemma lies in their unknown psychopathogenesis and the lack of objective criteria for the diagnosis and evaluation. Over the past decade, the team utilized non-invasive MRI technique to address the key research questions in relation to neuropsychiatry, and systematically investigated the pathogenesis and early diagnosis of major psychiatric illnesses including the schizophrenia. With the innovative utilization of functional neuroimaging and molecular imaging techniques of MRI, the team has made breakthroughs with respect to assessing the brain networks by resting state fMRI, improving the understanding of the psychopathological mechanisms and characteristic brain alterations of the patients (e.g., schizophrenia) prior to the illness onset, at the early stage or after treatment, and proposing the structure-function-behavior analytical model, first starting to

address the issue as to how the altered brain structure could affect symptoms, and also first reporting that the impaired neural circuitry could result in suicidal behavior. This project provided objective imaging markers which are potentially of value for individualized diagnosis and treatment evaluation of major psychiatric illnesses such as schizophrenia, and also offered novel methods for the development of brain science and precision medicine.

The above research has been published on the top journals in the fields including *PNAS*, *American Journal of Psychiatry* and *Biological Psychiatry*. The main finding that altered brain structure could affect symptoms was positively cited in the editorial of the *American Journal of Psychiatry*, in which it was commented as starting to answer the question as to how gray matter volume could be related to behavior or clinical symptoms in patients. Professor Marcus Raichle, who is the member of the National Academy of Science, and also the pioneer of brain functional imaging and the first who found the brain “default network”, positively cited the results in his papers published in *Nature Reviews*, suggesting that the findings reported by the team provided important imaging evidences for the understanding of the brain mechanisms of psychiatric illnesses. The relevant results have received 15,261 citations, in which the most cited article has received 190 citations. The related articles have been included in the “one hundred most influential papers in China” and ESI highly cited papers. The subsequent research of the project was also published on *American Journal of Psychiatry* and was selected as the subject of CME

course for clinicians in the USA.

Due to the achievement in psychiatric imaging, Professor Qiyong Gong, as the team leader, has been invited to write reviews for the top journals in the field including *American Journal of Psychiatry* and *Biological Psychiatry*. He was also invited to give lectures in universities such as Harvard University, Yale University and Stanford University. Furthermore, Professor Gong was invited to give the honorary named lecture “NIBIB New Horizons Lecture: Emerging MRI to Uncover the

‘Disordered Mind’: Are We in an Era of ‘Psycho-Radiology’?” in the 23th annual meeting & exhibition of International Society for Magnetic Resonance in Medicine (ISMRM) (among 8,000 members, only one is invited each year). Meanwhile, the invited review entitled “Psychoradiology: The Frontier of Neuroimaging in Psychiatry” has been in press for publication in *Radiology* which is the top journal in the field of radiology. In short, Dr. Gong’s team has made significant contributions to the development of clinical psychiatric imaging.

2.22

Chinese Scholars Revealed New Regulatory Mechanism in Innate Immunity and Inflammation

Supported by the National Natural Science Foundation of China, a joint research team led by Dr. Rongbin Zhou and Dr. Zhigang Tian at University of Science & Technology of China and Dr. Chen Ding at Beijing Proteome Research Center has made significant progress in innate immunity and inflammation and discovered that the neurotransmitter dopamine can prevent neuroinflammation and peripheral inflammation by inhibition of NLRP3 inflammasome. The results were reported on Cell on Jan. 15, 2015.

Inflammatory response is a double-edged sword for the host body. In one way, the appropriate inflammatory response is essential for human health by removing pathogen or harmful substance. But in another way, the inappropriate inflammatory response can promote the development of diseases by causing cell or tissue damage. The NLRP3 inflammasome is a cytosolic protein complex composed of NLRP3, ASC and caspase-1, and assembled in response to both microbial infection and endogenous “danger signal”. The activation of NLRP3 inflammasome promotes the maturation and release of several proinflammatory cytokines, such as interleukin-1 and IL-18, so it plays critical roles in the initiation of inflammation and has been involved in diverse inflammatory diseases, including neurodegenerative diseases, type 2 diabetes and Gout, etc., thus the activation of NLRP3 inflammasome should be tightly controlled.

To investigate the mechanism for the regulation of

NLRP3 inflammasome, the researchers screened inhibitors for NLRP3 inflammasome by using compound library and found that an agonist for dopamine receptor DRD1 could inhibit NLRP3 inflammasome activation. Based on this, they found that dopamine could induce NLRP3 ubiquitination and degradation to inhibit NLRP3 inflammasome activation through DRD1 and its downstream signaling. Further *in vivo* studies also showed that the suppression of NLRP3 inflammasome by dopamine and DRD1 signaling could prevent both neuroinflammation and peripheral inflammation. This study not only uncovered a key endogenous regulatory mechanism for NLRP3 inflammasome and its related diseases, but also provided an elegant example for the interaction between immune system and neuron system. In addition, this study also suggests that DRD1 might be a potential target for the intervention of inflammatory diseases.

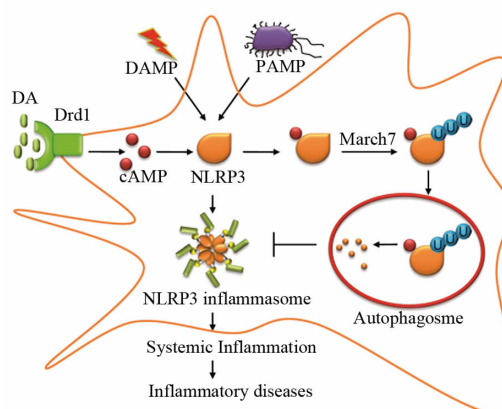


Fig. 1. Dopamine prevents neuroinflammation and peripheral inflammation by inhibition of NLRP3 inflammasome.



PART III

Introduction on Selected PIs of the Science Fund for Creative Research Groups

3.1

Dr. Lv Caidian

Professor

Institute of High Energy Physics, Chinese Academy
of Sciences

Academic Leader of the Creative Research Group
in 2015



Professor Lv Caidian, awardee of the “Hundred talent program” of the Chinese Academy of Sciences (2000), and NSFC National Science Fund for Outstanding Youth the scholar in 2006. His research interest is phenomenology of particle physics, especially about heavy flavor physics and CP violation. He has great achievement in the development and application of perturbative and non-perturbative QCD theory.

Heavy flavor physics is one of the frontier topics in particle physics. It has been a traditional subject in IHEP for both experimental and theoretical studies. The group members have achieved many successes in the research field. For instance, they have carried out systematic studies of the structure, production and decay of exotic hadrons, which allow self-consistent explanations for some long-standing puzzles in the literature. They have also led the discovery of the charged charmonium-like state Z_c (3900) in the BESIII and Belle collaborations, which was listed as the first of 11 “highlights of the year” by the APS journal Physics.

As the leader of the research group, professor Lv has published more than 130 peer-reviewed papers, which have been cited more than 4000 times. He has major contribution to the development of generalized factorization approach and perturbative QCD approach in non-leptonic B decays, which makes the prediction of direct CP violation in B decays.

Based on the BESIII experiment of BEPCII accelerator, and the experiment ATLAS, CMS, Belle and BelleII, and making use of the high statistic data collected from these experiments, the research group expects to study the decay and product mechanism of heavy quarkonium-like hadronic states and B/D mesons. From these studies, the group expects to get more experimental and theoretical information of the strong interaction and electro-weak interaction. Using the collected data of super B factory, the research group plans to discover the properties of quarkonium-like particles. Through rare decays, it is expected to find some evidence of new physics signal.

3.2

Dr. Zhu Xiping

Professor

School of Mathematics and Computational Science,
Sun Yat-sen University

Academic Leader of the Creative Research Group
in 2015

Professor Zhu Xiping, a winner of the National Science Fund for Distinguished Young Scholars in 1998, recruited as a distinguished professor for Chang Jiang Scholars, and an advisor of the winners of Top 100 National Excellent Doctoral Dissertation Award in both 2002 and 2013. Professor Zhu's research is mainly on geometric analysis. He solved the open problem on the uniqueness of the Ricci flow, proved a conjecture on manifolds with positive isotropic curvature, proposed by Gromov, who is winner of Wolf prize and Abel prize, and made contributions to the final proof of the celebrated Thurston's Geometrization conjecture.

The famous Poincaré conjecture is only part of the Thurston's Geometrization conjecture. Between 1982 and 2002, Hamilton established a program to use the Ricci flow to solve the Thurston's Geometrization conjecture. In 2002 and 2003, Perelman posted three articles on the internet, which provided a brief argument to complete Hamilton's program. At that time, mathematicians all over the world concerned about whether the theory of Hamilton-Perelman could finally give a complete proof of the Thurston's Geometrization conjecture. At least three teams, Cao-Zhu, Morgan-Tian and Kleiner-Lott, were consciously verifying whether the argument is correct. In 2006, Cao Huaidong and Zhu Xiping completed all the details needed in the argument and published the complete proof of the Thurston's Geometrization conjecture. Hamilton (member of the US National Academy of Sciences, and winner of the Shaw Prize) wrote in the abstract of his plenary lecture given on ICM 2016: "A full exposition has been written recently by H.-D. Cao and X.-P. Zhu". The journal *Science* honored the solving of the Poincaré conjecture as the "Breakthrough of the Year" in 2006



(totally 10 scientific achievements were honored).

There are 2 distinguished professors for Chang Jiang Scholars, 4 winners of the National Science Fund for Distinguished Young Scholars and 2 winners of Top 100 National Excellent Doctoral Dissertation Award in the Creative Research Group of NSFC named "Geometry and Topology on manifolds", which was built under the support of Sun Yat-sen University. The research group has done systematic and deep research on the fields of geometry and topology: an article published on *Invent. Math.* in 2000 was extended by Schoen (member of the US National Academy of Sciences) using a whole section; an article published on *Invent. Math.* in 2008 was called "foundational article" by McDuff, who is a fellow of the Royal Society, in her paper published on *Duke Math. J.*; an article on the dual theory of the function spaces was published on *J. Amer. Math. Soc.* in 2005; an open problem proposed by Villani (winner of the Fields medal), published on *Ann. of Math.*, was solved by the group in 2010; and an article on the Einstein field equations was published on *Ann. of Math.* in 2015.

In the past few decades, the trend in the research of the geometry and topology of manifolds was that it involves more and more analytic techniques. The research group will continue its research on the geometry and topology, following the international trends, and try to obtain breakthroughs in several important and frontier topics.

3.3

Dr. Chen Peng

Professor

Department of Chemical Biology, Peking University
Academic Leader of the Creative Research Group
in 2015

The NSFC Funded Creative Research Group “Chemical Biology Study of Cell Fate Modulation” is based on College of Chemistry and Molecular Engineering at Peking University and Beijing National Laboratory on Molecular Science. Our team focuses on investigating the essential roles of biomolecules’ dynamic chemical modifications on cell fate modulation, probing the molecular mechanism of cellular processes, and developing the corresponding chemical perturbation strategies. Emerged at the end of last century, chemical biology is an interdisciplinary research field that integrates chemistry with biology and medical science in order to address fundamental questions related with human health. Chemical biology research in China was kept at the same pace with the world and NSFC has offered continuous supports to this new exciting area. The Department of Chemical Biology was established at Peking University in 2001, which is one of the earliest chemical biology research units in China. Embarking on these previous foundations, the idea of using chemistry-enabled tools to study biological questions gradually came into shape among our team members, which allowed us to establish unique features within the team including versatile research strategies, converged scientific questions, complementary research expertise, and fruitful collaboration experience. In recent years, our team has developed a series of biomolecule-based research tools and dynamic detection methods. Using these powerful techniques, we illustrated the cell fate regulation mechanism, identified “exogenous” perturbation strategy on cell fate modulation and achieved an array of



high impact work in areas such as protein functional manipulation, glycosylation modification and chemical genetics. We have published over 150 papers with 4500 overall citations, and parts of our work were published on top journals including *Nat. Chem. Biol.*, *Nat. Chem.*, *Cell* and have been highlighted by scientific media such as C&E News. The team leader Professor Chen Peng has conducted some ground-breaking work in areas such as “protein chemistry in living cells”. He received grant of National Science Fund for Distinguished Young Scholar Award in 2012 and Royal Society of Chemistry Chem Soc Rev Emerging Investigator Lectureship in 2014.

More and more evidences have shown that the protein-protein interaction (PPI) network, mediated by dynamic biomolecule chemical modifications, plays essential roles in controlling diverse cellular processes, and misregulation of such interactions will cause severe diseases such as cancer and neuron degenerative diseases. Our team plans to focus on discovering, deciphering and specific perturbation of crucial PPIs underlying all the major stages during cell cycle. By developing new research tools and detection techniques for PPI study, we hope to precisely uncover the PPI-mediated cell fate regulation mechanism, search for “exogenous” perturbation strategies, and endeavor to make breakthroughs in developing new reactions tools, novel perturbation targets and new targeting molecules for living systems.

3.4

Dr. Jiang Yunbao

Professor
College of Chemistry and Chemical Engineering,
Xiamen University
Academic Leader of the Creative Research Group
in 2015

The “Spectrochemical Analysis” Creative Research Group, led by Professor Jiang Yunbao, is based on the Ministry of Education Key Laboratory of Spectrochemical Analysis and Instrumentation and the National Key Discipline of Analytical Chemistry at Xiamen University. Analytical chemistry at Xiamen University has been developing for 50 years under a general strategy of “developing new techniques and methods, building new instruments”. The creative research group has carried out systematic investigations to develop new principles, technologies and methods of spectrochemical analysis, enhanced by designing and building new instruments and devices to promote the integration of new methods and technologies, in order to target analytical chemistry challenges in complex sample systems that are critical to national strategic programs in life sciences, environment, materials, and energy. The group has been a national leading team with high international reputation in atomic, molecular and mass spectroscopy, micro/nano scale analysis, and instrumentation. In the past 5 years: the members of the group have published a total of 414 SCI papers, of which 97 are in the JCR grade 1 and 179 are in the JCR grade 2; 31 Chinese invention patents and 2 utility patents were approved; the group received 2 team-awards at the provincial and ministerial level and 9 individual awards, and published 1 book and 5 book chapters.

The group leader, Professor Jiang Yunbao, has focused on electron/proton transfer photophysics and supramolecular photochemical sensing. He is one of the leading researchers in China in fluorescence spectroscopic analysis. Dr. Jiang has published more than 150 SCI papers with a total citation of over 3000. He has won several awards or prizes including one



second-class research prize and one third-class research prize from the Ministry of Education, Young Faculty Award of the Ministry of Education, Fok Ying Tung Young Faculty Excellence Award, China Youth Science and Technology Award, and the Young Chemist Award of the Chinese Chemical Society. Dr. Jiang has been on the (advisory) editorial boards for many journals, including *Photochem. Photobiol. Sci.*, *Supramol. Chem.*, *Methods and Application of Fluorescence*, and *ACS Sensors*.

Innovation in the theory, methodology, technique and instrumentation to obtain physical, chemical and biological properties and their changes will be the future development in the spectrochemical analysis, enabling therefore analysis at molecular level, interface, and micro and nano-scale, with the potential of high spatial and temporal resolution. Members in the “Spectrochemical Analysis” Creative Research Group will collaborate closely in the following 4 directions of atomic, molecular and mass spectrometry, micro- and nano-scale analysis, multimodal imaging, and innovation in instruments and devices. The group will concentrate on both basic principles, methods and technologies and their hyphenation, to afford fast, sensitive, selective, and feasible *in situ* and real-time analysis and thereby play key roles in solving scientific issues of national need and scientific frontier in spectrochemical analysis and at large in analytical chemistry as well.

3.5

Dr. Jin Li

Professor
School of Life Sciences, Fudan University
Academic Leader of the Creative Research Group
in 2015



Professor Jin Li is the Vice President of Fudan University. He was elected into Chinese Academy of Sciences in 2013 and “Thousand Talent Plan” in 2011. His research interests include human population genetics, genetic epidemiology, medical genetics and computational biology.

The Creative Research Group on “the mechanisms of *de novo* mutations and related diseases” was assembled based on the State Key Laboratory of Genetic Engineering at Fudan University. All group members are either the awardess of National Science Fund for Distinguished Young Scholar, National Science Fund for Excellent Young Scholar, or Thousand Youth Talent Plan, with shared interest on the mechanisms of *de novo* mutations and related diseases. This is a young and active team with complimentary expertise. The members of the group have been collaborating in the last several years, and their strength lies with integrating evolutionary perspectives into the studies of molecular mechanisms. The group leader, Dr. Jin Li is a veteran researcher in the field of human population genetics and human evolution. He has been studying the characteristics of genetic diversity of East Asian populations, the genetic mechanisms of adaption, and genetic susceptibility of diseases in the context of natural selection. He coauthored over 400 papers published in premier journals including *Nature*, *Science* and *Cell*, reflecting his contribution to the theories and methodologies in the field of evolutionary genetics,

genomics and computational biology. Dr. Jin Li is the winner of State Award of Natural Sciences, Prize for Scientific and Technological Progress of Ho-Leung-Ho-Lee Foundation, and Tan Jianzhen Life Science Innovation Award. Three of his students received National Excellent Doctoral Dissertation Award.

The research of this group showed that *de novo* mutations in human genomes play important roles in human diseases especially in birth defects. The in-depth study on the mechanisms of such mutations and their nosogenesis of related diseases could provide scientific as well as technical support to the national agenda of reducing the birth defects, contributing to the revelation of many idiopathic diseases.

This group focuses on birth defects as a model for the studies of *de novo* mutation and takes full advantage of the pedigrees and populations samples of the biobank at Fudan University which provide ideal resource to the identification of *de novo* mutations including point mutations and copy number variations and to the investigation of mutational mechanisms. The expertise of this group, such as paired-end analysis of transcriptional start sites, genome editing, and stem cell disease model provides strong methodological support. Our goal is to reveal the role of *de novo* mutations in human diseases.

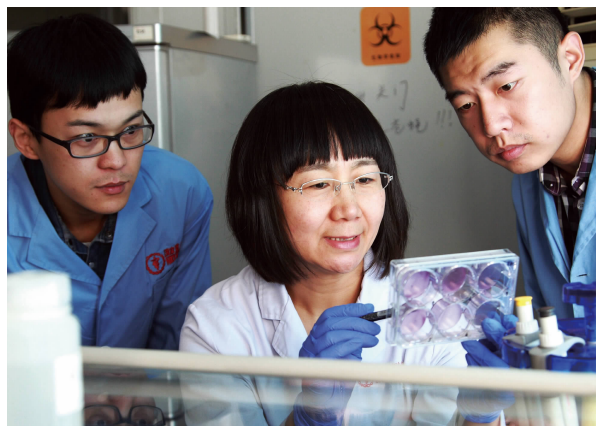
3.6

Dr. Chen Hualan

Professor

Harbin Veterinary Research Institute, Chinese Academy of Agricultural Sciences

Academic Leader of the Creative Research Group in 2015



The “Evolution and virus-host interactions of animal influenza viruses” Creative Research Group, which is affiliated with the State Key Laboratory of Veterinary Biotechnology, Harbin Veterinary Research Institute, Chinese Academy of Agricultural Sciences, focuses on studies related to the prevention and control of animal influenza outbreaks, and to the scientific aspects of evolution, variation, pathogenesis, and cross-host transmission of animal influenza viruses as well as the mechanisms of virus-host interactions. The group consists of scientists in the fields of virology, immunology, and structural biology. The academic leader Chen Hualan was awarded of the National Science Fund for Distinguished Young Scholars in 2008, and has published over 100 research papers in international peer-reviewed journals, including *Science*, *PNAS*, and *PLoS Pathogens*. Thomson Reuters, United States, identified her as one of the “highly cited researchers in 2015”. In recognition of her research contributions to the prevention and control of avian influenza, Chen Hualan was selected as one of “the 10 people that mattered in 2013” by *Nature*, and was one of the laureates for the UNESCO “Women in Science Award” in 2016.

Members of the group are committed to working closely together in the long term on animal influenza virus-related basic research and applied technology research

and development. As a result of their dedication, they won the National Prize for Natural Science in 2013, the National Prize for Technological Invention in 2007, and the National Prize for Scientific and Technological Progress in 2005. More than 140 billion doses of the novel avian influenza vaccines they developed have been used in China and other countries, which has enormous positive impact on the prevention and control of avian influenza and have resulted in huge economic and social benefits. Their comprehensive research has greatly improved our understanding of the genetic and biological properties of the H5N1 and H7N9 influenza viruses, and has revealed the public health risks posed by these viruses. Accordingly, their work has provided important information for the prevention and control of H5N1 and H7N9 viruses in animals, and pandemic preparedness for humans.

Supported by the National Science Fund for Creative Research Group, the members of this group will continue to investigate the evolution of animal influenza viruses, to conduct in-depth studies on the mechanisms of pathogenesis, cross-species infection and transmission of animal influenza viruses, and to explore the key molecules, regulatory pathways and underlying structural and functional mechanisms involved in virus-host interactions in order to advance influenza virus research.

3.7

Dr. Wang Dongxiao

Professor

South China Sea Institute of Oceanology, Chinese Academy of Sciences

Academic Leader of the Creative Research Group in 2015



Dr. Wang Dongxiao is the Deputy Director of the South China Sea Institute of Oceanology (SCSIO), Chinese Academy of Sciences. He was the winner of the National Natural Science Fund for Distinguished Young Scholars in 2006, and the former director of the State Key Laboratory of Tropical Oceanography (LTO). He won the National Prize for Natural Science (second place) in 2014, “Ten Thousand Talent Program” leading talent of scientific and technological innovation, National Award for Youth in Science and Technology, etc. Dr. Wang has been engaged in the research of physical oceanography, including air-sea interaction for many years. He has served as the chief scientist of scientific cruises in the South China Sea (SCS) and Indian Ocean (IO) more than 10 times, and presided over construction of the China’s first deep-sea observation station.

The creative research group, led by Dr. Wang Dongxiao, is the core team of the LTO, with focus on fundamental theories. After 10-year long-term cooperation with each other on dynamic process of oceanic circulation and theoretic research of oceanic circulation based on long-term ocean observations, the team has made a series of important achievements with international recognition in ocean dynamics, air-sea interaction and ocean observations in the SCS. Dr. Wang co-discovered and named “SCS through flow”, which is an important pathway of water exchange linking the SCS and adjacent oceans. His team found the

ENSO-like phenomenon in the IO, revealed the mechanism of the joint effect between baroclinicity and relief (JEBAR) linking offshore shelf and open sea in the SCS via dynamic diagnosis on mid-depth and bottom current and simulations. His team also investigated the energy budget in the SCS and spatial-temporal characteristics of its transportation by studying mesoscale eddies, internal waves and tidal-wave mixing in the SCS.

The research team includes three winners of the National Science Fund for Distinguished Young Scholars. In the recent 5 years, the team has published 261 scientific articles, among them 183 are in SCI and EI journals, and are recorded 2150 SCI citations by colleagues in global scientific community.

The research team will focus on the impact of tropical IO on the SCS through Asian monsoon, build the theoretical system of spatial-temporal structure of oceanic circulation in the SCS-eastern IO and its variation mechanism, and deepen the understanding of oceanic circulation dynamics and air-sea interaction in the SCS. The main goal is to form a world-class innovative team by establishing the China’s leading position at the SCS oceanic circulation research, and serving the national marine economy, military and other demands.

3.8

Dr. Wang Yanxin

Professor
China University of Geosciences, Wuhan
Academic Leader of the Creative Research Group
in 2015

Professor Wang Yanxin, the awardee of National Science Fund for Outstanding Young Scholars, President of China University of Geosciences, has been actively involved in research work related to environmental hydrogeology.

The research group takes groundwater system as the object, focus on the migration and transformation of hazardous substances as the key scientific issue under the guidance of earth system science and water-rock interaction. It has developed and integrated advanced analytical, tracing and modeling technology, promoted multi-disciplinary crossing and integration, accelerated progress on bringing forth the new through the old as follows: (1) His group proposed new geochemical model on genesis of soda water, and studied the geochemical processes controlling arsenic mobilization and transformation in aquifer sediments, including iron oxyhydroxide adsorption-desorption and reductive dissolution, sulfate reduction, organic matter degradation and microbial activities; (2) a novelty method using the economic mineral materials and advanced electrochemistry technique has been proposed to deal with some prevalent organic and inorganic contaminants, which provides some new technical supports to the remediation of groundwater and soil systems; (3) targeting the unique features of contaminants in groundwater systems, such as specificity, sensitivity and selectivity, some new analysis and tracing techniques have been developed to better cover the high-level requirement and to understand the transportation mechanism of contaminants, for instance, the application of untraditional isotope in tracking contaminant flow path and transformation in groundwater system; (4) a new assessment model was proposed to evaluate vulnerability of groundwater system, and further the formulas of non Darcy flow and non Fickian dispersion processes were explored, and



finally quantitative models were established to delineate the multi-dimensional behaviors of metal element and radioactive nuclear in soil and sediment, which has been successfully to on the coupled simulation on multi-rate mass transfer of contaminants and surface complexation reaction in field scale.

In recent 5 years, his group has published 244 SCI papers cited by other scholars 3340 times, and 13 proceedings of conferences and symposia, and translated 3 books. Professor Wang has been rewarded 9 Science and Technology rewards. He has held international conferences in China 5 times and has actively involved in academic communication with other famous international scholars.

In the next step, his group will move forward to integrate multi-disciplinary theory and technology to develop method to analysis, trace and simulate trace hazardous contaminants in groundwater systems, keeping the crucial role of hydrogeology, in order to finely delicate and better understand the migration and transformation of hazardous contaminants and controlling factors under coupled processes on multi type and multi scale. Furthermore, his group will pursue research on low-cost and effective groundwater remediation techniques, and apply these methods in the *in situ* remediation practice, which will be useful for policy making in sustainable groundwater utilization, and guarantee safe groundwater availability.

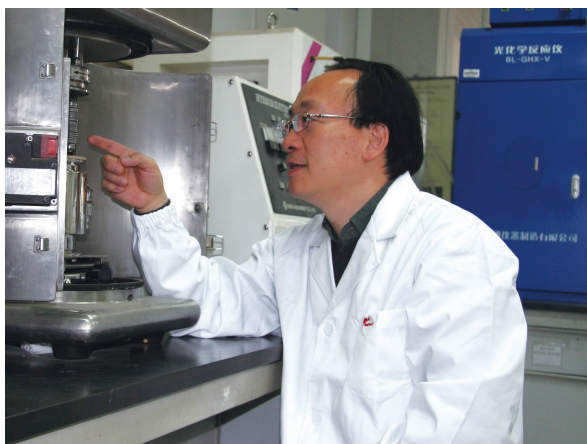
3.9

Dr. Fu Zhengyi

Professor

State Key Laboratory of Advanced Technology
of Materials Synthesis and Processing, Wuhan
University of Technology

Academic Leader of Creative Research Group in
2015



Professor Fu Zhengyi is a winner of the National Science Fund for Distinguished Young Scholars in 1999, National High-level Talents Special Support Program in 2014, and Cheung Kong Scholar of the Ministry of Education of China in 2000. He has focused his research on the design of the structure of functional materials, the development of new compositing technologies and the applications of functional materials. He has received the Third-class Award of National Science and Technology Prize of China in 1997, the Second-class Award of Technology Invention Prize of China in 2012 and 2015. He has published 130 SCI indexed papers and is inventors of 50 patents.

Functional composites are frontiers of materials technology, which are urgently needed by industry. The Creative Research Group relies on Wuhan University of Technology. The group's research topic is designing of new structure and fundamentals of fabricating technology for functional composites. In recent 5 years, the group has won 3 Second-class Awards of National Technological Innovation Prize, 1 Second-class Award

of National Science and Technology Progress Prize, 1 Second-class Award of National Natural Science Prize, 8 First-class Award of Provincial and Ministerial Science and Technology Progress Prize and 2 International Academic Awards. The group members have published 90 SCI indexed papers with impact factors bigger than 6. Their published papers have been cited over nine thousand times. The group members have been authorized 151 Chinese Patents.

The group will emphasize in three research directions: creating of multi-scale composite structure realizing transport with synergistic regulation, fundamentals of integrated fabrication techniques and physical chemistry of service process of functional composites, hoping to get original and frontier research results in the development of new multi-scale composite structure and structural/functional properties, the structure formation mechanism and fabrication technologies, which can supply the key technical support for the development of national high tech industries.

3.10

Dr. Ma Yuguang

Professor

School of Material Sciences and Engineering, South
China University of TechnologyAcademic Leader of Creative Research Group in
2015

Professor Ma Yuguang currently is the dean of the State Key Lab of Luminescent Materials and Devices. He won the National Science Fund for Distinguished Young Scholars in 2001, and then was selected as Yangtze River Scholars Distinguished Professor of Ministry of Education in 2006. He devoted to the researches on “Relations between Structures (chemical, condensed, electronic structures) and Properties (luminescence, laser, mobility) in Organic/Polymer Functional Material Systems”. He has developed many novel material systems, deeply studied the photophysical processes, and investigated advanced polymerization methods. He has published many influential research papers in important international academic journals including *JACS*, *Adv. Mater.*, etc.

The established creative research group, relying on the State Key Lab of Luminescent Materials and Devices of South China University of Technology, mainly focuses on the basic science and technology issues of organic/polymer optoelectronic functional materials, especially on the development of solution-process able techniques for high-performance light-emitting diodes (OLEDs) and photovoltaic devices. The research group innovatively presented and discussed the principle of using phosphorescent materials to improve efficiency of OLEDs, and exploited a class of material system to greatly enhance the efficiency of devices, based on which the group member received the Second-class Prize of the State Natural Science Award in 2009. The group developed variety of new luminescent and photovoltaic material systems and especially a series of conjugated polyelectrolyte interface materials, and for the first time realized OLEDs and display with full-printing preparation technology (containing metal electrode), based on which the group members received the Second-class Prize of the State Natural Science



Award in 2010. In the organic photovoltaic field, the group developed a series of main-chain/side-chain type D-A polymers to broaden the absorption and improve the mobility, and also designed a new type of device structure to achieve the highest efficiency of single heterojunction polymer solar cells among the publicly reported results over the same period, based on which the group members received the Second-class Prize of the State Natural Science Award in 2015. In past 5 years, the group members totally published more than 480 SCI papers including 59 papers with impact factor (IF) higher than 10. 21 of which were cited more than 200 times, and 31 papers were selected as ESI highly cited papers. Specially, one paper on organic photovoltaic (*Nature Photon.*, 2012, 6: 591) has been cited more than 1800 times, ranking first in the world highly cited papers in physics, and ranking second in highly cited papers for the last 10 years in China, which was also selected as 2012 annual “The Top Ten Advances in Science in China”.

The research group will strives to make breakthroughs in the following aspects: material systems—from screening research to rationally design; physical mechanism—from macroscopic property to microscopic mechanism; device design—from small device to large area modules. The overall research level should be among the world class research team in organic photoelectric field, making internationally recognized breakthrough and leading achievement, and promoting the development of related industries in China.

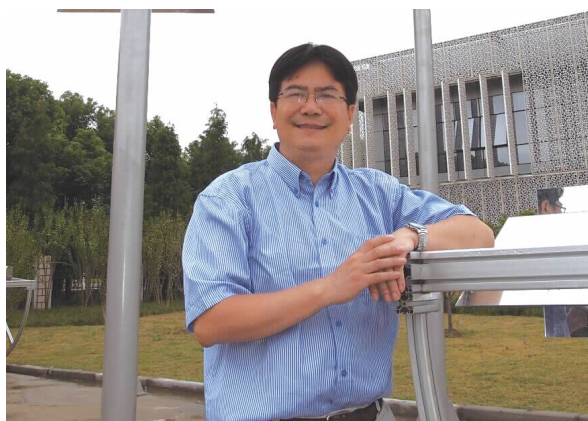
3.11

Dr. Wang Ruzhu

Professor

School of Mechanical Engineering, Shanghai
Jiao Tong University

Academic Leader of Creative Research Group in
2015



Professor Wang Ruzhu holds several academic honors & awards, including National Distinguished Young Scholars, Cheung Kong Chaired Professor, Elsevier Most Cited Chinese Researcher, National Model Teacher, National Advanced Worker, PI of the Innovation Team in Key Research Field of Ministry of Science & Technology of China (MOST). His major research focuses on HVAC & refrigeration and high-efficient utilization of energy. Professor Wang was awarded the second prizes of the State Natural Science Award in 2014 and the State Technological Invention Award in 2010 (both as the first contributor). In 2013, he was also awarded as the J&E Hall Gold Metal by Institute of Refrigeration (IOR). Professor Wang serves as the Vice President of Commission of Refrigeration Equipment (B2) of International Institute of Refrigeration, the Vice President of Chinese Association of Refrigeration, Deputy Editor-in-Chief of *Energy*, regional editor of *International Journal of Refrigeration*. He published 388 SCI index research papers with 4294 times cited by other researchers and an H-index of 40.

The main research of Creative Research Group is focused on “Fundamental Research on Heat & Mass Transfer and High-efficient Thermodynamic System” supported by Shanghai Jiao Tong University. The group includes 1 member of Chinese Academy of Science, 3 Distinguished Young Scholars, 2 Cheung Kong Chaired

Professors, 2 members from the National High-level Personnel of Special Support Program, 2 members of “1000 Plan Scholars of China”, 2 Outstanding Young Researchers and 2 National 100 Excellent PhD Thesis winners. Moreover, 1 member was awarded the Thomson Reuters 2014 Highly Cited Researcher and other 4 members were awarded the Elsevier 2014 Most Cited Chinese Researchers.

The Creative Research Group developed advanced technologies for the cutting-edge researches on thermal science and energy utilization. Tremendous achievements have been obtained in recent years, which have satisfied the important needs of economic development. The relevant achievements have been awarded several academic prizes: 2 second prizes of the State Natural Science Award, 1 second prize of State Technological Invention Award, 1 second prize of National Science and Technology Progress Award; 5 first prizes and 7 second prizes of Provincial/Ministerial awards. The group also published 350 SCI indexed research papers in recent 5 years with 8669 times cited, granted more than 60 invention patents. Besides, the team has cultivated national top 100 excellent PhD theses twice, and with nomination awards 8 times. The representative achievements obtained in recent years mainly include: (1) The group developed advanced solid-gas adsorption refrigeration theory and

technology, with merits of composite sorption, heat and mass recovery cycle and capillary-assisted evaporation heat exchange. The high-efficient and stable sorption refrigeration powered by low-grade thermal energy can be realized by employing above-mentioned methods. The designed simulation software for refrigeration has been widely applied in the international and domestic large air-conditioner enterprises. Due to the most noteworthy contribution to the advancement of international refrigeration science, Professor Wang Ruzhu was awarded the J&E Hall Gold Metal by the Institute of Refrigeration (IOR), who is the only Chinese winner globally since the setup of this award 37 years ago. (2) The group performed a leading international research on the fields of micro-scale single phase flow and convection heat transfer, micro-scale boiling heat transfer, micro-scale condensation heat transfer. Academician Mr. Cheng Ping was awarded the Max Jakob Memorial Award by ASME-AIChE, which is regarded as the highest honor in heat transfer field. (3) The group firstly revealed the thermal non-equilibrium around the blood vessels and surrounding tissues, and a new biotic heat transfer model has been proposed. A new series of biomimetic functional material has been synthesized for thermal storage, heat transfer, heat detection and heat conversion. The relevant

achievement was awarded the B.S.F Schaefer Young Faculty Award. (4) The group has designed and developed a green energy building with different advanced renewable energy utilization technologies. The green energy building has been awarded the only one first prize of National Green Building Innovation Award in 2005 by Ministry of Construction of China. The solar heating and air-conditioning demonstration program was successfully selected as the generalized exemplary by Wisions, Germany. The Sino-Italian Green Energy Lab (GEL) was awarded LEED Gold Metal due to its innovative design.

In order to achieve energy saving and efficient uses of renewable energy, the group will develop advanced cutting-edge researches. The interdisciplinary research of heat transfer, life science and thermodynamics will be performed. With the help of heat and mass transport principle and thermal control means in life science, the group will systematically study multi-scale heat and mass transfer, biological thermodynamic mechanism and micro-scale bio-thermal physics, and advanced biomimetic thermodynamic systems, which may form a complete original biomimetic thermodynamics in the world, which may has obvious international impact.

3.12

Dr. Ji Xinsheng

Professor

Information Technology Research Institute, The
PLA Information Engineering University

Academic Leader of Creative Research Group in
2015



Professor Ji Xinsheng, who is a state-level young and middle-aged expert with outstanding contributions and a state-level talent of the “Pacesetter Project”, serves as the Deputy Director of China National Digital Switching System Engineering and Technological R&D Center (NDSC). He has been engaged in the research and development of network communication and security technology for a long time, winning the First Prize of the National Science and Technology Progress for three times (in one of the awards, he ranks first among the contributors) and has acquired 12 invention patents.

NDSC, as the innovation research carrier for basic theories of the Cyberspace Mimicry Defense, has been focusing itself on the need for the development of the information communication network core for the past 30 years. Great efforts have been made in the development of network switching, wireless communication, computing technology, information security and applied mathematics in cooperation with other national experts. NDSC takes the lead in the growth of the national SPC switching technology and industrialization and plays a driving role in the breakthrough and development of the national high-speed broadband network technology and industrialization. It keeps developing itself in pushing the growth and enhancement of the national communication network technology and core equipment, winning the First Prize of the National Science and Technology Progress for 4 times, and the Second Prize of the

National Science and Technology Progress for 8 times, the Second Prize of the National Invention for 1 time, acquiring more than 120 invention patents and has more than 100 papers cited by SCI.

In 1991, China’s first SPC exchange HJD04, whose design and development was guided and led by Professor Wu Jiangxing (an academician and the founder of the creative group), was known for breaking the foreign monopoly, which was regarded as the first major achievement in China’s communication industry. HJD04 created the hierarchical distributed architecture and fully-decentralized duplicated-T digital switching network core technology and has maintained its advantage in the call busy processing capability (one of the major SPC indexes) with its processing capability tripling that of the world for 4 years. The technological breakthroughs and the industrialization of HJD04 machine were a milestone in the field of engineering technology in China.

Among the innovations by NDSC are the large-scale convergence access router architecture, the realization of point-to-point, point-to-multipoint and tri-mode unification streaming media transmission mode, the trinity (storage, calculation and transmission) streaming media processing mode, and the leading role of the development of the world’s largest and most advanced high performance broadband information network (3TNet), which was highly praised by the British

magazine *New Scientist*.

The creative research group created the theory of the new ring sequence code, provided the 4G encryption ZUC algorithm source design, one of the two main work sequences, and made great contributions to the international 4G standard for the ZUC algorithm. The group members also delivered academic speeches at the Asia Annual Cryptography Conference, one of the top world cryptography meetings in the world.

The creative group established a highly efficient processing oriented computing theory of mimicry, achieved the “active reconstruction calculation based on the cognitive architecture”, “reconfigurable internet

network”, “advanced reconfigurable processor” and other invention patents and led the development of the world’s first mimicry calculation principle prototype, and the third party test showed that the typical scenario application effectiveness can increase 13.6 to 315 times. It was selected as one of China’s Top Ten Scientific and Technological Progress achievements for 2013.

As the current network space defense system is difficult to deal with unknown vulnerabilities/serious security threat from the back door of the unknown attacks, the group will continue its exploration without relying on prior knowledge of active defense mechanism, and create a new defense theory system to change the game rules.

3.13

Dr. Chen Jian

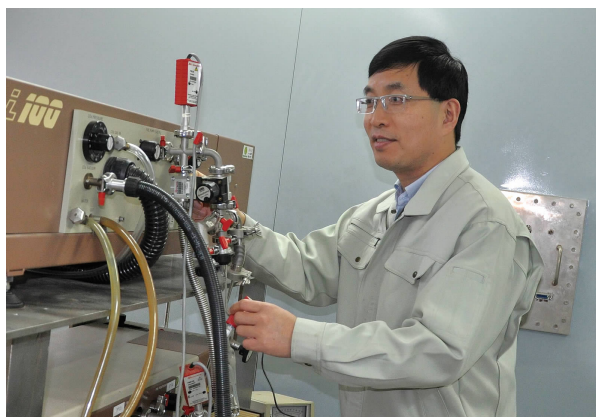
Professor

School of Electronic Engineering, Nanjing University
Academic Leader of Creative Research Group in
2015

Chen Jian is a distinguished professor of the Chang Jiang Scholars Program. He is now a Principal Investigator of the Project, named “Novel terahertz (THz) sources, receivers, other key functional devices and their applications”, supported by the National Basic Research Program of China (“973” Program). Also, he is the Chairman of Superconducting Electronics Society of Chinese Institute of Electronics. He has published more than 160 papers on the SCI journals.

The Creative Research Group of “Towards the quantum limit of the electromagnetic (EM)-wave detection” is accompanied with multi-disciplinary developments and requirements from the THz science and technology, the quantum information science and technology, and so on. With the support from the National Natural Science Foundation of China (NSFC), in order to solve several frontier and key scientific and technical problems during the developing processes, the team was formed naturally in the long term cooperation to give full play to the academic and technical expertise of the members. The team includes 1 academicians of CAS, 1 professor of National Thousand Talents Program, 3 Distinguished Young Scholars from NSFC, 5 Distinguished Professors of the Chang Jiang Scholars Program, and so on. In the past 5 years, 11 papers on *Nature* sub journals have been published from the team and cited for more than 2000 times.

The team carries out the researches including basic



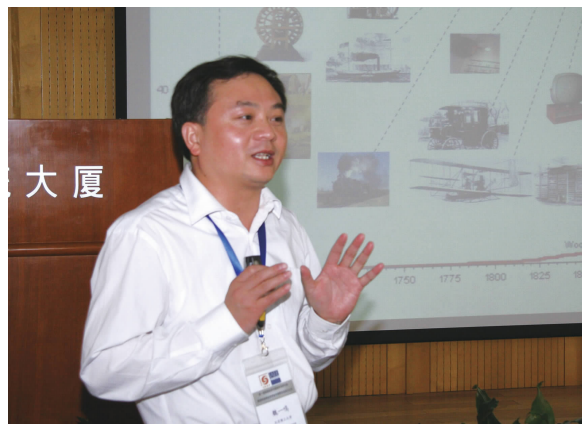
researches for the applications, key breakthroughs of the technologies, and developments of the instruments. The team has made great achievements on the new materials and fabrication processes, single photon detection in the optical band, THz wave detection towards the quantum noise limit. The details include: (1) We have successfully fabricated the high quality ultra-thin superconducting films and nanowires with large area; (2) After solving the effective optical coupling, low noise readout and integration of the system, and so on, we have developed high performance superconducting nanowires single photon detectors, and delivered them to other groups around the world to demonstrate their applications on the quantum key distribution, laser ranging, as well as the evaluation of the ultra-broadband parametric fluorescence and the application in quantum metrology, and so on; (3) We have realized the 8 times of the quantum noise temperature limit using the superconducting THz mixer working at 2.5 THz, which laid the foundation for approaching the quantum limit detection at THz wave band in near future.

Focusing on the novel EM materials and devices, the team will continue to play a complementary and crossover characteristics and concentrate on the single photon and ultra-sensitive EM-wave detections. We hope to establish new detection mechanisms, develop new techniques, find new materials and devices, and achieve several breakthroughs on major scientific issues and key technologies of the EM-wave sensitive detections.

3.14

Dr. Wei Yiming

Professor

Center for Energy & Environmental Policy
Research, School of Management and Economics,
Beijing Institute of TechnologyAcademic Leader of Creative Research Group in
2015

Professor Wei Yiming is the Chair Professor of Chang Jiang Scholars Program of the Ministry of Education of China in 2008, Winner of National Science Fund for Distinguished Young Scholars in 2004 and Hundred Talents Program of the Chinese Academy of Sciences in 2005. He is the PI of the NSFC Fund for Creative Research Group of Energy Economics and Climate Policy. Professor Wei has long been engaged in the research and teaching of management system engineering. He has performed innovative researches and made contributions in such fields as energy-economic forecasting and decision-making modeling, resource and environment management, energy economics and climate policy. He has hosted over 40 projects including the Key International Collaboration Program Initiated by National Natural Science Foundation of China, National Basic Research Program of China ("973" Program), National Key S&T Program Initiated by State Ministry of Science and Technology of China, Key Program Initiated by National Natural Science Foundation of China, EU FP7, etc. He has published over 10 books and more than 370 academic articles. 113 of the articles have been included in SCI/SSCI, and over 100 articles have been included in EI. According to the statistics of Web of Science, his published SCI/SSCI articles have been cited by 1463 times, with the number strictly cited by others amounting 1280 times and the H index reaching 22; according to

the statistics of Google Scholar, his publications have been cited by peers with over 8000 times and with an H Index of 46. He entered the list of Most Cited Chinese Researchers in 2014. He has been awarded 7 provincial/ministerial level Science and Technology/Natural Science/Philosophy and Social Science prizes, with 3 of which being first class prize. He has submitted a number of policy consultation reports to the Central Committee and the State Council. The reports have been paid attention to. His research outcomes have made great impact in both academic circles and government departments.

The Creative Research Group of Energy Economics and Climate Policy gathered a group of excellent young scholars (with an average age of 37) who engage themselves in energy economics and climate policy research. Given that in the energy-economy system there exists huge amount of problems of positive/negative feedback with high nonlinear, dynamics and uncertainty, the group founded methodology and integrated model systems that could comprehensively describe the interaction and dynamic relationship among energy, climate, technology, economy, and society, developed models, platforms and database systems with independent intellectual property rights, and performed application researches at macro, intermediate and micro levels to provide scientific supports for the nation's

decision making about energy economies and climate policies.

Academic articles published by the group have received wide citation and high evaluation from both domestic and foreign peers. According to the statistics of Web of Science, the SCI/SSCI papers published by the group members have been cited by 1908 times (H Index = 25), with the citations per paper being 9.4 times. 5 of the papers were cited by others with over 60 times. 8 papers were referenced in the IPCC 5th Assessment Report. Members of the group were invited to assume the members of editorial boards or associate editors of more than 10 international academic journals in the field of energy economics and climate policy, such as *Applied Energy*. Moreover, members of the group have organized special issues in 8 international journals such as *Annals of Operations Research*, *Natural Hazards*, with the subjects such as energy economics and climate policy modeling.

The group will continue to meet the important strategic needs of China, and carry out researches in the field of

energy economics and climate policy, so as to become an academic research team with high international reputation, and become a think tank for China in this field. Research work of the group will further highlight the integrity characteristics of the energy-economy complex system. With respect to the mechanism and forecasting methods of energy consumption and carbon emissions, the time use allocation model will be further explored and established. In the field of the mechanism and strategy of climate policy, both the temporal and spatial uncertainty will be completely taken into account, and the inter-generation and inter-nation equity issues of carbon emission allowances allocation will be explored. As for the analysis of energy-economy system, an integrated approach that combines bottom-up and top-down methods will be established, the energy economics and climate policy integrated model and methodology system will be created, so as to provide theoretical methods and technical supports for energy economics and climate policy researches, and provide scientific basis for ensuring the nation's energy security and for the policy decisions addressing climate change.

3.15

Dr. Liu Xinbao

Professor

School of Management, Hefei University of Technology

Academic Leader of Creative Research Group in 2015

In 1992, Professor Yang Shanlin, the member of the Chinese Academy of Engineering, presided over the research of a national key project titled “System of computer aided management and production process real-time monitoring of Anqing Petrochemical General Plant”, which was approved by the Electronic Information System Popularization and Application Office of the State Council. After then, an interdisciplinary research institute was established and a research squad was constructed to form a research group led by Professor Yang Shanlin. Professor Liu Xinbao has been long polished by the group culture, played an important role in the group formation and development process, and has gradually grown into a new academic leader of the group. He has been engaged in the research of process optimization and decision science, and in recent 5 years he has published 20 academic papers in SCI cited journals, including *Annals of Operations Research* and *European Journal of Operational Research*. He has won 2 second prize of National Scientific and Technological Progress awards, 3 first prize of Provincial Scientific and Technological Progress awards, and 1 second prize of State-level Teaching Achievement.

The main research characteristic of the group can be concluded as follows: refine the key scientific problems in the process of complex product development and production process optimization for further theoretical study, realize the improvement and distillation of the theoretical achievements by multiple circular interactions of theory and practice, and finally form systematic theoretical innovative achievements which have guiding effects to management practices. For example, taking the engineering management of vehicle development as the research background, the group has constructed a



requirement-oriented and innovation-driven dynamical decision theory system of development engineering management of complex products, which comprises functional system, methodology system, and technical system of dynamical decision. Then, combining dynamical decision theories of development engineering management of complex products with technologies of information management system, this group has developed the complete vehicle's self-developed system platform and the system of process optimization and engineering management to form the technologies of development process control and management of complete vehicle with independent intellectual property rights, which is an important contribution to our country's development of theories, methodologies and technologies of development engineering of complete vehicle with independent intellectual property rights. On the basis of the above researches, the group has systematically made conclusions and distillations of theories, wrote and published an academic monograph titled “*Theories and methods of development engineering management of complex products*” (2012, Science Press), which is highly praised by peer experts.

The present technologies of internet and big data are producing a profound influence on the development of industries, which changes the business decisions deeply. In the direction of “Business-oriented decision theories and methods under the environment of internet and big data”, the group is now focusing on scientific problems in four aspects: business management reform, business decision-making modes innovation, business decision methods, and enterprise intellectual decision support system under the environment of internet and big data.

3.16

Dr. Ge Junbo

Professor

Zhongshan Hospital, Fudan University

Academic Leader of Creative Research Group in
2015



Dr. Ge is now the Director of the Department of Cardiology, Zhongshan Hospital, Fudan University. He received his grant of the National Science Fund for Distinguished Young Scholars in 2007. He was promoted as Academician of the Chinese Academy of Sciences in 2011. His main research direction is the pathogenesis of atherosclerosis especially immune-inflammatory effects on atherosclerosis. He is also an interventional cardiologist. Based on the study of the pathogenesis and therapeutics of ischemic coronary diseases creative group in Zhongshan Hospital and Shanghai Institute of Cardiovascular Diseases, the group has been focusing on the mechanism of immune-inflammatory effects on atherosclerosis, microvascular dysfunction and metabolic energy disorder, myocardial injury and repair as well as early intervention on above disorders. It has published more than 400 SCI indexed papers which were cited more than 3000 times by other publications.

In the study of the pathogenesis of atherosclerosis, Dr. Ge and his team members found that foam cells may originate from dendritic cells and immature plasma cells. They elucidated the effects of dendritic cells in the development of atherosclerosis. In the study of myocardial energy metabolism, they found that ALDH2

might contribute to the preservation of the injury of mitochondria and the following consumption of energy. They further explored the pathways of protection as well as signal modulation. In the study of myocardial remodeling, they found the mechanism of angiotensin II receptor is activated directly by mechanical stimulation. For the first time, they discovered that the receptor could be activated by direct mechanical stimulation rather than angiotensin II pathway. In the study of myocardial repair, they hypothesized the theory of “myocardial stiffness post myocardial infarction will affect the transplanting cell transformation”. They introduced a novel method using magnetic field for targeting preconditioned stem cells. In addition, they successfully made a new concept coronary stent with biodegradable polymer coating which has significantly decreased the incidence of stent thrombosis.

This research group will focus on the chain of atherosclerosis-microvascular dysfunction and energy metabolism-myocardial injury and remodeling for further study. Serial novel findings of elucidation the mechanism of the initiation of atherosclerotic plaques, blocking the process of its progression and restoration of the injured myocardium are expected.

3.17

Dr. Qiao Jie

Professor and Chief Physician
Peking University Third Hospital
Academic Leader of Creative Research Group in
2015

The Creative Research Group on “Female germ cell development and reproductive genetic disorders” is led by professor Qiao Jie and is based Beijing Key Laboratory of Reproductive Endocrinology and Assisted Reproduction and the Key Laboratory of Assisted Reproduction for the Ministry of Education Professor Qiao Jie is the winner of National Science Fund Distinguished for the chief scientist of the Ministry of Education Chang Jiang Scholar Professor, and the leading scientist of “973” special program for “Growth and Reproduction”. The main researchers include Professor Tang Fuchou, the winner of the National Natural Science Fund for Outstanding Young Scholar; Professor Zhang Jing, the expert of “Thousand Talents Program”; Professor Li Mo, a member of “Thousand Youth Talents Program”.

The team has been engaged in studying the clinical and basic research of reproductive biology related to human infertility diseases. Over the past 5 years, this research group made a series of great progresses in underlying the key molecular mechanisms regulating oocyte maturation and early embryonic development process, exploring the pathogenesis of reproductive diseases, creating novel assisted reproductive technologies, and improving the success rate of the difficult infertile cases. They have published more than 200 papers in top journals, including *Nature*, *Cell*, *Science*, *Lancet*, *Cancer Cell* and so on, and were awarded the title of “Creative Team” by the Ministry of Education in 2010, the Second Prize for National Science and Technology Progress Award in 2011, the First Prize for the Award of University of Science and Technology Progress of Education Ministry in 2014, and the First Prize for Beijing Science and Technology Progress Award in 2015.

In the process of clinical research and application, the team recognized that infertility prevention and assisted



reproductive technology improvement depend on the in-depth understanding of the regulation mechanisms of human embryonic development. In 2010, Professor Qiao Jie began to collaborate with Professor Tang Fuchou on the study of human germ cell development. Based on the leading single cell high-throughput sequencing platforms, they endeavor to elucidate the key factors in human gametogenesis, early embryonic development and nucleus and cytoplasm mutual effect processes, using donated oocytes, embryos and their established embryo stem cell lines. In addition, by using the MALBAC genome amplification and high-throughput sequencing technology, they completed the whole genome sequencing of healthy women single oocyte, analyzed chromosome recombination characteristics and rules during oocyte meiotic division, which directly provided important basis and technology platform for clinical diagnosis of genetic diseases. Furthermore, they have successfully accomplished the clinical transformation from techniques to the clinics of preimplantation genetic disease screening, resulted in the first and second births of MALBAC babies in the world, attested by “China Top Ten Scientific Progresses” in 2014.

The team aims to further elucidate the genetic and epigenetic regulation mechanisms of female germ cells and embryonic development. And based on this, they will explore in depth the etiology and treatment strategies of female reproduction diseases, so as to provide the basis for the optimization of preimplantation molecular diagnosis of genetic diseases, the prevention and control of infertility, these curative issues of the offsprings born from assisted reproductive technology, and finally to promote the clinical application of assisted reproduction and new reproductive genetic technologies.

3.18

Dr. Shen Hongbing

Professor
Nanjing Medical University
Academic Leader of Creative Research Group in
2015

Professor Shen Hongbing, President of Nanjing Medical University, was awarded the National Science Fund for Distinguished Young Scholars in 2004 and recognized as “Chang Jiang Scholar Professor” by the Chinese Ministry of Education in 2009. Professor Shen mainly focuses on the cancer genomics and molecular epidemiology.

Based on the Cancer Center of Nanjing Medical University, the Creative Research Group on “genetic basis of cancer heterogeneity” recruited the PIs of basic medical sciences, clinical and preventive medicine to work collaboratively on cancer research. The group has established a solid research foundation, gathered innovative talents and made groundbreaking achievements in cancer etiology and mechanisms, biomarkers for early diagnosis, and personalized therapy. As the academic leader, Professor Shen has made significant progress in the identification of cancer susceptibility genes and biomarkers for accurate diagnosis. His researches on lung cancer susceptibility genes are leading the field internationally. He has published more than 200 original papers in peer-reviewed SCI journals with a total SCI citation of more than 6800 times, and is the corresponding author of 7 articles on *Nature Genetics*. Among all published papers, 6 were ranked among the world’s top 1% highly cited papers based on Essential Science Indicators (ESI) from Thomson Reuters. Professor Shen has been listed on Elsevier’s “Most Cited Chinese Researchers” in both 2014 and 2015, with an H index of 45. He has obtained 7 national invention patents, 1 National Natural Science Award (Second Class), 5 Science and



Technology Awards of Jiangsu Province, and was invited to be the editorial board member of multiple international journals such as *Lung Cancer*.

Through genome-wide association studies, subsequent fine mapping and biological functional research, the group has systematically investigated the genetic basis for individual heterogeneities during the development and progression of lung cancer and other malignancies, filling the gaps in this field in China. The group has also identified a series of cancer susceptibility genes, elucidated their mechanisms in carcinogenesis and constructed risk prediction models for tumors using genetic biomarkers in order to implement cancer risk evaluation and precision prevention. They found that genetic variations and circulation expression levels of non-coding microRNA were applicable to early diagnosis, dynamic monitoring of efficacy and prognosis prediction for cancers.

Next, to answer the key scientific question of “genetic basis of cancer heterogeneity”, the group will focus on genetic features and molecular mechanisms of inter-individual heterogeneity, mutation profiles and regulation process of cancer driver genes, as well as identification and dynamic monitoring of biomarkers for personalized medicine. Hopefully, these efforts and achievements will help provide theoretical basis and technical support for precision prevention and treatment of malignant neoplasms in China, and the group can develop into one of the most important and influential research teams in this field.

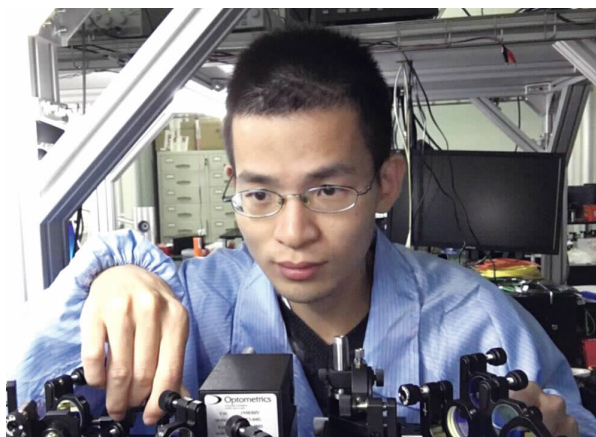


PART IV
Introduction on Selected Grantees
of the National Science Fund for
Distinguished Young Scholars

4.1

Dr. Lu Chaoyang

Professor

Hefei National Laboratory for Physical Sciences at
Microscale, University of Science and Technology
of ChinaThe Distinguished Young Scholar of National
Natural Science Foundation of China in 2015

Lu Chaoyang obtained his PhD from Cambridge University and has been a Professor of Physics of the University of Science and Technology of China since 2011. He has focused his research on optical quantum information processing and solid-state quantum photonics. He has so far published 1 *Reviews of Modern Physics*, 3 *Nature*, 3 *Nature Physics*, 3 *Nature Photonics*, 2 *Nature Nanotechnology*, 3 *PNAS*, 12 *Physical Review Letters*, 1 *Physical Reports*, and 2 *Nano Lett.* He was the first or senior author in 21 of the above papers. His publications have attracted 1800 citations. His main scientific contribution as the first or senior author can be summarized below:

1. The first experimental realizations of entangled six-photon Schrödinger cat state and cluster state, eight-photon entanglement and five-photon ten-qubit hyper-entanglement; refreshing the world's record on photon entanglement for three times, and holding the record until now.
2. The first realization of teleportation of multiple degrees of freedom of a single photon, pushing teleportation to unprecedentedly high levels.
3. The first demonstrations of Shor's algorithm using

photonic qubits, loss-tolerant quantum coding, quantum simulation of anyons in Kitaev model, solving systems of linear equations, and entanglement-based machine learning. These works have pioneered in the field of optical quantum computing.

4. The first non-destructive readout of single quantum-dot spin, deterministic single photons with near-unity indistinguishability. These works have significantly advanced the precise control of single photons and spins.
5. Single quantum emitters from monolayer semiconductors, opening a new realm of two-dimensional quantum photonics.

His work is widely covered in popular press such as *Nature*, BBC, Wikipedia, IOP (physics world "breakthrough of the year"), APS (physics news update "The Physics Story of the Year", physics today), *New Scientist*, and *Scientific American*. One of his current research goals is entangling ~25 single photons from solid state and using them to implement Boson sampling, aiming for the first smoking-gun evidence of quantum supremacy over classical computers.

4.2

Dr. Sun Binyong

Professor

Academy of Mathematics and Systems Science,
Chinese Academy of Sciences

The Distinguished Young Scholar of National
Natural Science Foundation of China in 2015



Langlands program is a series of far-reaching mathematical vision, which predicts that there are deep connections between number theory, algebraic geometry and representation theory. L-functions are central objects of study in Langlands program. Two of the seven famous “Millennium Prize Problems” are about L-functions (the Riemann hypothesis and the BSD conjecture). On the other hand, classical groups, which describe the symmetries of various metric spaces, are ubiquitous in mathematics and theoretical physics. Sun Binyong has made a series of important contributions to the study of L-functions, classical groups, and the connections between them.

1. Theta correspondence

Classical invariant theory and the classical branching laws are two of the most prominent achievements in finite dimensional representation theory of classical groups. The theory of theta correspondence, which is initiated by Howe, is a far-reaching development of classical invariant theory in the setting of infinite dimensional representations. This theory has three basic assertions: the Howe duality conjecture, the multiplicity preservation conjecture, and the conservation relation conjecture of Kudla-Rallis. Based on many previous works, Sun Binyong and his collaborators have finished the proof of these three basic assertions.

2. The multiplicity one theorem

The theory of local periods is a generalization of classical branching laws to the setting of infinite dimensional representations. The existence and

uniqueness are two basic questions in the theory. The multiplicity one conjecture, which is proposed by Bernstein and Rallis, is a fundamental uniqueness problem. Based on previous works, Sun Binyong and his collaborator finally completed the proof of this conjecture.

3. The nonvanishing hypothesis of Kazhdan-Mazur

The arithmetic of special values of L-functions is one of the core issues of the Langlands program. A vital obstacle occurs in the arithmetic study of higher degree L-functions, which is raised by Kazhdan-Mazur and is called the non-vanishing hypothesis in the literature. The referee for *J. Amer. Math. Soc.* point out that “this nonvanishing is a fundamental sticking point in all the work on the subject”. This work is commended as “Sun’s breakthrough” in some research papers.

Sun Binyong has completed more than 30 papers, published in *J. Amer. Math. Soc.*, *Ann. of Math.*, *Invent. Math.*, and other academic journals and academic books. He was awarded the Tan KahKee young scientist award in 2014.

Funded by the National Science Fund for Distinguished Young Scholars, Sun Binyong’s research will focus on: (1) the construction and classification of unipotent representations of classical groups, which is one of the most important problem in representation theory; (2) the arithmetic study of special values of L-functions, and to give a general construction of higher degree p-adic L-functions.

4.3

Dr. Gong Jinlong

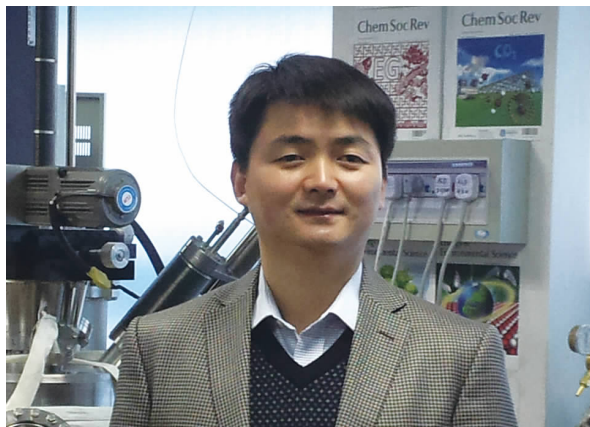
Professor

School of Chemical Engineering and Technology,
Tianjin University

The Distinguished Young Scholar of National
Natural Science Foundation of China in 2015

Professor Gong Jinlong is a Principal Investigator(PI) of the Collaborative Innovation Center of Chemical Science and Engineering of Tianjin and a Fellow of the Royal Society of Chemistry (FRSC). Focusing on fundamental problems of hydrogen related topics in energy catalysis, Professor Gong has devoted himself to research fields including hydrogen production from reforming and solar water splitting, as well as hydrogen utilization via the hydrogenation process for ethanol production. His main achievements include:

1. Based on model catalysis with single crystals, Professor Gong has proposed the molecular level mechanism of alcohol activation for hydrogen production in reforming reactions. Based on this, the structure-function relationship of Ni-based catalyst has been revealed, which enables the rational design and controllable synthesis of coking- and sintering-resistant Ni-based catalyst for the reforming of C1-C4 alcohols for hydrogen production.
2. An alternative route for ethanol production through the hydrogenation of oxalate from syngas has been realized by Professor Gong, with the successful synthesis of a high-temperature-resistant Cu-based catalyst with balanced Cu (I)/Cu (0) active sites. The nano-confinement effect of this catalyst prevents the deactivation of active sites in high temperature hydrogenation conditions, thus achieving the high selectivity of target products. A pilot plant has been established under the cooperation between Tianjin University and Guizhou Xinxin Group. This pilot plant has passed the on-site evaluation of experts from China Petroleum and Chemical Industry Federation (CPCIF).
3. Employing theoretical calculation to guide the design of new material structures, Professor Gong has proposed various nano structuring and surface modification methods to improve the light absorption of photocatalysts for hydrogen production in solar



water splitting. Meanwhile, Professor Gong has introduced a series of methodological approaches for efficient utilization of photo-generated charge carriers. These endeavors have realized efficient conversion of solar energy to chemical energy, providing important theoretical benchmarks for designing photocatalysts in solar water splitting.

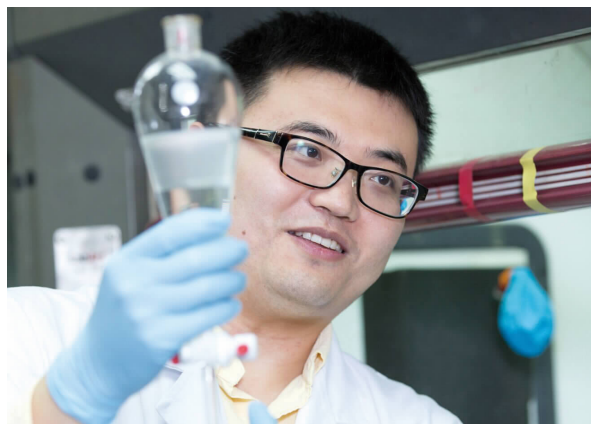
Professor Gong has published 146 peer-reviewed articles with more than 2500 citations from others on high-quality international journals including *J. Am. Chem. Soc.*, *Nat. Commun.*, *AIChE J.*, *Angew. Chem. Int. Ed.*, *Adv. Mater.*, *Nano Lett.*, *Energy Environ. Sci.*, *Chem. Comm.*, etc, as well as several invited reviews for *Chem. Rev.*, *Chem. Soc. Rev.* and *Acc. Chem. Res.*. Professor Gong has been granted 15 Chinese patents, with other 30 pending patent applications. Professor Gong is currently an advisory board member of International Association for Hydrogen Energy (IAHE), and board member of the Catalysis Society of China (CSC) and the Chinese Materials Research Society. He also serves as an Associate Editor for *Chemical Engineering Science* and *Chinese Journal of Chemical Engineering*, the Consulting Editor of *AIChE Journal*, and the Advisory Editorial Board Member of *Chemical Science*, *Chemical Society Reviews*, and *Scientific Reports*.

Under the support of the National Science Fund for Distinguished Young Scholars, Professor Gong will continue to explore the fundamental surface/interface material properties for artificial photosynthesis. Focused on the atomic level material surface/interface structure, electron-hole separation/recombination processes, and elementary reaction steps, Professor Gong will endeavor to uncover the microscopic mechanism of photocatalytic CO₂ reduction by tuning surface/interface structure as well as analyzing the microscopic reaction processes.

4.4

Dr. Li Ang

Professor

Shanghai Institute of Organic Chemistry, Chinese
Academy of SciencesThe Distinguished Young Scholar of National
Natural Science Foundation of China in 2015

Professor Li Ang works on the total synthesis of structurally and biologically interesting natural products. During the last 5 years, he has developed several synthetic strategies for multi substituted 6 membered ring formations, and accomplished the total syntheses of over 50 natural products, which belong to 10 families. 24 of them were synthesized for the first time.

1. The 6π electrocyclization/aromatization strategy. This *de novo* strategy for assembling multi substituted arene enables the total syntheses of daphenylline, clostrubin, rubriflordilactone A, xiamycin family, anominine family, and ileabethoxazole family.
2. The Prins cyclization strategy. A variety of 6 membered ring systems is built by tuning the reactivity of the carbocation species generated from Prins cyclization, which leads to the total syntheses of epoxyeujindole A, sespenine, drimentine family, and hapalindole family.
3. Diels Alder cycloaddition strategy. This strategy is suitable for constructing continuous stereogenic centers especially quaternary ones, the application of

which include the syntheses of fusarisetin and taiwaniadduct family.

In the last 5 years, Professor Li published 13 papers in *Nat. Chem.*, *Nat. Commun.*, *J. Am. Chem. Soc.*, and *Angew. Chem. Int. Ed.* as the corresponding (or co-corresponding) author. He received Asian Core Program Lectureship Award in 2012 and 2013, Thieme Chemistry Journal Award in 2013, Chinese Chemical Society Wei-Shan Natural Product Synthesis Award in 2013, China Pharmaceutical Association-Servier Youth Medicinal Chemist Award in 2013, Roche Chinese Young Investigators Award in 2015, Wuxi Pharma Tech Life Science and Chemistry Awards in 2015. He serves on the advisory board of *Chin. Chem. Lett.*

Under the support of the National Science Fund for Distinguished Young Scholars, Professor Li will develop novel strategies and methods for natural product synthesis, in particular the 6 and 7 membered ring formation based on controllable radical reactions, which may facilitate the understanding and application of natural product functions.

4.5

Dr. Li Guohong

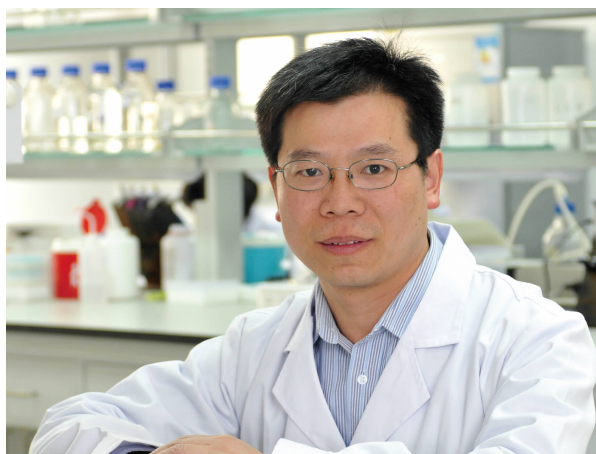
Professor

National Laboratory of Biomacro Molecules, Institute
of Biophysics, Chinese Academy of Sciences

The Distinguished Young Scholar of National Natural
Science Foundation of China in 2015

Professor Li is mainly focusing on the research on the epigenetic regulation of chromatin higher-order structures and their biological functions in cell fate determination during programming and reprogramming of embryonic stem (ES) cells. The main achievements are described as follows:

1. Successfully developed a world-leading analysis system on chromatin structure and function, and investigate the molecular mechanism of how histone variants H3.3 and H2A. Z function together to regulate gene transcription via the modulation of chromatin dynamics over the enhancer and promoter regions (*Genes & Dev.* 2013).
2. Firstly determined the high-resolution 3Dcryo-EM structures of 30 nm chromatin fibers and reveal the 30 nm chromatin fiber as a histone H1-dependent left-handed twist of the repeating tetranucleosomal structural units, through the close collaboration with Professor Zhu Ping. The work is published in 2014 as a research article in *Science*.
3. Illustrated several high-resolution 3D structures and their biological function for some important protein complexes involved in the specific recognition of histone H3 variants and chromatin assembly, through the close collaboration with Professor Xu Ruiming. These findings provide important mechanistic insights into the epigenetic regulation of higher-order chromatin organization and cell lineage commitment (*Genes & Dev.* 2011; *Nat. Struct. Mol. Biol.* 2012).
4. Successfully established a system to investigate the chromatin structure and function on centromeres, and reveal for the first time that the spatiotemporal assembly of CENP-A into active centromeres is controlled by its dynamic phosphorylation at Ser68



(*Develop. Cell* 2015), and find that the higher-order structural transitions of centromeric chromatin orchestrate the temporal loading of CENP-N to centromeres during the cell cycle (*Genes & Dev.* 2015).

5. Successfully established a system to investigate the dynamics of genome-wide chromatin organization, which helps to understand the biological function and its molecular mechanisms of chromatin higher-order structures on epigenetic regulation of cell fate determination.

Professor Li Guohong has made a series of achievements in the research on the chromatin higher-order structures and their biological functions, with more than 40 research articles published in prestigious journals, including *Cell*, *Science*, *Mol. Cell*, *Nat. Struct. Mol. Biol.* and *Genes & Dev.*, totally cited over 1200 times.

With the funding of the National Science Fund for Distinguished Young Scholars, and based on these powerful established research systems for the *in-vitro* reconstitution of chromatin fibers and the *in-vitro* and *in-vivo* investigation on the structural dynamics and transcriptional activity of chromatin fibers, the future research work is mainly focusing on the establishment and maintenance of chromatin higher-order structure, especially the 30 nm chromatin fiber, and their epigenetic regulation and biological functions in gene transcription during programming and reprogramming of ES cells. The research will provide important mechanistic insights into the biological functions of higher-order chromatin organization in epigenetic regulation and inheritance, cell lineage commitment, and epigenetic deregulation in human diseases and ageing.

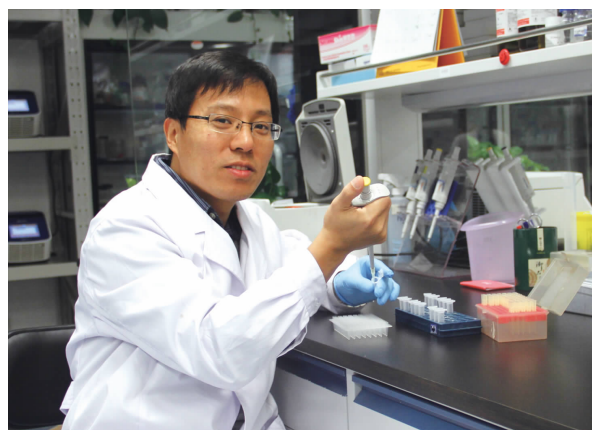
4.6

Dr. Tian Zhixi

Professor

Institute of Genetics and Developmental Biology,
Chinese Academy of Sciences

The Distinguished Young Scholar of National Natural
Science Foundation of China in 2015



Dr. Tian Zhixi's interest focuses on functional genomics and genetics of soybean. His lab is trying to dissect the underlying network controlling agronomically important traits and to apply them into soybean molecular design breeding. Currently, his main achievements are:

1. Through a systematic study on the evolution of soybean genome attritional, translational, and regulational levels, his team clarified the functional divergence patterns of duplicated genes and uncovered the underlying effectors. The results provide a valuable platform for the functional genomics study in soybean.
2. Through population genetic analysis, his team found that oil related traits experienced strong selection during soybean domestication and improvements, and for the first time globally identified the responsible selection sweeps. Their study suggested that the variation of oil quantity and quality in different germplasms was caused by the allelic divergence of a sophisticated genetic regulation network for fatty acid metabolism. This study facilitated future studies on fatty acid regulation network and benefit soybean production improvement.
3. Using a combined approach of the genome-wide association study and map-based cloning, his team identified a set of key genes and loci responsible for important agronomic traits. He and his collaborators

have introduced one of these genes into “Kedou No. 1”, a primary soybean cultivar in the Huanghuaihai area in China, to develop improved cultivars. Currently, they had gotten several lines that can increase yield by 10% compared with “Kedou No.1” and some lines have been under the national and provincial variety certification. This work will promote molecular design breeding to practice from concept.

Till now, Dr. Tian Zhixi has published 8 corresponding papers, 9 first-author papers and 8 collaborated papers on *Nature Biotechnology*, *the Plant Cell*, *the Plant Journal* etc. In 2012, Dr. Tian was awarded as “Youth Science of the Stars” by the Science Times Media Group of China. He also serves as editorial board member of some journals, such as *PLoS ONE*, *Frontiers in Plant Genetics and Genomics*, *Plant Genetics & Transgenics*, *the Crop Journal* and *the Soybean Science*.

Under the support of the National Science Fund for Distinguished Young Scholars, Dr. Tian Zhixi and his team will integrate omics and systems biology approaches to study on seeds size controlling. The aim is to elucidate the genetic regulatory network of the seed size and uncover the molecular interactions between different regulatory elements. The study will be a breakthrough on the study of complex trait and provide a theoretical and technical basis on the soybean molecular design breeding.

4.7

Dr. Yang Yueheng

Professor

Institute of Geology and Geophysics, Chinese Academy of Sciences

The Distinguished Young Scholar of National Natural Science Foundation of China in 2015

Professor Yang Yueheng is mainly engaged in the analytical protocol of isotopic geochemistry using multiple collector inductively coupled plasma mass spectrometry (MC-ICP-MS). He got a series of research achievements in the methodology field of *in situ* U-Th-Pb geochronology and radiogenic Sr-Nd-Hf isotopic composition of accessory minerals by laser probe, mainly including the following:

1. He established analytical method of *in situ* Sr-Nd isotopic composition of perovskite using LA-MC-ICP-MS, indicating its effective techniques to obtain initial Sr-Nd isotopic composition of kimberlitic magmas, which provide an important tool of kimberlitic magma source region and origin and promote the development of international kimberlitic rock research.
2. He developed a combined chemical separation procedure of Lu, Hf, Rb, Sr, Sm and Nd from a single rock digestion, which ensure the homology of Sr-Nd-Hf isotope, strengthen the combination of three radiogenic isotopes and solve the problem of inhomogeneity of natural geological materials.
3. He found a reference material of *in situ* bastnaesite U-Th-Pb chronology and established relative geochronological method, indicating Th-Pb age preferable to U-Pb age with higher precision, which provides a new tool for the direct access to the formation of the rare earth deposit.
4. He accurately calibrated the Sr-Nd isotopic compositions of 11 apatite reference materials. The heterogeneity of Sm-Nd isotope of Durango standard samples is demonstrated and quantifies heavy rare earth effect on apatite Sr isotope by laser ablation,



which provide technical support for the future research of the apatite laser *in situ* Sr-Nd isotope.

He has published 131 SCI papers cited more than 4600 times with H-index 33, entered the high citation rate of the top 500 academic scientists. Among them, the first or corresponding author 18 SCI paper cited more than 400 times, including *Chemical Geology*, *Journal of Analytical Atomic Spectrometry*, *Spectrochimica Acta Part B: Atomic Spectroscopy*, *International Journal of Mass Spectrometry*, *Analytical Letters*, *Chinese Science Bulletin*, *Science China Earth Sciences*, etc. He also act peer reviews in many journals like *Analytical Chemistry*, *Chemical Geology*, *Journal of Analytical Atomic Spectrometry*, *Geostandards and Geoanalytical Research*, *Analytical Method*, *Analytical Letter*, *Geoscience Journal*, *Chinese Science Bulletin*, etc. Now he is a member of the China mineral rock geochemistry Institute Microbeam Analysis Testing Committee.

Under the support of the National Science Fund for Distinguished Young Scholars, Professor Yang Yueheng will investigate detailed field work, combine petrology with mineral and carry out allanite *in situ* micro U-Th-Pb geochronology and Sr-Nd isotope method by laser ablation, which will provide a new idea of allanite origin for the Dabie Sulu UHP metamorphic belt. The spirit of independence and realization of experimental breakthrough will promote the development of interdisciplinary research, which has very important significance of both metallogenic geochronology and metamorphic study.

4.8

Dr. Wang Kaicun

Professor

Institute of Global Change and Earth System
Science, Beijing Normal University

The Distinguished Young Scholar of National
Natural Science Foundation of China in 2015

Dr. Wang has made thorough and deep study of surface energy budget and climate change, significantly improved spatiotemporal coverage of the estimates of components of surface energy budget, quantified their uncertainty and long-term variability, and gained the following innovative achievements:

1. He has reconstructed the global surface incident solar radiation using meteorological visibility, sunshine duration and air temperature diurnal range, which confirmed the authenticity of “global dimming” but highlighted the overestimation of the global brightening. His studies disproved the so called “urban bias of global dimming” identified by the IPCC assessment report fourth. He found that the dimming rate over China had been overestimated due to the sensitivity drift of pyranometers used to measure diffuse solar radiation, which explained the discrepancies between models and observations.
2. He developed models to estimate terrestrial evapotranspiration, which have been widely applied to estimate global evapotranspiration. He quantitatively assessed the terrestrial evapotranspiration and pan evaporation over the last several decades; which showed that global potential evaporation decreased during the enhanced warming period while increased during the warming hiatus period, indicating that global warming did not directly result in a drier land.
3. He found that the existing global surface temperature datasets over land have important biases in quantifying regional warming rates. These datasets overestimate the warming rates over China, high



latitudes of the northern hemisphere, and underestimates the warming rate of the U.S..

Dr. Wang has published 65 peer reviewed papers, including 53 SCI papers. He has published 38 SCI papers as the first-authored or corresponding-authored, including 1 *Science*, 1 *PNAS*, 2 *Reviews of Geophysics*, and 1 *BAMS*. Up to Nov. 20, 2015, his papers have been cited by SCI papers over 1355 times, more than 900 among them cited by peers. Three of his first-authored papers have been cited over 110 times. 5 papers of the applicant were selected into the “Essential Science Indicators Highly Cited Papers (last 10 years)”. 5 first-authored papers were cited by IPCC AR5. Dr. Wang is a recipient of “Youth Thousand Talents Program” award from the Central Coordination Committee. He has served as an Associate Editor of *Journal of Geophysical Research-Atmosphere* and an Editorial Board Member of *Scientific Reports*.

Under the support of the National Science Funds for Distinguished Young Scholars, Dr. Wang will enhance his studies in regional contrast of surface energy budget and climate change, make full use of the existing meteorological observations, construct new datasets of global surface temperature, investigate the feedback of surface energy budget to climate change, and provide fundamental datasets and theoretical framework for regional climate change study.

4.9

Dr. Shan Zhongde

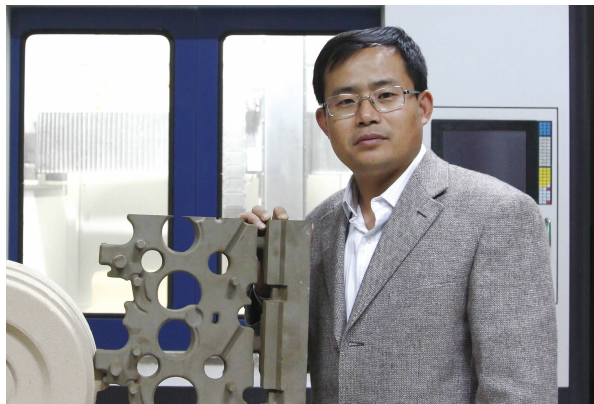
Professor

State Key Laboratory of Advanced Forming Technology and Equipment, China Academy of Machinery Science & Technology

The Distinguished Young Scholar of National Natural Science Foundation of China in 2015

Professor Shan Zhongde is mainly engaged in the research on digital green manufacturing theory, technology & equipment and has achieved innovative results in the field of clean, patternless, lightweight green manufacturing as follows:

1. Professor Shan designed the cheese-based, digital, clean and efficient automatic dyeing method and equipment, revealed the digital, automatic water-saving dyeing mechanism, developed the methods, principles and systems for digital, quality, clean and efficient dyeing equipment, and expanded clean dyeing manufacturing methods and equipment. He has obtained 13 invention patents and provided assistance in the installation of 11 automatic production lines in Luthai Textile Group and Shandong Companion Group.
2. Professor Shan proposed the sand mould machining method and equipment with patternless casting process, revealed the sand machining mechanism and the principle of digital patternless casting machine, and expanded the forming manufacturing methods and equipment. He has obtained 8 international invention patents in the United States, Japan, etc and 11 invention patents in China, and the patternless casting machine have been exported to Spain and applied in more than 100 enterprises including FAW and Yuchai Group in China.
3. Professor Shan invented the composite material flexibility oriented three-dimensional weaving method and equipment, established the theoretical model for dimensionality reduction weaving of composite complex parts, developed the principles for pre-forming the equipment for integrated dipping and flexible, three-dimensional weaving, and expanded lightweight manufacturing methods and theories. He has obtained 4 invention patents in the United States



and 9 patents in China, and the component for the key projects of National Natural Science Foundation is evaluated as excellent.

Professor Shan Zhongde received National Science and Technology Progress Award (First Class) in 2014, and Beijing Science and Technology Award (First Class) in 2001, 2009, 2012 respectively. He has published 78 papers (45 papers included in SCI and EI) and 3 books. As the first inventor, he has been authorized 52 invention patents (including 14 international patents authorized by United States, Japan, etc), and he has cultivated 35 M.S. and Ph.D. students in the past 5 years.

Professor Shan has been awarded the Special Government Allowances of the State Council, the “Ten Thousand Talent Program” of the Central Organization Department of CCP, candidate of National Program for Millions of Leading Engineering Talents (State Class), and Young and Middle-aged Leading Scientists, Engineers and Innovators. He also served as Fellow of the Institution of Engineering and Technology and Adjunct Professor at Korea Pohang University.

Supported by the National Science Fund for Distinguished Young Scholars, Professor Shan will carry out the study on composite sand mould forming approach of digital extruding and cutting integration, providing technical support for high-performance, large- and giant-scale, fast precision manufacturing of complex castings. The study covers composite sand mould forming approach, sand mould and casting interaction mechanism, adaptive principle of sand mould and casting solidification process, and impact of sand mould surface morphology and dimensional accuracy on casting quality performance.

4.10

Dr. Xiong Lihua

Professor

School of Water Resources and Hydropower Engineering, Wuhan University

The Distinguished Young Scholar of National Natural Science Foundation of China in 2015



Professor Xiong Lihua was awarded the National Science Fund for Distinguished Young Scholars in the year 2015.

The major research topics by Professor Xiong include runoff generation mechanism, rainfall-runoff modelling, and hydrological design. Three academic achievements from these researches are listed as follows:

1. Investigation of runoff generation mechanism on the middle or long time scales. Based on the Budyko theory, the influencing factors and controlling mechanisms of middle- or long-term runoff generation have been revealed. It is found that the impacts of climate and watershed conditions on runoff are interacted because climate change can impact the runoff not only through the alteration of the hydrological inputs into the watersheds but also through the alteration of the watershed characteristics. A two-parameter monthly water balance model has been proposed and proved to be an effective tool in assessing the impacts of climate change on water resources.
2. Methods in reducing the uncertainties in rainfall-runoff modelling. GLUE, the classical method for quantifying the parameter uncertainty in rainfall-runoff modelling, has been improved by considering the impacts of the systematic errors of models on parameter estimation. To reduce the model structural errors, an efficient ensemble method was proposed for flood forecasting. Also, a set of complete indexes has been put forward for the objective performance assessment of different probabilistic flood forecasting

models.

3. Nonstationary hydrological frequency analysis. A framework has been proposed for the change-point detection of the multivariate hydrological series. By establishing the relations between the characteristics of the annual maximum flood and the corresponding annual flow-duration curve, a regional flood frequency analysis method was established. A direction integration method based on the Budyko theory was proposed for deriving the probability distribution of annual runoffs. Also, a theoretical framework has been proposed for studying the probability distribution of annual minimum flows.

In recent 5 years, Professor Xiong has published around 30 SCI papers in the peer-reviewed journals such as *Water Resources Research* and *Journal of Hydrology*. He has also won a number of awards from Ministry of Education of China for contributions to scientific and technological progress in water resources engineering. He is also a “Chang Jiang Scholar” professor appointed by Ministry of Education.

Under the support of the National Science Fund for Distinguished Young Scholars, Professor Xiong is going to carry out the researches on rainfall-runoff modelling under changing environments as well as hydrological nonstationarity, in order to reveal the physical mechanisms of runoff changes over different time scales and their relations, thus providing the scientific backup for the planning, design, and operation of water resources projects facing changing environments.

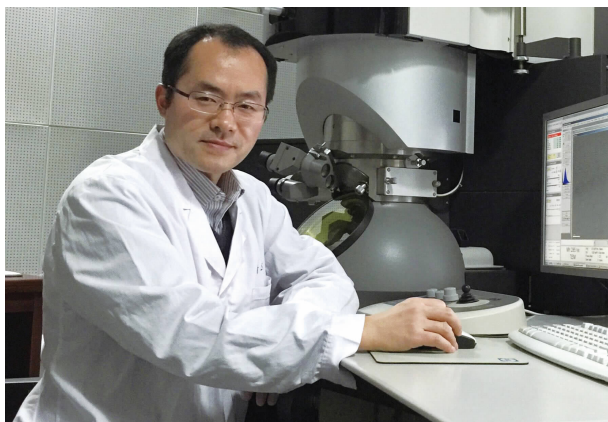
4.11

Dr. Yu Rong

Professor

School of Materials Science and Engineering,
Tsinghua University

The Distinguished Young Scholar of National
Natural Science Foundation of China in 2015



Professor Yu Rong focuses his research on microstructure and properties of materials. His major achievements include:

1. Developed experimental and computational methods for analyzing atomic structure and properties of materials at the sub-angstrom scale. He realized direct sub-angstrom measurement of atomic structure of materials defects, and wrote a series of programs for quantitative analysis and theoretical calculations, making important contribution to the establishment of the first aberration-corrected electron microscopy platform in China.
2. Determined surface structure of typical supported catalytic particles and insulators, breaking the limits of conventional surface science methods that require conductive single crystals. He has determined atomic structure of lattice defects in metal oxides and complex intermetallic compounds, based on which the strain-induced phase transitions, local magnetic
3. Developed an efficient method to obtain single-crystal elastic constants. The idea in the efficiency improvement is to apply linear-independent coupling strains to a crystal, and to extract the complete set of elastic constants simultaneously. He established a database of elasticity of crystals.

and polarization, and deformation mechanisms were investigated.

Professor Yu published more than 80 papers on SCI journals like *Phys. Rev. Lett.*, *Angew. Chem. Int. Ed.*, *Acta Mater.*, etc. The publications have been cited more than 1300 times on journals like *Science*, *Nature Mater.*, and *Phys. Rev. Lett.*.

Awarded the National Science Fund for Distinguished Young Scholars, Professor Yu will investigate the microstructure of high temperature structural intermetallic compounds, and structure and behavior of surfaces of functional materials.

4.12

Dr. Wu Ligang

Professor

School of Astronautics, Harbin Institute of Technology
The Distinguished Young Scholar of National Natural
Science Foundation of China in 2015



Professor Wu Ligang is mainly doing the search on control and signal processing for complex uncertain dynamical systems. His representative achievements are summarized as follows:

1. Established a series of novel sliding mode control (SMC) design methods for uncertain dynamical systems. These new methods released the limitations of the traditional SMC methods in dealing with some complex uncertain systems including stochastic systems, singular systems, switched systems and parameter-jumping systems. In particular, a new integral-type SMC design scheme was proposed, with which the SMC problem for complex uncertain dynamical systems was addressed in a unified framework.
2. Proposed a set of less conservative analysis and synthesis methods for switched hybrid system with restricted switching signal, and with which some important problems for such switched systems, including control, filtering and model reduction, were addressed successfully.
3. Based on Takagi-Sugeno fuzzy model approach, a novel approach with less conservatism was established for analysis and synthesis of nonlinear dynamical systems.

Up to now, Professor Wu has published 97 papers in international journals (48 of them are with the first author), including 36 IEEE Transactions papers (30 regular papers) and 11 automatic papers, having received 2899 SCI citations with H-index 33, and 5914 Google Scholar citations. 3 monographs have been published in the Springer and Wiley as the first author. 24 papers ranked in top 1% Highly Cited Papers according to the ESI reports. 4 papers were named as the Most Cited Articles (2009-2012) in Automatica. 3 papers were named as the Most Influential 100 Academic Papers in China Published in International Journals. Partial achievements of him won the second

prize of the National Natural Science Award in China in 2014 and the first prize of the Natural Science Awards of Heilongjiang Province in 2013. In addition, his research results were cited and remarked by international peers from over 30 countries and regions with broad citation and high praise. The representative peers include over 10 academicians and over 30 IEEE Fellows.

Professor Wu was the winner of the National Science Fund for Distinguished Young Scholars, the winner of the National Science Fund for Excellent Young Scientists, the winner of Heilongjiang Science Fund for Distinguished Young Scholars. He was awarded the "Top-Notch Young Talents" by the Central Organization Department of China and also awarded as the "New Century Excellent Talents in University" by the Ministry of Education of China. He was selected as Thomson Reuters Highly Cited Researchers and Elsevier Most Cited Chinese Researchers. He was also the winner of the Heilongjiang Youth Five Four Medal, the Nomination Award of National Excellent Doctorate Dissertation of China, and the Heilongjiang Youth Science and Technology Award. Professor Wu currently serves as an Associate Editor for over 10 international SCI journals, including *IEEE Transactions on Automatic Control*, *IEEE/ASME Transactions on Mechatronics, Information Sciences, Signal Processing*, and *IET Control Theory and Applications*.

Under the support of the National Science Fund for Distinguished Young Scholars, Professor Wu will continue the research on analysis and design for discontinuous control systems based on the previous research foundation. He will focus not only on the theoretical research on discontinuous control systems, but also on the real applications of the theoretical results in the control of aerospace crafts. He is ready to devote his energy and make his best contributions to the implementation of this project.

4.13

Dr. Zhang Yongdong

Professor

Institute of Computing Technology, Chinese
Academy of SciencesThe Distinguished Young Scholar of National
Natural Science Foundation of China in 2015

Dr. Zhang Yongdong has been mainly engaged in the research of internet video content analysis and processing. His representative achievements are listed as follows:

1. He proposed a highly parallel video coding method with task and data level fusion, which broke the parallelism restriction of encoding and decoding resulted from tight data coupling. This work was nominated as Best Paper Candidate of IEEE ICME 2011.
2. He proposed an affine transformation decomposition model for geometrical consistency verification, established a topology-preserving balanced distributed indexing, which successfully achieved collaborative optimization of precision and speed of detection. This work won the best papers of IEEE ICME 2010 and PCM 2013, and ranked first in the international authoritative evaluation.
3. He proposed a multi-view spectral embedding model and a sparse ensemble learning algorithm for visual concept recognition to overcome the problem of semantic polymorphism. Related work ranked first in the international authoritative evaluation and has been internationally applied.
4. To meet the national strategic requirements of internet video regulation, his team developed a large scale internet video content analysis system, which has been applied in national department of internet video supervision and deployed over the country.

This work played a significant role in a serial of major specific tasks of internet information security. Thus his team became the provider of key techniques and systems in the national internet video regulation. Meanwhile his work also helps the International Criminal Police Organization to fight crimes.

He has published more than 60 papers in the conferences and journals indexed by SCI/EI, including 19 IEEE/ACM transactions papers, 3 best paper awards from famous international conferences in multimedia, which received 300 SCI citations by other authors including more than 30 IEEE/ACM fellows. He holds more than 30 authorized invention patents. He won the first prize of Beijing Science and Technology Award in 2014 (First Class), the CCF Science and Technology Award in 2012 (First Class), the Excellent Instructor Award of Chinese Academy of Sciences in 2014 and Olympics Advanced Individual Award from the Ministry of Science and Technology in 2008, and so on.

Under the support of the National Science Fund for Distinguished Young Scholars, Dr. Zhang is going to focus on the key science problem of visual information cognitive computing, and the basic theory and key technologies on the deep understanding of large scale internet video content. Thus, he will try his best to make breakthrough in the technique challenges of video complex semantic event recognition, and automatic video content captioning to provide theoretical and technical support for both developing internet information service and ensuring network space security.

4.14

Dr. Shu Jia

Professor

School of Economics and Management, Southeast University

The Distinguished Young Scholar of National Natural Science Foundation of China in 2015



Professor Shu's research focuses on logistics, transportation and supply chain management. Selected research achievements are listed below:

1. Motivated by the practices in distribution networks, we are among the first in the research community to study the supply chain network design problems that integrate single- and multi-echelon inventory management. Based on the structural analysis of the corresponding mathematical models, column generation algorithms are proposed to solve medium-scale problem instances.
2. We proposed strongly polynomial time constant-ratio approximation algorithms capable to solve large-scale supply chain network design problems arising in supply chain globalization. These works provide a unified framework for supply chain network design optimization from single- to multi-echelon inventory, from deterministic to stochastic demand, and from medium- to large-scale problems.
3. For empty container deployment with laden container routing under uncertainty, which is a prominent challenge in maritime logistics, we proposed an equivalent tractable model for this robust multi-commodity network flow problem. The structural characterization and complexity analysis of the model can be applied to the robust counterparts of general two-stage stochastic programs.
4. We proposed a deterministic proportional network flow linear optimization model based on a time-space network to predict the stochastic network flow in public-vehicle sharing systems, whose accuracy is validated by real transportation data. As these systems belong to the famous Jackson network, the proposed forecasting approach is applicable to the general Jackson network, and partially addresses the intractability of the network flow problem in the Jackson network.

In the recent 5 years, Professor Shu has published over 10 papers in peer reviewed SCI journals such as *Operations Research*, *Transportation Science*, and *INFORMS Journal on Computing*. He is also one of the first batch recipients of the National Science Fund for Excellent Young Scholars in 2012.

Under the support of the National Science Fund for Distinguished Young Scholars, Professor Shu will pay special attention to the practices in Chinese contexts and continue studying the relevant logistics, transportation, and supply chain problems. Some examples are provided as follows: supply chain network design optimization with the impact of financial cost in supply chain finance systems, distributionally robust optimization approaches for dynamic container allocation in maritime logistics, and intelligent public vehicle-sharing system design with location choices.

4.15

Dr. Huo Baofeng

Professor

School of Management, Zhejiang University

The Distinguished Young Scholar of National
Natural Science Foundation of China in 2015

Professor Huo Baofeng's major research area is supply chain management (SCM). His work mainly includes four aspects:

1. He enriched the knowledge in SCM and created new research areas for this field through applying theories and methods of marketing, strategy, organizational behavior, and management information system (MIS) into SCM. For example, he combined theories from relationship marketing with SCM practices and built the new theory of relationship management-based supply chain integration (RM-based SCI). He helped more and more scholars to pay attention to the role of relationship management in SCI. He extended quality management from the sole company to the whole supply chain, building the new research area of supply chain quality integration (SCQI).
2. He adopted multiple theoretical perspectives to examine SCM research questions, providing empirical evidence for applications of these theories in SCM. At the same time, he also proposed some new concepts for SCM, such as supply chain balance, supply chain power, SCQI, providing solid theoretical lenses for future SCM research.
3. He contributed to research methodology for SCM. For example, he created and used the contingency and configuration method to explore SCI patterns.
4. He comprehensively investigated the status of

Chinese SCM practices. He contributed to the development of SCM of Chinese firms through providing detailed suggestions for SCI, SCQI, and relationship management.

In the past 5 years, as the first or the corresponding author, he has published more than 20 papers in high-level international journals, such as *JOM*, *POM*, *IEEE-TEM*, *IJPR*, *IJPE*, and Chinese journals, such as *Journal of Management Sciences in China*. His papers were cited by more than 500 SSCI/SCI indexed papers, and more than 1500 Google Scholar indexed articles. He was awarded "2014 Most Cited Chinese Researchers in Business, Management and Accounting of Elsevier". He won many research awards and his research has a great influence on the international academic world, and scholars from more than 10 countries and regions are following his research to further explore new knowledge in this area. He is Zhejiang University Leading Professor of Liberal Arts, Associate Editor of *JOM*, and Editorial Board Member of *POM*, *IEEE-TEM* and *IJPDLM*.

Under the support of the National Science Fund for Distinguished Young Scholars, Professor Huo Baofeng will investigate roles of contract, trust, dependence in improving SCM, based on transaction cost economics, social exchange theory, and resource dependence theory, from the perspective of economics, sociology and political science, in order to build a new SCM framework.

4.16

Dr. Ju Zhenyu

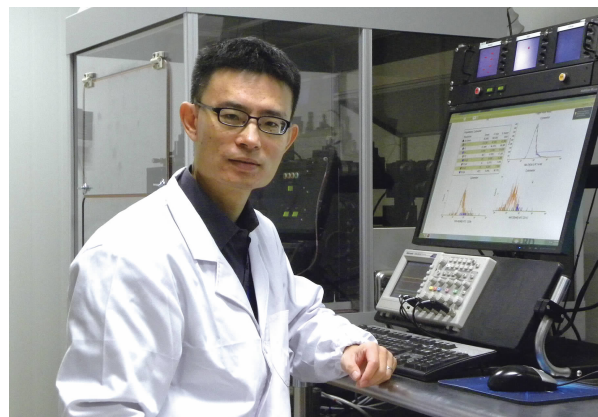
Professor

Institute for Aging Research, School of Medicine,
Hangzhou Normal University

The Distinguished Young Scholar of National Natural
Science Foundation of China in 2015

Professor Ju Zhenyu commits himself to the research of telomere biology in stem cell aging. By investigating the DNA damage response (DDR) and mitochondrial energy metabolism in established cellular models (e.g. hematopoietic stem cells (HSCs), embryonic and intestine stem cells), and telomerase-deficient mouse model, Professor Ju systematically delineated intrinsic and extrinsic factors regulating stem cell aging and the molecular mechanisms contributing to the physiological aging process. Major findings include:

1. Identified the key molecules (p21, puma, Gadd45a, etc) mediating the degeneration of stem cell function and organismal aging in telomerase dysfunctional mice. He also defined the essential roles of these molecules in maintaining the HSC genomic stability and preventing the oncogenic transformation of HSCs. Such explorations open an avenue for targeting small molecular compound screening tackling against aging and aging-related diseases.
2. Discovered the molecular link between telomere shortening and its serologic markers/pro-aging factors with the onsets of aging and aging related diseases. Disclosed the systematic environmental changes in telomerase knockout mice impede the differentiation and maturation of T and B lymphocytes and exhaust the stemness of HSCs. These findings conceptually validated the hypothesis that improvement of systematic environment could rejuvenate the aging stem cells and prolong organismal life span, which provides new molecular biomarkers for the early clinical diagnosis and prognosis of aging and aging related diseases.
3. Demonstrated that p53-PGC1a regulatory axis mediated mitochondrial function and the differentiation of pluripotent stem cells in the context of telomerase dysfunction. Illuminated the interaction between telomere DDR and aberrant energy metabolism. These findings imply the significant link



of DDR with mitochondrial energy dysfunction in stem cells.

4. Wip1 regulates the HSC aging, and hematopoietic and liver tissue regeneration through dephosphorylation of mTOR, which sheds light on a common mechanism in stem cell aging and tissue regeneration. Furthermore, Wip1 controls p53 phosphorylation to regulate the B cell development. These findings show new perspectives for research topics on aging and regeneration.

In recent 5 years, Professor Ju has published 41 research articles in high impact journals, such as *Cell*, *Cell Stem Cell*, *Nat Genet*, *Nat Med*, *Blood*, *Nat Cell Biol*, *Aging Cell*, including 13 first author or corresponding articles. His research has been supported by “Program for New Century Excellent Talents in University” (2010, awarded by Ministry of Education), “National Science Fund for Excellent Young Scholars” (2012, awarded by National Science Foundation of China), and “Thousand Talents Program in Zhejiang Province” (2014). He is also chair of Sino-German Max-Planck Partner Group on Stem Cell Ageing.

Under the support of the National Science Fund for Distinguished Young Scholars, Professor Ju is going to expand and deepen his research in: (1) investigating the novel mechanisms on stem cell aging mediated by telomere shortening and DDR; (2) identifying the pro-aging and rejuvenating factors in circulation and designing new strategies for the anti-aging therapy; (3) PGC1a in improving stem cell function and prolonging longevity. His long-term goals are to translate basic research findings into clinical application and to promote the development of Chinese gerontological research.

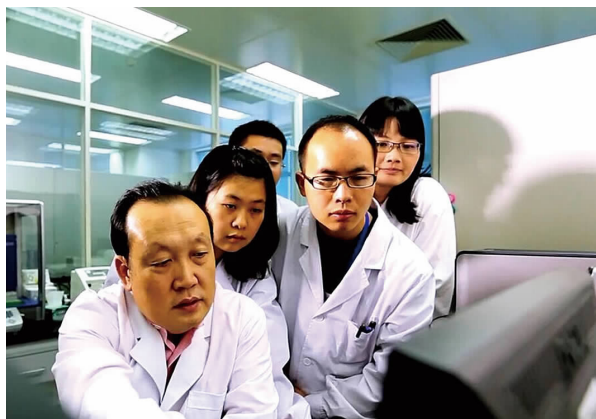
4.17

Dr. Shu Yuelong

Professor

National Institute for Viral Disease Control and
Prevention, China CDC

The Distinguished Young Scholar of National
Natural Science Foundation of China in 2015



Professor Shu is engaged in the mechanism studies on interspecies transmission and pathogenesis of influenza viruses. The major contributions are included as follows:

1. Firstly to identified a novel triple reassorted H7N9 avian influenza virus, which could infect humans and lead to fatal outcome. Also firstly identified the virus which is low pathogenic for avian but cause severe syndrome in humans in the world.
2. Firstly illustrated that the “dual-receptor” binding preference of the H7N9 avian influenza viruses was crucial for the interspecies transmission.
3. The efficient replication of the H7N9 viruses in human lung tissue impaired lung function. “Cytokine storm” and the lack of preexisting immunity for human populations are the important contributions to the clinical severity and fatal outcomes of H7N9 patients.
4. Transmissibility of the H7N9 viruses was systematically evaluated. The results showed that the low efficiency of virus replication in human upper respiratory tract and limited airborne transmissibility of the virus in mammal models limited its sustained human-to-human transmissibility. However, H7N9 virus could transmitted efficiently via direct contacts in ferrets, indicating that its pandemic potential should not be underestimated.
5. Firstly developed the detection kits for the novel H7N9 viruses, providing the diagnosis for the clinical treatments and outbreak control and prevention.
6. Firstly to identified a novel reassorted H10N8 avian influenza viruses which could infect humans and lead to fatal outcome. The genesis process of the virus was demonstrated as well.
7. A “genetic tuning” mechanism was proposed to mediate host adaptation and interspecies transmission of the novel H7N9 viruses.
8. Firstly provided the molecular evidence that linked the live poultry markets with human infections with avian influenza viruses.

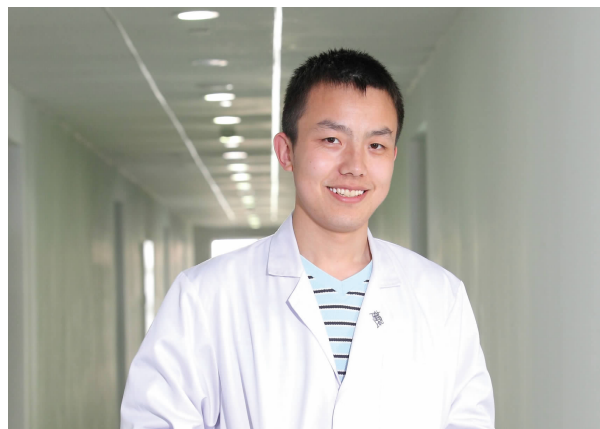
In the past 5 years, a total of 48 peer-reviewed scientific papers with first (including co-first) or corresponding (including co-corresponding) authorship have been published in journals such as *Science*, *Nature*, *NEJM*, *Lancet*, and so on. The scientific achievements of H7N9 viruses were selected as one of the TOP 10 Scientific Progresses in China in 2013. Professor Shu was awarded as the “The Annual Science and Technology Innovation Leader” in 2014.

Under the support of the National Science Found for Distinguished Young Scholars, Professor Shu will focus on the impact of host gene polymorphism on the immune responses to influenza vaccine. This study will not only enrich the vaccine immunology theory, but also provide evidences on developing new influenza vaccines for those humans with low immune response.

4.18

Dr. Zhao Qiang

Professor

Shanghai Institute of Materia Medica, Chinese
Academy of SciencesThe Distinguished Young Scholar of National
Natural Science Foundation of China in 2015

The research focus of Dr. Zhao is mainly on the structural pharmacology of G protein-coupled receptors (GPCRs), especially the relationship between receptor structure and function. He is also carrying out functional studies and drug design based on the complex structures. His work includes:

1. In 2013, by collaborating with Professor Wu Beili in SIMM, he solved the crystal structure of chemokine receptor CCR5, a major co-receptor of HIV infection. The structure of CCR5, together with crystal structure of CXCR4 which was previously solved, revealed the mechanism of HIV tropism. Soon after the structure was solved, a much improved lead chemical compared to the marketed drug maraviroc was developed by the collaboration in SIMM.
2. In 2014, he further determined the crystal structures of purinergic receptor $P2Y_{12}R$ in complex with AZD1283, a clinical anti-thrombotic drug developed by Astrazeneca. $P2Y_{12}R$ regulates platelet activation and thrombus formation, and is responsible for severe disease such as stroke and heart attack etc. The crystal structure of $P2Y_{12}R$ explains the recognition mechanism between $P2Y_{12}R$ and corresponding drugs. The crystal structure, as well as docking assays, will help the chemists develop better drugs targeting on this receptor.
3. Based on the antagonist structure, he further solved the crystal structure of $P2Y_{12}R$ in complex with

agonist and partial agonist respectively. He found that agonist access to the binding pocket requires large-scale rearrangements in the extracellular region, which is never predicted within the GPCR superfamily. The structure determination work will deepen the understanding of signal transduction of GPCRs and shed a light on future research direction of high selective agents.

4. In 2015, he solved the crystal structure of $P2Y_1R$ in complex with different antagonists. Based on the structures, a new allosteric regulation mechanism was proposed. Studies suggest that this new mechanism is not only processed in $P2Y_1R$, but also could be applied to other receptors. This mechanism revealed a new direction of functional studies and drug development targeting on GPCR superfamily.

In the past 5 years, he has published over 10 papers in the top journals such as *Science*, *Nature*. He received the youth award of Shu-Lan medical research in 2014, and the Innovation Award of Tan Jiazhen Life Science Research.

Under the support of the National Science Fund for Distinguished Young Scholars, Dr. Zhao will keep working on the structural pharmacology study of receptors in human cardiovascular and nervous systems. These studies will help researchers to understand the roles of GPCRs playing in severe human diseases and development of new drugs.



PART V

Financial Statistics of NSFC's Funding in 2015

5.1 Statistics of Financial Allocations for NSFC in 2015

Statistics of Financial Allocations for NSFC in 2015

Table 5-1

(Unit: 10,000 yuan)

National Natural Science Fund	2,141,420.81
National Science Fund for Distinguished Young Scholars	72,900.00
National Science Fund for Fostering Talents in Basic Research	8,456.00
Total	2,222,776.81

5.2 NSFC Funding for Projects Approved in 2015

Statistics of NSFC Funding of Direct Cost for Projects Approved in 2015

Table 5-2

(Unit: 10,000 yuan)

Type of Project			Direct Funding
Research Projects	General Program		1,024,050.00
	Key Program		178,800.00
	Major Program		31,813.81
	Major Research Plan		71,193.00
	International (Regional) Joint Research Program		59,843.29
Talents Projects	Young Scientists Fund		319,460.00
	Fund for Less Developed Regions		109,600.00
	Excellent Young Scientists Fund		52,000.00
	National Science Fund for Distinguished Young Scholars		67,935.00
	Fund for Creative Research Groups	New Project	38,955.00
		Extended Project	21,210.00
	Joint Research Fund for Overseas Scholars and Scholars in Hong Kong and Macao	Two-Year Project	2,088.00
		Four-Year Extended Project	3,600.00
Projects for Research Environment Building	Joint Fund		86,009.50
	Special Fund for National Major Scientific Research Equipment		87,211.25
	Projects of Emergency Management		24,394.44
	Tianyuan Fund of Mathematics		2,500.00
	Research Fund for International Young Scientist		2,800.49
	Fund for International (Regional) Cooperation and Exchange		4,945.59
Total			2,188,409.36

5.3 Funds for Research Programs

General Program Projects

Application and Funding Statistics of General Program Projects in 2015 (by Scientific Department)

Table 5-3

(Unit: 10,000 yuan)

Scientific Department	Applications	Approved				Funding Rate (%)
		Projects	Direct Cost	Percentage of the Total (%)	Average Funding Per Project *	
Mathematical and Physical Sciences	5,001	1,533	97,330	9.50	63.49	30.65
Chemical Sciences	6,154	1,568	101,980	9.96	65.04	25.48
Life Sciences	10,777	2,665	164,640	16.08	61.78	24.73
Earth Sciences	5,792	1,554	109,230	10.67	70.29	26.83
Engineering and Materials Sciences	13,911	2,794	177,270	17.31	63.45	20.08
Information Sciences	8,240	1,793	109,000	10.64	60.79	21.76
Management Sciences	3,563	700	33,660	3.29	48.06	19.65
Health Sciences	19,587	4,102	230,940	22.55	56.30	20.94
Total	73,025	16,709	1,024,050	100.00	61.29	22.88

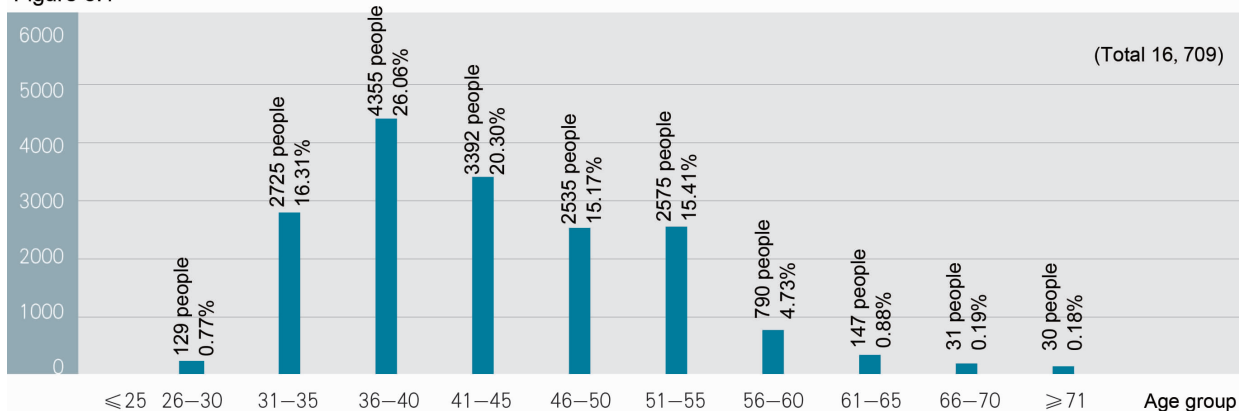
Note: average direct funding per project=direct funding/project;

funding rate =No. of approved/ No. of applications×100.

There were 55,256 proposals from male PIs and 12,741 funded; 17,769 from female and 3,968 funded.

Age Distribution of Principal Investigators of General Program Projects in 2015

Figure 5.1



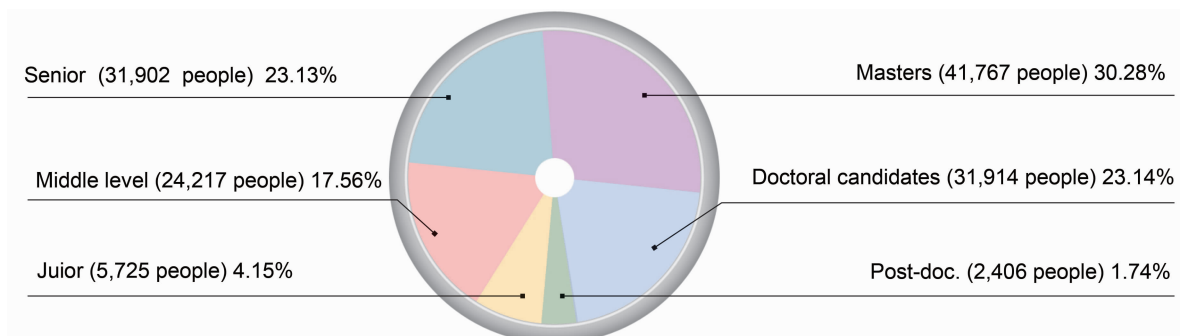
Professional Structure of Members of Research Groups for
General Program Projects in 2015

Figure 5.2

(Total 137,931)

Statistics of General Program Projects by Region in 2015

Table 5-4

(Unit: 10,000 yuan)

No.	Region	Projects	Direct Cost	No.	Region	Projects	Funding
1	Beijing	3,376	212,271.35	17	Jilin	323	20,194.00
2	Shanghai	1,832	109,910.95	18	Henan	268	16,011.00
3	Jiangsu	1,726	105,232.40	19	Gansu	166	10,827.30
4	Guangdong	1,184	71,594.63	20	Shanxi	125	7,649.00
5	Hubei	1,100	67,835.00	21	Hebei	124	7,293.00
6	Zhejiang	843	50,970.67	22	Yunnan	95	6,037.00
7	Shaanxi	781	47,752.60	23	Xinjiang	44	2,843.00
8	Shandong	701	42,591.40	24	Guangxi	44	2,728.70
9	Liaoning	614	37,320.50	25	Jiangxi	38	2,374.00
10	Sichuan	561	34,294.30	26	Guizhou	34	2,333.00
11	Hunan	552	33,023.60	27	Hainan	15	1,005.00
12	Anhui	502	31,365.10	28	Inner Mongolia	13	830.00
13	Tianjin	470	28,635.20	29	Qinghai	11	683.00
14	Heilongjiang	432	26,382.70	30	Ningxia	5	300.00
15	Chongqing	387	23,078.30	31	Tibet	1	25.00
16	Fujian	342	20,658.30				

Key Program Projects

Application and Funding of Projects of Key Program Projects in 2015 (by Scientific Department)

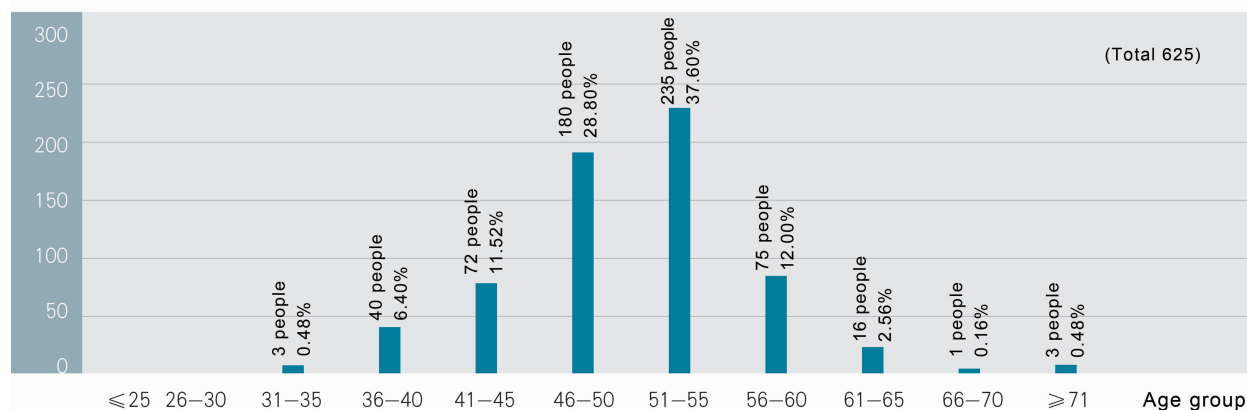
Table 5-5

(Unit: 10,000 yuan)

Scientific Department	Applications	Approved				Funding Rate(%)
		Projects	Direct Cost	Percentage of the Total (%)	Average Funding Per Project	
Mathematical and Physical Sciences	266	73	21,670	12.12	296.85	27.44
Chemical Sciences	242	65	19,430	10.87	298.92	26.86
Life Sciences	522	95	26,350	14.74	277.37	18.20
Earth Sciences	451	80	23,610	13.20	295.13	17.74
Engineering and Materials Sciences	403	90	26,100	14.60	290.00	22.33
Information Sciences	272	85	25,100	14.04	295.29	31.25
Management Sciences	164	35	8,680	4.85	248.00	21.34
Health Sciences	485	102	27,860	15.58	273.14	21.03
Total	2,805	625	178,800	100.00	286.08	22.28

Age Distribution of Principal Investigators of Key Program Projects: 2014

Figure 5.3



Professional Structure of Members of Research Groups for Key Program Projects: 2014

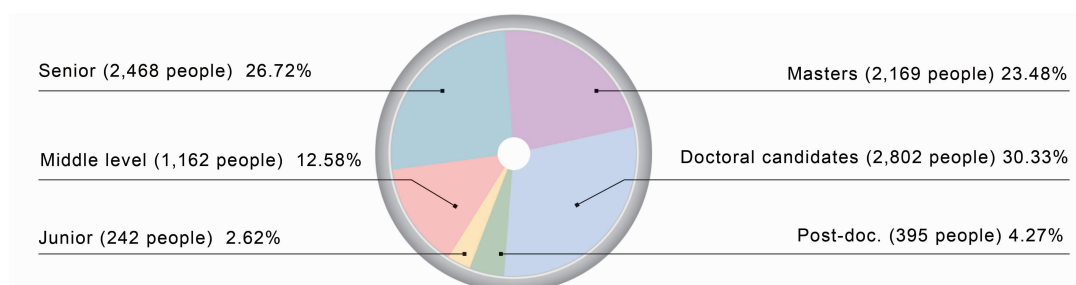


Figure 5.4

(Total 9,238)

Major Program

In 2015, twenty-nine proposals received for major program and twenty proposals were funded, with a total funding of direct cost of 318.1381 million yuan.

Funding of Major Program Projects in 2015

Table 5-6

(Unit: 10,000 yuan)

Name of project	PI	Professional title	Home institution	Direct Cost
Basic research on biological characteristics and pathogenesis of Ebola Virus	Gao Fu	Researcher	Institute of Microbiology, CAS	2,000.00
Multilingual spontaneous speech recognition; foundational theories and modeling methods	Yan Yonghong	Researcher	Institute of Acoustics, CAS	1,652.00
Explore global star formation and ISM properties with Tianma Radio Telescope	Shen Zhiqiang	Researcher	Shanghai Astronomical Observatory, CAS	1,625.00
The relationship between the physical and chemical properties of rare earth and their 4f5d electronic structures	Zhang Hongjie	Researcher	Changchun Institute of Applied Chemistry, CAS	1,692.60
Dynamics foundation for achieving high power chemical laser	Zhang Donghui	Researcher	Dalian Institute of Chemical Physics, CAS	1,656.00
Deep elimination of low concentration organic pollutants in water and the mechanism study	Zhao Jincai	Researcher	Institute of Chemistry, CAS	1,698.00
The complexity of the floristic elements and its evolutionary mechanisms of Sino-Himalayas	Sun Hang	Researcher	Kunming Institute of Botany, CAS	1,280.00
RNA binding proteins control early embryonic development	Chen Dahua	Researcher	Institute of Zoology, CAS	1,300.00
Distribution of effect of water in the interior of Earth	Zhen Yongfei	Professor	University of Science and Technology of China	1,676.50
Coupled mechanisms and interactive coercing effects between urbanization and eco-environment in mega-urban agglomerations	Fang Chuanglin	Researcher	Institute of Geographic Sciences and Natural Resources, CAS	1,657.55
Lunar-based observation research of Earth macroscopic scientific phenomena	Guo Huadong	Researcher	Institute of Remote Sensing and Digital Earth, CAS	1,653.90
Study on the Cenozoic tectonic evolution and deep dynamics of the northeastern Tibetan Plateau	Shi Yaolin	Professor	University of Chinese Academy of Sciences	1,671.59
Structure of the cloud system in the typical region of China and its radiation-climate effect	Shi Guangyu	Researcher	Institute of Atmospheric Physics, CAS	1,651.77
A research on multiple-main-phase permanent magnets made from misch-metal	Shen Baogen	Researcher	Institute of Physics, CAS	1,258.25
Thermal-mechanical-chemical coupling mechanisms and microstructure tailoring methods of thermal barrier coatings	Xu Huibin	Professor	Beihang University	1,500.00
Fundamental researches of energy transfer and conversion in solar energy utilization	Xuan Yimin	Professor	Nanjing University of Aeronautics and Astronautics	1,500.00
Research of low energy building in hot-humid climate zone	Liu Jiaping	Professor	Xi'an University of Architecture and Technology	1,500.00
Fundamental theory and key technology for plant-wide optimal operation of oil refining process	Li Shaoyuan	Professor	Shanghai Jiao Tong University	1,632.65
Research on fabrication of quantum photonic integrated circuits by femtosecond laser direct writing	Sun Hongbo	Professor	Jilin University	1,690.00
Acupoint sensation research	Liang Fanrong	Professor	Chengdu University of TCM	1,518.00
Total				31,813.81

Major Research Plan

Applications and Funding of Major Research Plan Projects in 2015

Table 5-7

(Unit: 10,000 yuan)

Title of major research plan	Applications	Approved	Direct Cost
Study of signaling pathway based on small molecular probes	1	1	200
Destruction of the North China Craton	8	4	1,000
Dynamic disaster of major projects	4	4	292
Molecular mechanism of plant hormone	1	1	280
Basic research on high confidence software	1	1	400
Apparent genetic mechanism of cell programming and re-programming	79	34	2,530
Cognitive computation of visual and audio information	25	7	1,703
Fundamental research on nano manufacturing	2	2	130
Research on unconventional emergency management	1	1	200
Integrated research on the eco-hydrological process of Heihe Basin	2	2	410
Controllable self-assembly system and its functionalization	23	7	2,100
Deep sea process and evolution of the South China Sea	5	4	750
The regulation network and molecular mechanisms of malignant transformation of non-resolving inflammation	41	10	1,960
Basic algorithm and computational modeling in high performance scientific computation	42	26	3,024
Multi genetic function and mechanism in micro evolution process	23	6	1,600
Mesosopic mechanism and regulation in multiphase reaction process	139	34	3,938
Genetic network analysis of production traits of major crops	53	18	2,927
Accurate measurement physics	55	25	4,580
The change of the Tibetan Plateau land-atmosphere coupled system and its effect on global climate	36	14	2,580
Basic theory and key technology of space information network	116	18	2,552
Regulatory mechanisms of vascular homeostasis and remodeling	147	33	3,550
Regulatory function of non coding RNA in the process of genetic information transfer	160	25	3,320
Basic research on turbulent combustion in engines	96	31	3,300
Regional immunological characteristics and diseases of tissue organs	146	33	4,000
Basic research on the causes and coping mechanisms of atmospheric compound pollution in China	156	33	6,800
Toxicology and health effect of air fine particulate matter	244	41	5,000
Catalytic science of carbon energy conversion and utilization	217	36	4,500
Research on big data-driven management and decision-making	396	29	1,822
The utilization of runoff variation and adaptability in southwest China	296	32	5,745
Total	2,515	512	71,193

5.4 Funds for Talented Professionals

Projects for Young Scientists Fund

Application and Funding of Projects of Young Scientists Fund in 2015 (by Scientific Department)

Table 5-8

(Unit: 10,000 yuan)

Scientific Department	Applications	Approved			Average Funding Per Project	Funding Rate (%)
		Projects	Direct Cost	Percentage of the Total (%)		
Mathematical and Physical Sciences	5,399	1,733	35,350	11.07	20.40	32.10
Chemical Sciences	5,253	1,428	29,990	9.39	21.00	27.18
Life Sciences	9,469	2,214	44,310	13.87	20.01	23.38
Earth Sciences	5,419	1,582	33,200	10.39	20.99	29.19
Engineering and Materials Sciences	11,194	2,900	59,160	18.52	20.40	26.52
Information Sciences	7,327	1,943	39,640	12.41	20.40	25.91
Management Sciences	3,273	675	11,800	3.69	17.48	20.62
Health Sciences	18,388	3,680	66,010	20.66	17.94	20.01
Total	65,722	16,155	319,460	100.00	19.77	24.58

Note: 34,395 proposals from male PIs and 9,562 granted; 31,327 from female, 6,593 granted.

Professional Structure of Members of Research Groups for Young Scientists Fund in 2015

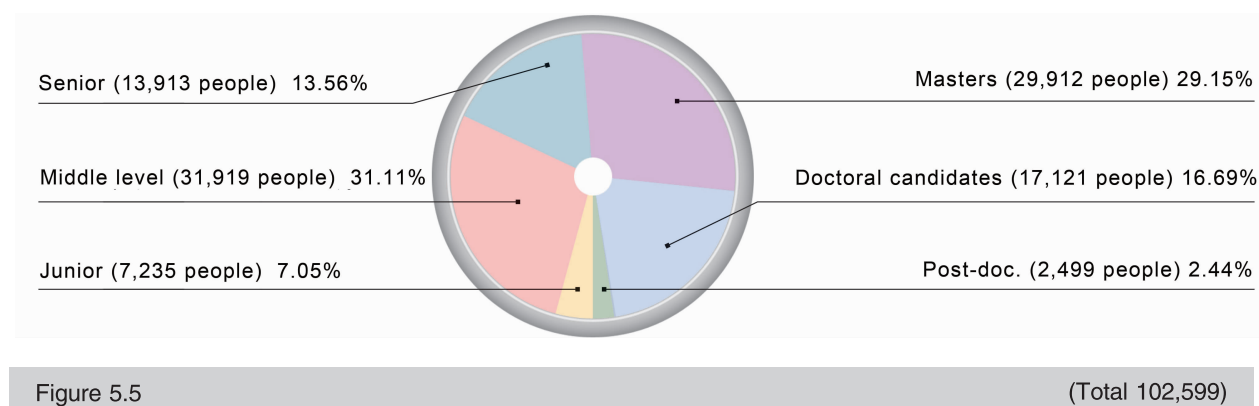


Figure 5.5

(Total 102,599)

Statistics of Projects for Young Scientists Fund by Region in 2015

Table 5-9

(Unit: 10,000 yuan)

Region	Projects	Direct Cost	Region	Projects	Direct Cost	Region	Projects	Direct Cost
Beijing	2,344	46,432.50	Tianjin	496	9,734.80	Jiangxi	130	2,581.08
Jiangsu	1,857	36,780.50	Anhui	459	9,246.00	Guangxi	76	1,489.00
Shanghai	1,405	27,039.00	Henan	463	9,209.00	Guizhou	60	1,226.50
Guangdong	1,062	20,720.27	Chongqing	413	8,028.60	Xinjiang	56	1,177.00
Hubei	1,047	20,668.50	Heilongjiang	388	7,767.00	Hainan	35	701.00
Shaanxi	894	17,871.40	Fujian	382	7,547.10	Inner Mongolia	30	590.00
Shandong	876	17,374.40	Jilin	315	6,355.10	Ningxia	14	263.50
Zhejiang	734	14,306.80	Shanxi	212	4,306.90	Qinghai	8	170.00
Sichuan	694	13,911.06	Gansu	192	4,060.90	Tibet	2	40.00
Liaoning	624	12,301.90	Hebei	183	3,674.80			
Hunan	569	11,172.99	Yunnan	135	2,712.40			
						Total	16,155	319,460.00

Projects of the Fund for Less Developed Regions

Application and Funding of Projects of the Fund for Less Developed Regions by Funding in 2015

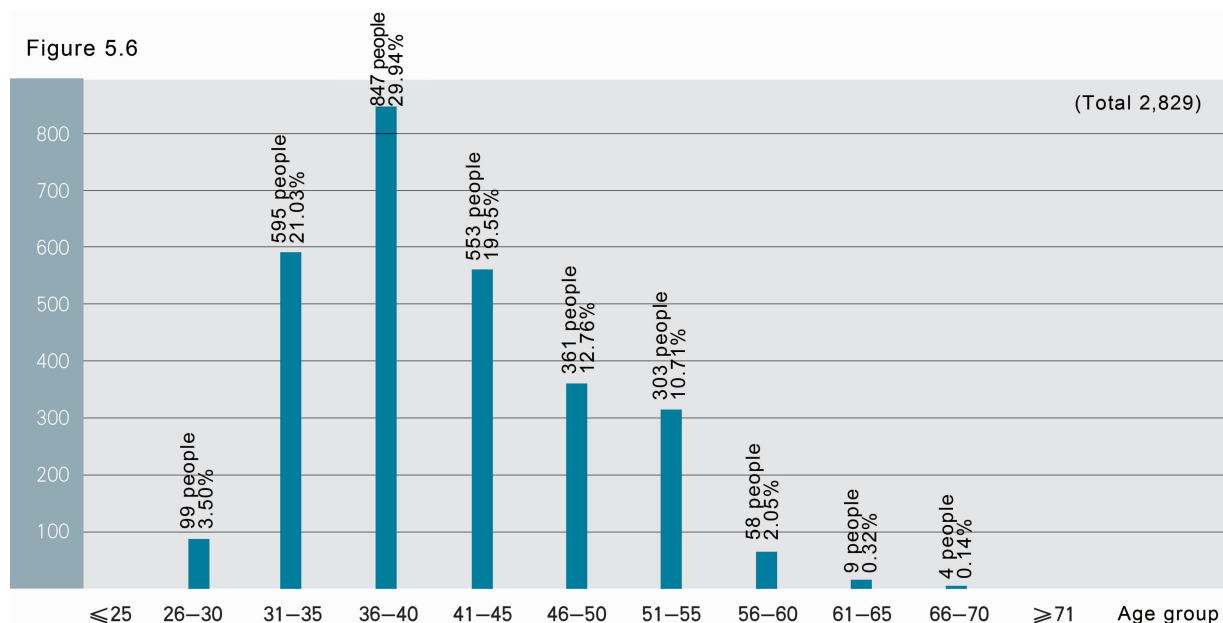
Table 5-10

(Unit: 10,000 yuan)

Region	Applications	Approved				Funding Rate (%)
		Projects	Direct Cost	Percentage of the Total (%)	Average Direct Cost Per Project	
Jiangxi	2,430	553	21,351.56	19.48	38.61	22.76
Yunnan	2,100	428	16,625.18	15.17	38.84	20.38
Guangxi	2,000	419	16,215.46	14.80	38.70	20.95
Xinjiang	1,543	356	13,883.60	12.67	39.00	23.07
Gansu	1,173	260	10,158.10	9.27	39.07	22.17
Guizhou	1,090	229	8,768.00	8.00	38.29	21.01
Inner Mongolia	1,103	201	7,833.00	7.15	38.97	18.22
Ningxia	664	144	5,507.10	5.02	38.24	21.69
Hainan	383	99	3,844.00	3.51	38.83	25.85
Qinghai	231	33	1,291.00	1.18	39.12	14.29
Tibet	102	31	1,212.00	1.11	39.10	30.39
Jilin	216	38	1,436.00	1.31	37.79	17.59
Hunan	73	22	855.00	0.78	38.86	30.14
Hubei	54	16	620.00	0.57	38.75	29.63
Sichuan	8	0	0	0	0	0
Total	13,170	2,829	109,600.00	100.00	38.74	21.48

Note: there were 8,619 applications from male applicants, of which 1,919 were funded; and 4,551 were from female applicants, of which 910 were funded.

Age Distribution of Principal Investigators of Projects of the Fund for Less Developed Regions in 2015



Professional Structure of Members of Research Groups for the Fund for Less Developed Regions in 2015

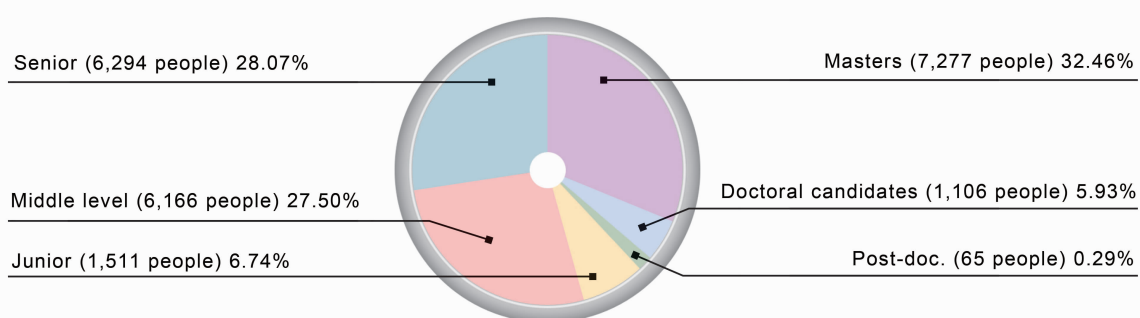


Figure 5.7

(Total 22,419)

Excellent Young Scientists Fund

Application and Funding of Projects of Excellent Young Scientists Fund in 2015 (by Scientific Department)

Table 5-11

(Unit: 10,000 yuan)

Scientific Department	Applications	Approved			Funding Rate (%)
		Projects	Direct Cost	Percentage of the Total (%)	
Mathematical and Physical Sciences	388	47	6,110	11.75	12.11
Chemical Sciences	499	57	7,410	14.25	11.42
Life Sciences	544	59	7,670	14.75	10.85
Earth Sciences	349	39	5,070	9.75	11.17
Engineering and Materials Sciences	661	74	9,620	18.50	11.20
Information Sciences	564	59	7,670	14.75	10.46
Management Sciences	110	14	1,820	3.50	12.73
Health Sciences	405	51	6,630	12.75	12.59
Total	3,520	400	52,000	100.00	11.36

Note: there were 2,901 applications from male applicants, of which 334 were funded; and 619 were from female applicants, of which 66 were funded.

National Science Fund for Distinguished Young Scholars

In 2015, we received 2,148 applications for National Science Fund for Distinguished Young Scholars. After review, we funded 198 people. The total direct funding was 679.35 million yuan.

Awardees of the National Science Fund for Distinguished Young Scholars in 2015

Table 5-12

(Unit: 10,000 yuan)

No.	Name	Project Name	Home Institution	Direct Cost
1	Wang Hansheng	High dimensional complex data: theory and application data	Peking University	245
2	Cai Yangjian	Manipulation and application of light beam	Soochow University	350
3	Gu Ying *	Interdiscipline and applications of Plasmonics	Peking University	350
4	Wan Xiangang	Computational condensed matter physics	Nanjing University	350
5	Ta Dean	Medical ultrasonic test	Fudan University	350
6	Xu Limei *	Theory of Phase transition and critical phenomena and its application in complex liquids	Peking University	350
7	Chen Zhiqiang	Research on X-ray imaging theory and key technologies	Tsinghua University	350
8	Yang Lijun	Instability of jets of non-Newtonian fluids	Beihang University	350
9	Sun Wenchang	Harmonic and wavelet analysis	Nankai University	245
10	Wu Hengan	Mechanical behavior and mechanism of materials at nanoscale	University of Science and Technology of China	350
11	Qu Shaoxing	Mechanics of advanced materials	Zhejiang University	350
12	Wu Haijun	Numerical methods for partial differential equations	Nanjing University	245
13	Bao yinhexi	Orbit theory in the irregular gravitational field	Tsinghua University	350
14	Fang Taotao	Multi-wavelength observations of cosmic structure formation and evolution	Xiamen University	350
15	Lu Chaoyang	Quantum optics and quantum information	University of Science and Technology of China	350
16	Wang Gangfeng	Mico-/nano-mechanics	Xi'an Jiaotong University	350
17	Sun Binyong	Langlands program	Academy of Mathematics and System Sciences, CAS	245
18	Sun Litao	Tailoring the surface structures and monitoring its dynamic process of nanomaterials based on electron microscopy	Southeast University	350
19	Liu Jianglai	Experimental particle astrophysics	Shanghai Jiao Tong University	350
20	Li Jing	Partial differential equations	Academy of Mathematics and System Sciences, CAS	245

(to be continued)

(continued)

No.	Name	Project Name	Home Institution	Direct Cost
21	He Yuan	High power superconducting radio frequency Proton-Linac	Institute of Modern Physics, CAS	350
22	Zhou Shangui	Nuclear physics	Institute for Theoretical Physics, CAS	350
23	Hu Jun	Algebraic groups, quantum groups, Hecke algebras	Beijing Institute of Technology	245
24	Fan Yizhong	Theoretical astrophysics	Purple Mountain Observatory, CAS	350
25	Hong Chunyan *	Topology of polymer synthesis and its application	University of Science and Technology of China	350
26	Huang Weixin	Catalytic surface chemistry	University of Science and Technology of China	350
27	Li Ang	Strategies and methods in natural product synthesis	Shanghai Institute of Organic Chemistry, CAS	350
28	Zeng Minghua	Coordination chemistry in solution and functional coordination chemistry	Guangxi Normal University	350
29	Qin Anjun	Synthetic polymer chemistry based on triple-bond building blocks	South China University of Technology	350
30	Zhang Wenke	Polymer molecular force spectrum	Jilin University	350
31	Wang Xinping	Radical chemistry of main group elements	Nanjing University	350
32	Huang Yanyi	Single cell analysis	Peking University	350
33	Lin Daohui	Pollution chemistry of nanomaterials	Zhejiang University	350
34	Peng Hailin	Nanomaterials chemistry and nanodevices	Peking University	350
35	Wu Chuande	Designed synthesis of biomimetic framework materials and property studies	Zhejiang University	350
36	Yang Qingzheng	Supramolecular photochemistry	Beijing Normal University	350
37	Chao Hui	Bioinorganic chemistry	Sun Yat-sen University	350
38	Wang Jinlan *	The theory of low dimensional materials chemistry	Southeast University	350
39	Wang Jingdai	Chemical reaction engineering	Zhejiang University	350
40	Zhang Wangqing	Radical polymerization under heterogeneous conditions	Nankai University	350
41	Wang Chunjiang	Catalytic asymmetric 1,3-dipolar cycloaddition	Wuhan University	350
42	Xia Fan	Bioanalytical chemistry	Huazhong University of Science and Technology	350
43	Wang Hongda	Structure of biophysical chemistry	Changchun Institute of Applied Chemistry, CAS	350

(to be continued)

(continued)

No.	Name	Project Name	Home Institution	Direct Cost
44	Tang Jinkui	Functional chemical complexes	Changchun Institute of Applied Chemistry, CAS	350
45	Chu Xia *	Bioanalysis and biosensing	Hunan University	350
46	Zhang Jianling *	Chemical thermodynamics of colloid and interface	Institute of Chemistry, CAS	350
47	Li Xingwei	Selective functionalization of arenes	Dalian Institute of Chemical Physics, CAS	350
48	Su Haijia *	The biochemical and food chemical engineering	Beijing University of Chemical Technology	350
49	Gong Jinlong	Catalysis for energy	Tianjin University	350
50	Chen Chunheng	Environmental photocatalysis	Institute of Chemistry, CAS	350
51	Ye Mingliang	New methods for proteomics analysis	Dalian Institute of Chemical Physics, CAS	350
52	Luo Junhua	Inorganic optoelectronic crystalline materials	Fujian Institute of Material Structure, CAS	350
53	Deng Weiqiao	Materials simulation and design	Dalian Institute of Chemical Physics, CAS	350
54	Zhao Bin	Environmental pollutants and health	Research Center for Eco-Environmental Sciences, CAS	350
55	Lv Xuefeng	Metabolic engineering in cyanobacteria	Qingdao Institute of Biomass Energy and Bioprocess Technology, CAS	350
56	Ma Zhonghua	Chemical control of plant diseases	Zhejiang University	350
57	Yan Jianbing	Maize genomics and molecular breeding	Huazhong Agricultural University	350
58	Ye Sheng	Biochemistry of microbiology	Zhejiang University	350
59	He Chaoying	Evolutionary developmental genetics of fruit morphological variation in plants	Institute of Botany, CAS	350
60	Tang Dingzhong	Plant disease resistance	Institute of Genetics and Developmental Biology, CAS	350
61	Ou Guangshuo	Mechanical behavior and mechanism of nano scale materials	Tsinghua University	350
62	Tian Zhixi	Soybean functional genomics	Institute of Genetics and Developmental Biology, CAS	350
63	Miu Wei	Protozoology	Institute of Hydrobiology, CAS	350
64	Du Weiguo	Physiological ecology of reptile embryos	Institute of Zoology, CAS	350
65	Qian Zhiyong	Nanobiomaterials	Sichuan University	350
66	Li Guohong	Gene regulation and epigenetics	Institute of Biophysics, CAS	350

(to be continued)

(continued)

No.	Name	Project Name	Home Institution	Direct Cost
67	Ren Jun	Pig genetic improvement	Jiangxi Agricultural University	350
68	Ai Qinghui	Nutrition physiology in aquatic animals	Ocean University of China	350
69	Li Bin	Molecular immunology	Shanghai Pasteur Institute, CAS	350
70	Xu Shuhua	Population Genomics	Shanghai Institutes for Biological Sciences, CAS	350
71	Xu Yongzhen	RNA splicing and insect development	Shanghai Institutes for Biological Sciences, CAS	350
72	Chen Jianfeng	The mechanism of cell adhesion and migration	Shanghai Institutes for Biological Sciences, CAS	350
73	Ying Hao	Thyroid hormone action and metabolic regulation	Shanghai Institutes for Biological Sciences, CAS	350
74	Lei Ming	Structural and functional studies of chromosome	Shanghai Institutes for Biological Sciences, CAS	350
75	Wang Jiawei	The role of small RNAs in age pathway in plants	Shanghai Institutes for Biological Sciences, CAS	350
76	Li Chengyu	Systems neuroscience	Shanghai Institutes for Biological Sciences, CAS	350
77	Li Shenghong	Secondary metabolites of plant specialized structures and their biological functions	Kunming Institute of Botany, CAS	350
78	Jiang Yi	Human visual perception	Institute of Psychology, CAS	350
79	Du Yan	Physical oceanography	South China Sea Institute of Oceanology, CAS	350
80	Wang Xilong	Environmental geography	Peking University	350
81	Wang Fengping *	The deep biosphere biogeochemical function research	Shanghai Jiao Tong University	350
82	Hu Xiumian	Sedimentology	Nanjing University	350
83	Wang Kaicun	Land surface energy budget and climate change	Beijing Normal University	350
84	Cui Jun	Investigating the formation mechanisms of the Martian ionosphere	National Astronomical Observatory of China, CAS	350
85	Yao Huaiying	Soil microbial ecology	Institute of Urban Environment, CAS	350
86	Tian Jun	Paleoceanography	Tongji University	350
87	Duan Wansuo	Studies of nonlinear error growth theory for the predictability of El Nino-Southern Oscillation and its applications	Institute of Atmospheric Physics, CAS	350
88	Wang Houjie	Estuarine and coastal science: Major processes of sediment dynamics of the Yellow River sediment "source-to-sink"	Ocean University of China	350

(to be continued)

(continued)

No.	Name	Project Name	Home Institution	Direct Cost
89	Luo Yi *	Environmental geochemistry	Nankai University	350
90	Guo Feng	Petrology	GuangzhouInstitute of Geochemistry, CAS	350
91	Shi Zhihua	Water erosion mechanism and process simulation	Institute of Soil and Water Conservation, CAS	350
92	Jiang Weiping	The physical mechanism of non-linear variation in coordinate time series	Wuhan University	350
93	Li Jianchun *	Rock blasting vibration analysis and prediction research	Wuhan Institute of Rock and Soil Mechanics, CAS	350
94	Lan Hengxing	Engineering geology dynamics and geo-hazards	Institute of Geographic Sciences and Natural Resources, CAS	350
95	Yang Yueheng	Isotopic geochemistry	Institute of Geology and Geophysics, CAS	350
96	Pei Tao	Spatiotemporal data mining	Institute of Geology and Geophysics, CAS	350
97	Liang Eryuan	Dendroecology and dendroclimatology	Institute of Tibetan Plateau Research, CAS	350
98	Wei Yong	Planetary space physics	Institute of Geology and Geophysics, CAS	350
99	Sun Youbin	Quaternary geology and paleoclimate change	Institute of Earth Environment, CAS	350
100	Liu Zhuang	Functionalnanomaterials for the development of novel cancer therapies	Soochow University	350
101	Zhang Haoli	Organic Semiconductor and Devices	Lanzhou University	350
102	Men Yongfeng	Polymer physics	Changchun Institute of Applied Chemistry, CAS	350
103	Fu Xudong	Sediment dynamics in mountain streams and watersheds	Peking University	350
104	Yu Rong	Microstructure and properties of materials	Peking University	350
105	Ruan Xinbo	Power electronics conversion techniques	Nanjing University of Aeronautics and Astronautics	350
106	Li Qinchuan	Mechanism theory of manipulator	Zhejiang Sci-Tech University	350
107	Fan Feng	Research on seismic behavior of long-span structures	Harbin Institute of Technology	350
108	Xiao Rui	Mechanism theory of manipulator	Southeast University	350
109	Zhang Xinghong	Ultra-high temperature ceramic matrix composites	Harbin Institute of Technology	350
110	Zhu Jintao	Polymer materials with well-ordered structures	Huazhong University of Science and Technology	350

(to be continued)

(continued)

No.	Name	Project Name	Home Institution	Direct Cost
111	He Zhengyou	Signal and information processing in power systems	Southwest Jiaotong University	350
112	Duan Lian	Organic electroluminescent materials and devices	Tsinghua University	350
113	Wu Gang	Structural engineering	Southeast University	350
114	Wang Tongmin	Solidification behavior and control of alloys	Dalian University of Technology	350
115	Yang Quanhong	Functional carbon materials: surface/interface control and hierarchical structure construction	Tianjin University	350
116	Li Yongle	Wind-induced and vehicle-induced vibration of bridges	Southwest Jiaotong University	350
117	Liu Shiyuan	Theory, method, and technology for mechanical measurement and testing	Huazhong University of Science and Technology	350
118	Pan Anlian	New information photonics materials and devices	Hunan University	350
119	Wang Xiaodong	Heat and mass transfer	North China Electric Power University	350
120	Xiong Lihua	Runoff generation and forecasting	Wuhan University	350
121	Han Qinghua	Long span and space structures	Tianjin University	350
122	Sun Yuwen	Digital manufacturing and CNC machining technology	Dalian University of Technology	350
123	Wang Tianyou	Airflow motion and sprays of internal combustion engines	Tianjin University	350
124	Li Runwei	Magnetic materials and devices	Ningbo Material Technology and Engineering Research Institute, CAS	350
125	Li Feng	Carbon nanomaterials for electrochemical energy storage applications	Institute of Metal Research, CAS	350
126	Xu Bo	Novel and high-performance metastable materials	Yanshan University	350
127	Li Weihua *	Corrosion and control of marine engineering	Institute of Oceanology, CAS	350
128	Tian Ming	Special and functional elastomer materials	Beijing University of Chemical Technology	350
129	Zhu Wancheng	Damage and failure of deep rock mass and associated mechanism for mining-induced hazards	Northeast University	350
130	He Maogang	Thermophysical properties of fluids	Xi'an Jiaotong University	350
131	Qiang Zhimin	Environmental engineering	Research Center for Eco-Environmental Sciences, CAS	350

(to be continued)

(continued)

No.	Name	Project Name	Home Institution	Direct Cost
132	Qin Gaowu	Design and preparation of new materials assisted by computational materials science	Northeast University	350
133	Liu Xuanyong	Bioceramic coating	Shanghai Institute of Silicate Research Institute, CAS	350
134	Song Yuntao	Research on the key science and technology of superconducting Tokamak	Hefei Institute of Material Science, CAS	350
135	Liu Hong	Environmental engineering	Chongqing Institute of Green and Intelligent Technology, CAS	350
136	Guo Jianchun	Fracturing and acidizing in low permeability and tight reservoir	Southwest Petroleum University	350
138	Wang Ling	Intelligent optimization and scheduling theory	Tsinghua University	350
139	Shi Baosen	Quantum information and quantum optics	University of Science and Technology of China	350
140	Huang Xiaochen	Semiconductor bio-optoelectronics	Nanjing Tech University	350
141	Zeng Xiaoyang	High energy efficient System-on-Chip (SoC)	Fudan University	350
142	Zhang Zhijun	Antennas and propagations	Tsinghua University	350
143	Zhang Min	Structure analysis and machine translation of natural language	Soochow University	350
144	Zhang Qinyu	Aerospace communications theory and technique	Harbin Institute of Technology	350
145	Xie Bing	Software reuse	Peking University	350
146	Zhang Xinpeng	Information hiding in multimedia	Shanghai University	350
147	Luo Jun	Anti-disturbance control technology in robotics	Shanghai University	350
148	Liu Huafeng	Quantitative medical imaging	Zhejiang University	350
149	Jin Zhonghe	MEMS and picosatellites	Zhejiang University	350
150	Liu Lei	Energy-band engineering and defects/impurity control of wide bandgap metal oxide semiconductors	Changchun Institute of Optics, Fine Mechanics and Physics, CAS	350
151	Wu Ligang	Analysis and design for discontinuous control systems	Harbin Institute of Technology	350
152	Qu Junle	Biomedical optical imaging	Shenzhen University	350
153	Chen Wenguang	Evaluation, optimization and programming of high performance computers	Tsinghua University	350
154	Liu Hongwei	Radar signal processing	Xidian University	350
155	Li Hongliang	Segmentation and coding for images and videos	University of Electronic Science and Technology of China	350

(to be continued)

(continued)

No.	Name	Project Name	Home Institution	Direct Cost
156	Xue Chenyang	Principle and integration of micro/nano sensors	North University of China	350
157	Liu Xueming	Theory and application of nonlinearity for fiber lasers	Xi'an Institute of Optics and Precision Mechanics, CAS	350
158	Li Chaohui	Multi-dimensional optical information transmission and processing	Jinan University	350
159	Pei Li *	The new type of optoelectronic devices	Beijing Jiaotong University	350
160	Zhang Yongdong	Large-scale video content analysis and processing in internet environment	Institute of Computing Technology, CAS	350
161	Guan Haibing	Virtualization methods and techniques	Shanghai Jiao Tong University	350
162	Ding Jinliang	Data driven complex industrial system operation optimization control and its applications	Northeastern University	350
163	Wang Liang	Analysis and understanding of visual patterns	Institute of Automation, CAS	350
164	Wang Dayi	Spacecraft autonomous navigation and control	Beijing Institute of Control Engineering	350
165	Feng Zhiyong *	Research on theory and technology in cognitive wireless networks	Beijing University of Posts and Telecommunications	350
166	Chen Shiyi	Risk management and economic efficiency analysis	Fudan University	245
167	Lu Jiangyong	International entrepreneurship	Peking University	245
168	Shu Jia	Logistics and supply chain management	Southeast University	245
169	Huo Baofeng	Supply chain management	Zhejiang University	245
170	Wu Jianjun	Management complexities of urban traffic system	Beijing Jiaotong University	245
171	Wang Can	Impacts of and policies for carbon mitigation	Tsinghua University	245
172	Li Zhichun	Transportation infrastructure investment and travel demand management	Hangzhou University of Science and Technology	245
173	Liu Junling	Molecular mechanisms of platelet activation in health and disease	Shanghai Jiao Tong University	350
174	Xu Wendong	Peripheral nerve injury-repair and central plasticity	Fudan University	350
175	Li Jianming	Molecular pathology of metastasis in colorectal cancer	Soochow University	350
176	Zhou Jiaguo	Cardiovascular pharmacology	Sun Yat-sen University	350
177	Zhou Rongbin	Innate immune receptors and diseases	University of Science and Technology of China	350
178	Zhao Chen	Retinal degenerative diseases	Nanjing Medical University	350

(to be continued)

(continued)

No.	Name	Project Name	Home Institution	Direct Cost
179	Zhang Huafeng *	Cancer biology	University of Science and Technology of China	350
180	Yi Fan	The pathogenesis of kidney disease	Shandong University	350
181	Gao Chengjiang	Antiviral innate immunity	Shandong University	350
182	Ju Shenghong *	Molecular imaging and functional imaging	Southeast University	350
183	Cheng Xiang	Immune inflammation and coronary heart disease	Huazhong University of Science and Technology	350
184	Chen Xinchun	Infection immunity	Guangdong Medical University	350
185	Gao Fei	Gametogenesis and gametogenesis-associated diseases	Institute of Zoology, CAS	350
186	Zhao Qiang	Structural pharmacology studies of GPCRs involved in important human diseases	Shanghai Institute of Materia Medica, CAS	350
187	Ju Zhenyu	Geriatric medicine	Hangzhou Normal University	350
188	Zhang Hao	Basic research for cardiovascular surgery	Fuwai Hospital, National Center for Cardiovascular Diseases China	350
189	Hu Rongui	Tumor and deregulated proteostasis	Shanghai Institutes for Biological Sciences, CAS	350
190	Zhu Bofeng	Forensic sciences	Xi'an Jiaotong University	350
191	Xia Kun	Genetic study of neuropsychiatric and severe inherited disorders	Central South University	350
192	Yang Qingwu	Neurology	Third Military Medical University	350
193	Hao Jihui	Oncology (digestive tract tumor)	Tianjin Medical University	350
194	Yu Ying	Prostanoid and cardiovascular diseases	Shanghai Institutes for Biological Sciences, CAS	350
195	Cheng Yongxian	Effective substances of traditional Chinese medicine	Kunming Institute of Botany, CAS	350
196	Shu Yuelong	Flu pathogen biology research	National Institute for Viral Disease Control and Prevention	350
197	Yu Hongjie	Infectious disease epidemiology	Chinese Center for Disease Control and Prevention	350
198	Li Wenhui	Molecular mechanisms of Hepatitis B virus infection	National Institute of Biological Sciences, Beijing	350

Note: 183 projects funded from 1,881 male applicants; 15 projects funded from 267 female applicants. * female

Science Fund for Creative Research Groups

1. Newly Started Creative Research Groups

In 2015, we received 249 applications. After review, we supported 38 groups, with a total funding of 389.55 million yuan. Please see the following table for details.

Awards in the Science Fund for Creative Research Groups in 2015

Table 5-13

(Unit: 10,000 yuan)

	Group Leader	Research Direction	Home Institution	Direct Cost
1	Jia Jinfeng	Novel quantum material physics and devices	Shanghai Jiao Tong University	1,050
2	Wang Jianxiang	Mechanics of multifunctional composites and structures	Peking University	1,050
3	Zhu Xiping	Geometry and topology on manifolds	Sun Yat-sen University	735
4	Han Zhanwen	Stellar astrophysics	Yunnan Observatory, CAS	1,050
5	Lv Caidian	Particle physics theory and experiment	Institute of High Energy physics, CAS	1,050
6	Yu Shuhong	Synthesis of nanomaterials for energy conversion and storage	University of Science and Technology of China	1,050
7	Chen Peng	Chemical biology approach to study cell fate regulation	Peking University	1,050
8	Jiang Yunbao	Spectrochemical Analysis	Xiamen University	1,050
9	He Jing	Intercalation chemistry and product engineering	Beijing University of Chemical Technology	1,050
10	Fan Qinghua	Molecular recognition and selective synthesis	Institute of Chemistry, CAS	1,050
11	Xu Ruiming	Chromatin structure and regulation	Institute of Biophysics, CAS	1,050
12	Jin Li	De novo genetic variants in human diseases: Mutational mechanisms and pathogenesis	Fudan University	1,050
13	Zhou Jianmin	Dissection of reactive oxygen species production and redox signaling in plants	Institute of Genetics and Developmental Biology, CAS	1,050
14	Deng Hongkui	Stem cell and regenerative medicine	Peking University	1,050
15	Chen Hualan	Animal infectious disease	Harbin Veterinary Research Institute, Chinese Academy of Agricultural Sciences	1,050
16	Huang Jianping	Arid and semi-arid climate change mechanism	Lanzhou University	1,050
17	Wu Fengchang	Theory and methodology of water quality criteria	Chinese Research Academy of Environmental Sciences	1,050
18	Wang Dongxiao	Physical oceanography	South China Sea Institute of Oceanology, CAS	1,050
19	Wang Yanxin	Environmental hydrogeology	China University of Geosciences (Wuhan)	1,050

(to be continued)

(continued)

	Group Leader	Research Direction	Home Institution	Direct Cost
20	Huang Runqiu	Early recognition and warning system for potentially catastrophic geohazards in West China	Chengdu University of Technology	1,050
21	Zeng Guangming	Remediation of the polluted wetland for lakes	Hunan University	1,050
22	Zhang Yinping	Fundamental research on scientific problems of built environment establishment	Tsinghua University	1,050
23	Wang Ruzhu	Fundamental research on heat & mass transfer and high-efficient thermodynamic system	Shanghai Jiao Tong University	1,050
24	Ma Yuguang	Organic and polymeric optoelectronic function materials and devices	South China University of Technology	1,050
25	Liu Hong	The fundamental theory and key technology of robotics	Harbin Institute of Technology	1,050
26	Fu Zhengyi	Designing of new structure and fundamentals of fabricating technology for functional composites	Wu han University of Technology	1,050
27	Shen Bo	Advanced semiconductor low-dimensional quantum structures and devices	Peking University	1,050
28	Chen Jian	Towards the quantum limit of the electromagnetic-wave detection	Nanjing University	1,050
29	Hu Shimin	Intelligent processing of internet visual media	Tsinghua University	1,050
30	Lu Wei	Infrared Physics: Study on the infrared optoelectronic manipulation	Shanghai Institute of Technical Physics, CAS	1,050
31	Ji Xinsheng	Research on the basic theory of mimic defense for cyber space	Information Engineering University	1,050
32	Liu Xinbao	Research on enterprise-oriented decision theories and methods in the environment of internet and big data	Hefei University of Technology	735
33	Wei Yiming	Research on energy economics and climate policy	Beijing Institute of Technology	735
34	Ge Junbo	The molecular mechanisms of Ischemic cardiovascular diseases and the therapeutic strategies	Fudan University	1,050
35	Qiao Jie	female germ cell development and genetic diseases	Peking University	1,050
36	Shen Hongbing	Genetic basis of cancer heterogeneity	Nanjing Medical University	1,050
37	Liu Youhua	Nephrology	Southern Medical University	1,050
38	Li Yaping	New anticancer drug delivery system based on nanotechnology	Shanghai Institute of Materia Medica, CAS	1,050

2. Continued Funding for Creative Research Groups of 3-Year Funding

After evaluation, all 30 creative research groups obtained the first extension of funding, with total funding of 154.35 million yuan. Please refer to the following table for details.

Continued Funding for Creative Research Groups of 3-Year Funding

Table 5-14

(Unit: 10,000 yuan)

	Group Leader	Research Direction	Home Institution	Direct Cost
1	Li Anmin	Mathematical physics	Sichuan University	367.50
2	Hu Haiyan	Dynamic behaviors of complex medium and structures	Beijing Institute of Technology	525.00
3	Pan Jianwei	Physics and technologies of quantum information with photons and cold atoms	University of Science and Technology of China	525.00
4	Wang Xinnian	High-energy nuclear physics	Central China Normal University	525.00
5	Cao Rong	Inorganic-organic hybrid functional materials	Fujian Institute of Material Structure, CAS	525.00
6	Fu Hongbing	Design, synthesis and optoelectronic properties of photo-functional materials	Institute of Chemistry, CAS	525.00
7	Tan Weihong	The analytical basic research of chemo- and biosensors	Hunan University	525.00
8	He Kebin	Multi medium compound pollution and control chemicals	Tsinghua University	525.00
9	Zhou Jinqiu	Mechanisms of chromatin covalent modification in epigenetic regulation (Epigenetics)	Shanghai Institute of Life Sciences, CAS	525.00
10	Cheng Heping	Cellular calcium signaling	Peking University	525.00
11	Dong Qi	Cognitive and neural mechanisms of learning	Beijing Normal University	525.00
12	Qian Qian	Rice genetic breeding	China National Rice Research Institute	525.00
13	Zhan Renbin	Early Paleozoic major biotic events and their dynamics	Nanjing Institute of Geological Paleontology, CAS	525.00
14	Yang Jinhui	Micro-scale isotopic constraint on early evolution of the Earth	Institute of Geology and Geophysics, CAS	525.00
15	Yi Fan	Remote sensing and numerical simulations of the middle and upper atmosphere	Wuhan University	525.00
16	Zhao Meixun	Marine organic biogeochemistry	Ocean University of China	525.00

(to be continued)

(continued)

	Group Leader	Research Direction	Home Institution	Direct Cost
17	Li Hejun	Physico-chemical process of preparation and service of ultra-high temperature composites for aeronautic and astronautic applications	Northwestern Polytechnical University	525.00
18	Yang Wantai	Preparation and functionalization of high performance polyolefins	Beijing University of Chemical Technology	525.00
19	Gao Deli	Basic research on drilling & completion of critical wells for oil & gas	China University of Petroleum (Beijing)	525.00
20	Tan Jianrong	Basic research on mechatronic and hydraulic system	Zhejiang University	525.00
21	Rong Mingzhen	Electrical insulation and discharge for power equipment	Xi'an Jiaotong University	525.00
22	Zhang Wenjun	Theory and technology for digital media communication	Shanghai Jiao Tong University	525.00
23	You Xiaohu	Fundamental theory and key techniques for beyond 4G mobile communications	Southeast University	525.00
24	Guan Xinping	Control theory and approaches—design, control and optimization of network systems	Shanghai Jiao Tong University	525.00
25	Liu Ming	Basic research on novel microelectronic devices integration	Institute of Microelectronics, CAS	525.00
26	Chen Shou	Financial innovation and risk management	Hunan University	367.50
27	Chen Yihan	Investigation of the mechanisms for cardiac arrhythmias	Tongji University	525.00
28	Lu Lin	Neural plasticity mechanisms underlying psychiatric disorders	Peking University	525.00
29	Duan Shumin	Molecular mechanisms underlying synapse and neural circuit regulation and their involvement in neuropsychiatric diseases	Zhejiang University	525.00
30	Zhang Xuemin	Tumor biology	Academy of Military Medical Sciences	525.00

3. Continued Funding for Creative Research Groups of 6-Year Funding

Among the 28 creative research group of 6-year funding, 23 of them applied for extended funding. After evaluation, 11 creative research groups obtained the second extension of funding. The total funding was 57.75 million yuan. Please see the following table for details.

Continued Funding for Creative Research Groups of 6-Year Funding

Table 5-15

(Unit: 10,000 yuan)

No.	Group Leader	Research Direction	Home Institution	Direct Cost
1	Chen Shiyi	Physical mechanism, modeling and experimental investigation of compressible turbulent flows	Peking University	525
2	Zhang Hongjie	Research and applications of new functional rare earth materials	Changchun Institute of Applied Chemistry, CAS	525
3	Li Yadong	Controlled growth of nanostructures and their functionalization and applications	Tsinghua University	525
4	Shu Hongbing	Cellular antiviral innate immunity	Wuhan University	525
5	Deng Xiuxin	Germplasm resources research and genetic improvement of horticultural crops	Huazhong Agricultural University	525
6	Wu Lixin	Mechanisms of ocean dynamic processes variations and roles in climate change	Ocean University of China	525
7	Cheng Huiming	Controllable synthesis, structure and application explorations of nano-structured carbon materials	Institute of Metal Research, CAS	525
8	Zhang Jun	Theory and application of networked coordination air traffic management system	Beihang University	525
9	Li Guojie	High parallel high performance computer architecture and system design methodology	Institute of Computing Technology, CAS	525
10	Li Ruxin	Basic research of high-field lasers and their applications	Shanghai Institute of Optics and Fine Mechanics, CAS	525
11	Wang Hongyang	The molecular mechanism between inflammation and carcinogenesis	Second Military Medical University	525

Joint Research Fund for Overseas Chinese Scholars and Scholars in Hong Kong and Macao

The Joint Research Fund for Overseas Chinese Scholars and Scholars in Hong Kong and Macao adopts "2+4" funding model, which means that those 2-year projects with substantial cooperation and clear potential for future development will be renewed to another 4 years.

Joint Research Fund for Overseas Chinese Scholars and Scholars in Hong Kong and Macao (2-Year Projects)

Table 5-16 (unit: 10,000 yuan)

Scientific Department	Applications Accepted	Approved	
		Number of Projects	Direct Cost
Mathematical and Physical Sciences	24	10	180
Chemical Sciences	23	8	144
Life Sciences	42	19	342
Earth Sciences	28	9	162
Engineering and Material Sciences	54	16	288
Information Sciences	66	22	396
Management Sciences	30	8	144
Health Sciences	60	24	432
Total	327	116	2088

Joint Research Fund for Overseas Chinese Scholars and Scholars in Hong Kong and Macao (Extension to 4-Year Projects) in 2015

Table 5-17 (Unit: 10,000 yuan)

Scientific Department	Applications Accepted	Approved	
		Number of Projects	Direct Cost
Mathematical and Physical Sciences	11	2	360
Chemical Sciences	6	2	360
Life Sciences	12	4	720
Earth Sciences	3	1	180
Engineering and Material Sciences	10	3	540
Information Sciences	11	3	540
Management Sciences	5	1	180
Health Sciences	14	4	720
Total	72	20	3,600

Note: there were 343 applications from male applicants, of which 116 were funded; and 56 were from female applicants, of which 20 were funded (sum of the above two tables).

5.5 Funding of Environment Construction Programs

Joint Funds

Applications and Funding of Joint Funds in 2015

Table 5-18

(Unit: 10,000 yuan)

	Type of Program	Applications	Funded	Direct Cost
1	NSAF Joint Fund	152	62	5,160.00
	NSAF Joint Fund-Center project	2	2	6,720.00
2	Joint Fund of Iron and Steel	82	18	2,520.00
3	Joint Fund of Astronomy	162	48	3,360.00
4	NSFC-Guangdong Joint Fund	148	27	6,480.00
	NSFC-Guangdong Supercomputing Applications Joint Fund	1	1	5,800.00
5	NSFC-Yunnan Joint Fund	138	20	4,090.00
6	Joint Fund of Large Science Facilities	239	69	6,720.00
7	NSFC-Xinjiang Joint Fund	200	38	4,090.00
8	Joint Fund of High Speed Trains	61	10	2,477.00
9	NSFC-Henan Joint Fund of Talent Fostering	1,012	164	4,432.50
10	Joint Fund of Petrochemical Engineering, Type A	199	19	2,520.00
11	Joint Fund for Promoting S&T Cooperation Between Both Sides of the Strait	114	19	4,090.00
12	Salt Lake Joint Fund	205	26	1,680.00
13	Joint Fund of General Technology	107	31	3,360.00
14	Joint Fund of Advanced Aerospace Manufacturing Technology Research	155	25	4,200.00
15	NSFC-Liaoning Joint Fund	107	21	5,040.00
16	NSFC-Zhejiang Joint Fund of Industrialization and Informatization	107	21	4,200.00
17	Joint Fund of China's Auto industry Innovation and Development	103	14	3,270.00
18	NSFC-Shanxi Joint Fund of Coal-Based Low Carbon	509	44	4,120.00
19	Joint Fund of Civil Aviation Research	285	37	1,680.00
	Total	4,088	716	86,009.50

The Special Fund for Development of National Major Research Instruments and Facilities

In 2015, we received 606 applications for the Special Fund for Development of National Major Research Instruments and Facilities. After expert review, we funded 81 applications, with direct funding of 502.64 million yuan. The receiving departments recommended 59 applications. After review, we supported 5 projects, with total funding of 369.48 million yuan.

Projects Funded in Special Fund for Development of National Major Research Instruments and Facilities (by Application) in 2015

Table 5-19

(Unit: 10,000 yuan)

No.	Project Title	PI	Home Institution	Direct Cost
1	The research on the superhigh frequency laser tomography system and its applications in supersonic/hypersonic flow	Yi Shihe	National University of Defense Technology	763.00
2	System for device-oriented in-situ growth, fabrication and characterization of two-dimensional materials	Zhang Yuanbo	Fudan University	643.46
3	Key technology studies on a high-intensity muon source	Tang Jingyu	Institute of High Energy Physics, CAS	735.40
4	Creating a fiber arrayed solar optic telescope (FASOT)	Qu Zhongquan	Yunnan Observatory, CAS	754.10
5	Fiber based compact source of photon pairs with tunable wavelength and controllable spectral properties	Li Xiaoying	Tianjin University	521.00
6	Underwater acoustic receiving system based on high-order acoustic sensor theory	Yang Yixin	Northwestern Polytechnical University	503.80
7	Ultra-low-temperature multi-channel Quantum Manipulation System	Lv Li	Institute of Physics, CAS	750.30
8	Developing instruments for testing biaxial-bidirection mechanical behavior of materials at high strain rate	Li Yulong	Northwestern Polytechnical University	752.50
9	The development of in-situ polarization neutron system based on high flux research reactor	Chen Dongfeng	China Institute of Atom Science Research	671.20
10	Development of micro-magnetic techniques and instrument for nondestructively measuring mechanical properties of materials, components/structures	He Cunfu	Beijing University of Technology	720.50
11	Optical frequency comb in the extreme-ultraviolet (XUV)	Liu Xiaojun	Wuhan Institute of Physics and Mathematics, CAS	699.51
12	Integrated system for in-situ growth, characterization and optoelectronic property measurement on organic semiconductor thin films	Chi Lifeng	Soochow University	562.00

(to be continued)

(continued)

No.	Project Title	PI	Home Institution	Direct Cost
13	Development and application of 3D electron diffractometer	Sun Junliang	Peking University	331.30
14	High-resolution scanning electrogenerated luminescence microscopy and its application to bioimaging analysis	Niu Li	Changchun Institute of Applied Chemistry, CAS	574.00
15	Chemiluminescence / photothermal multimodal microscopy for studying single nanoparticle catalysis	Cui Hua	University of Science and Technology of China	671.70
16	Upconversion luminescence imaging guided photo-thermal therapy system with luminescence temperature feedback	Li Fuyou	Fudan University	597.53
17	Asensor and sensor array R&D system for the extended study of fluorescence sensing films	Fang Yu	Shaanxi Normal University	461.00
18	Lipidomics analysis system and its applications	Liu Huwei	Peking University	563.50
19	In-situ analytical system for key chemical components of particular matters and biotoxicity	Chen Jianmin	Fudan University	643.00
20	Investigation and preparation of solid phase microextraction-laser desorption/ionization-TOF mass spectrometer instrument and its application	Ouyang Gangfeng	Sun Yat-sen University	486.00
21	Development of single cell analyzer based on picoflow separation for investigation of small molecule drug-protein interactions	Guo Guangsheng	Beijing University of Technology	501.00
22	Single-molecule imaging and counting system for digital rolling circled amplification bioanalysis	Jiang Jianhui	Hunan University	519.00
23	Development of single-molecule detection system	Zhang Chunyang	Shandong Normal University	548.00
24	UV-vis wavelength-tuned nanosecond pulse laser resonance Raman spectrograph for operando study of catalytic reaction	Feng Zhaochi	Dalian Institute of Chemical Physics, CAS	763.08
25	Instrumental development on metastable zone measurement and process control of crystallization based on microporous membrane distillation	He Gaohong	Dalian University of Technology	678.00
26	High throughput and high sensitivity pathology slide scanner	Zhou Wenyan	Nankai University	652.35

(to be continued)

(continued)

No.	Project Title	PI	Home Institution	Direct Cost
27	Study of the high resolution patch-amperometry glutamatergic synaptic vesicular signal detector	Sun Jianyuan	Institute of Biophysics, CAS	538.00
28	Wireless monitoring instrument for free amino acids sensing in vivo	Yin Yulong	Institute of Subtropical Agriculture, CAS	625.00
29	Development and construction of the platform for collisionless magnetic reconnection	Lu Quanming	University of Science and Technology of China	726.84
30	The development of equipment for the measurement of reactive radicals in atmosphere based on ultrafast laser techniques	Zhu Tong	Peking University	715.15
31	A compact hyperspectral spectrometer with dual gratings and multi-angle observation and its application in atmospheric sounding	Duan Minzheng	Institute of Atmospheric Physics, CAS	368.60
32	A process monitored equipment designed for testing geo-materials with ultra low gas permeability	Ye Weimin	Tongji University	379.70
33	Development of a system for measuring acoustic scattering characteristics of marine interfaces at mid-frequency	Liu Baohua	National Deep-Sea Base Management Center	651.12
34	A field-portable atmospheric aerosols photoelectro imaging spectrometer	Huang Wei	Hefei Institute of Material Science, CAS	766.45
35	Development of high-precision superconducting gravimeter	Wang Qiuliang	Institute of Electrical Engineering, CAS	586.53
36	The development of a small airborne/marine gravimeter based on three-axis inertial stabilized platform	Hu Pinghua	China Aerospace Aviation Institute of Technology	706.10
37	Novel geophone based on fiber-optic distributed acoustic sensor	Rao Yunjiang	University of Electronic Science and Technology of China	665.68
38	In-situ testing system in TEM for correlations studies between ferroelasticity, ferroelectricity and ferromagnetism	Zhu Jing	Tsinghua University	374.00
39	Development of instrument on low temperature-mechanical/physical properties & microstructure system in synchrotron source	Wang Yandong	University of Science and Technology Beijing	735.00
40	Development of a high-precision instrument for quickly and comprehensively measuring multi-parameters of five-axis machine tools and its applications	Feng Qibo	Beijing Jiaotong University	741.05

(to be continued)

(continued)

No.	Project Title	PI	Home Institution	Direct Cost
41	The development of well logging tool for measuring production profile of oil-gas-water three phase flow in oil wells	Jin Ningde	Tianjin University	694.00
42	Development of experimental system and measurement control technology for multiphase flow in deepwater oil-gas production	Guo Liejin	Xi'an Jiaotong University	731.55
43	Test equipment for the whole process of concrete damage and fracture performance evolution in real environment	Hu Shaowei	Nanjing Hydraulic Research Institute	572.00
44	Multifunctional integrated test instrument of organic semiconductor spin properties and magnetic field effects	Ma Dongge	Changchun Institute of Applied Chemistry, CAS	735.84
45	Development of the absolute distance measurement system with laserinterferometric wavelength leverage	Chen Benyong	Zhejiang Sci-Tech University	653.65
46	Development of an in-site, real-time acoustic instrument for measuring 3D coupled parameters of sediment-laden flows	Yang Wenjun	Changjiang River Scientific Research Institute of Changjiang Water Resources Commission	738.66
47	Development of the testing apparatus for simulating and instrumenting "one high and two perturbations" characteristic scientific phenomena	Wang Mingyang	PLA University of Science and Technology	730.00
48	A system in-situ characterizing thenanoscale multi-field coupling effects	Zhang Yue	University of Science and Technology Beijing	695.89
49	Development of the low dose, ultra high resolution cone beam CT (CBCT) specialized for imaging temporal bone	Wang Zhenchang	Capital Medical University	600.61
50	The development of broadband multi-band arbitrary-modulation-format vector mm-wave signal generator and analyzer	Jin Yaqiu	Fudan University	708.30
51	Visualized electronic endoscopy system for tumor-targeted photodynamic therapy	Gu Ying	Chinese PLA General Hospital	455.78
52	Quantitative FRET microscopic imager	Chen Tongsheng	South China Normal University	442.10
53	Multi-physics signal based systematic health analysis instrument for high-speed trains	Gu Ming	Tsinghua University	716.00
54	Modular design Mueller matrix microscope and its clinical applications	Ma Hui	Tsinghua University	580.14

(to be continued)

(continued)

No.	Project Title	PI	Home Institution	Direct Cost
55	Physical properties and biochemical ingredients of hand biometric acquisition instrument	Liang Ronghua	Zhejiang University of Technology	692.40
56	Research on the instrument of integrated tests and intelligent simulation for power battery	Zhang Chenghui	Shandong University	695.61
57	Ultrahigh resolution optical vector analyzer	Pan Shilong	Nanjing University of Aeronautics and Astronautics	495.00
58	Transient absorption microscopy of ultra high resolution and quantum control system	Wang Yongsheng	Beijing Jiaotong University	634.59
59	Research integrated hyperspectral computing imaging measurement and processing instruments	Xu Tingfa	Beijing Institute of Technology	723.00
60	Photonic integrated broadband chaotic signal generator	Zhang Mingjiang	Taiyuan University of Technology	488.67
61	Nonlinearly wireless interrogation for passive sensors and the measurement network instrumentation system	Wen Yumei	Chongqing University	655.25
62	Integrated coastal zone multipurpose aerial surveying instrument	Pei Hailong	South China University of Technology	563.17
63	The development of the efficient instrument for new tumor cell marker screening based on aptamer recognition	He Nongyue	Southeast University	606.00
64	Cardiodynamicsgram for early detection of myocardial ischemia and sudden cardiac death	Wang Cong	South China University of Technology	366.70
65	Perceptual quality analyzer for ubiquitous video	Yang Xiaokang	Shanghai Jiao Tong University	675.00
66	Scientific instrument for multi-scale neural regulation and synchronous detection of multichannel neural signals	Cai Xinxia	Institute of Electronics, CAS	625.00
67	Research and development multi-physics high-speed patrol monitoring and instrument for rail contact fatigue and cracks	Tian Guiyun	University of Electronic Science and Technology of China	728.50
68	Amicro-gravimetric sensing based instrument for extraction of thermodynamic/kinetic parameters and material characteristic evaluation	Li Xinxin	Shanghai Micro System and Information Technology, CAS	638.00

(to be continued)

(continued)

No.	Project Title	PI	Home Institution	Direct Cost
69	Tunable optical frequency comb system based on dual-wavelength microcavity lasers and nonlinear optical fibers	Huang Yongzhen	Institute of Semiconductors, CAS	686.00
70	Novel instruments for femtosecond pulse measurement based on the SRSI method	Liu Jun	Shanghai Institute of Optics and Fine Mechanics, CAS	299.00
71	Design and development of epitaxial growth equipment for growing high aluminum composition nitride with integrated monitoring module	Li Jinmin	Institute of Semiconductors, CAS	748.00
72	A new kind of low interface state dielectric deposition system for GaN electron device	Wang Wenwu	Institute of Microelectronics, CAS	754.37
73	High sensitivity millimeter-wave/THz wave dual-band joint aperture and coherent instrumentation radar for cloud observation	Lv Xin	Beijing Institute of Technology	679.00
74	3D direct laser writing system for micro/nano photonic device based on femtosecond all-fiber laser	Wang Pu	Beijing University of Technology	760.64
75	The development of single molecular quantum coherent spectrometer	Xiao Liantuan	Shanxi University	416.01
76	Low frequency low intensity focused ultrasound mediated microbubble liquid-vapor phase change cavitation tumor treatment device	Huang Pintong	Zhejiang University	569.37
77	The special equipment used in the study of lung disease and diagnostic imaging in lowfield based on polarized helium 3	Xu Jinzhang	Hefei University of Technology	581.47
78	Development and application of high-performance high-speed countercurrent chromatography technologies	Chen Lijuan	Sichuan University	650.98
79	In vivo three-dimensional neural circuit imaging system for small animal	Yang Xin	Institute of Automation, CAS	602.89
80	Microfluidic-based automatically fetal nucleated red blood cell analyzer	Zhao Xingzhong	Wuhan University	536.36
81	A high spatial resolution, high sensitivity and MRI compatible pet scanner for marmoset brain research	Yang Yongfeng	Shenzhen Institute of Advanced Technology, CAS	692.61

Note: Direct funding was given 2 significant digits.

Projects Funded in Special Fund for Development of National Major Research Instruments and Facilities (by Recommendation)

Table 5-20

(Unit: 10,000 yuan)

No.	Project Title	PI	Home Institution	Direct Cost
1	Femtosecond-nanometer spatiotemporal resolution optical experimental system	Gong Qihuang	Peking University	7,026.60
2	High throughput and multifunctional integrated toxicology analyzer	Jiang Guibin	Research Center for Eco-Environmental Sciences, CAS	7,529.61
3	Global deep ocean smart float	Wu Lixin	Ocean University of China	7,549.09
4	High-resolution comprehensive system for in-situ detection of friction energy dissipation	Luo Jianbin	Tsinghua University	7,475.90
5	Research instrument for deep brain stimulation and neuromodulation based on acoustic radiation force	Zheng Hairong	Shenzhen Institute of Advanced Technology, CAS	7,366.50

Emergency Management Projects

NSFC's General Management Projects

We funded 100 projects in this category, and the total direct cost was 31.01 million yuan.

NSFC's Departmental General Management Projects

We funded 1,058 projects in this category, and the total direct cost was 186.29 million yuan.

Soft Projects entrusted by NSFC's Functional Departments

We funded 83 soft projects or tasks in this category with total direct cost of 26.65 million yuan.

Tianyuan Fund of Mathematics

Tianyuan Fund of Mathematics supports scientists to combine the characteristics and demands of mathematics, conduct scientific research, train young talents, promote academic exchange, optimize research environment and transmit mathematical culture. The academic leading group is in charge of the review and academic organization for this fund. In 2015, the academic leading group of the Tianyuan Fund of Mathematics held two meetings to review applications, and discussed the trend and demand of mathematics' development. The group meeting also helped to optimize its project positioning and funding pattern, summarized the work of the leading group and planned for the future work of the Tianyuan Fund of Mathematics.

On the basis of existing funding structure, Tianyuan Fund continued to support the “projects to promote interdisciplinary research”. 11 applications were funded and 8 of them were extended funding projects. We hope to promote cooperation and interdisciplinary research activities by setting up this project and poster young mathematicians for better development of mathematical disciplines.

In 2015, we received 750 applications in this category, and funded 215 projects with direct cost of 25 million yuan. Among them,

- 1) There were 647 applications for projects of Young Mathematicians, and 166 projects were funded with direct cost of 4.85 million yuan;
- 2) There were 9 applications for the projects of mathematical summer schools for graduate students, training projects for young mathematical teachers in the west and northeast regions of China, and 9 were funded with direct cost of 5.62 million yuan;
- 3) There were 31 applications of seminar, workshop and important academic exchange activities, and we funded 22 projects with direct cost of 2.99 million yuan;
- 4) There were 6 applications for mathematical education, mathematical dissemination and mathematical cultural studies, and 6 projects were funded with direct cost of 360,000 yuan;
- 5) There were 12 applications for discussions on problem-driven applied mathematics, and 1 project was funded with direct cost of 180,000 yuan;
- 6) There were 45 applications for the projects to promote interdisciplinary research, and 11 projects were funded with direct cost of 11 million yuan.



Part VI

Completion and Evaluation of NSFC Projects

6.1 Completion of General Program Projects

Since 2011, the funding period of general program projects has been extended from 3 years to 4 years. Therefore no general program project has been completed in 2015.

6.2 Completion of Key Program Projects

Research Outputs of Key Program Projects Completed in 2015

Table 6-1

Projects completed				432
Research outputs	Publications	Invited presentations	International conferences	3,934
			Domestic conferences	3,129
		Academic articles and monographs	International journals	11,567
			Domestic journals	4,675
			Monographs	438
	Technology innovation and application		Peer-reviewed applications	51
			Patents	1,240
			Technology dissemination	73
	Awards		International awards	60
			National awards	44
			Ministerial or provincial awards	185
Talent training			Post-docs	816
			PhD students	5,193
			Master students	6,512

6.3 Completion of Major Program Projects

Research Outputs of Major Program Projects Completed in 2015

Table 6-2

Projects completed				15
Research outputs	Publications	Invited presentations	International conferences	862
			Domestic conferences	724
		Academic articles and monographs	International journals	3,019
			Domestic journals	755
			Monographs	130
	Technology innovation and application		Peer-reviewed applications	13
			Patents	220
			Technology dissemination	30
	Awards		International awards	52
			National awards	4
			Ministerial or provincial awards	24
Talent training			Post-docs	217
			PhD students	1,219
			Master students	1,367

6.4 Completion of Major Research Plan Projects

Research Outputs of Major Research Plan Projects Completed in 2015

Table 6-3

Projects completed				420
Research outputs	Publications	Invited presentations	International conferences	1,784
			Domestic conferences	1,621
		Academic articles and monographs	International journals	4,724
			Domestic journals	1,317
			Monographs	254
	Technology innovation and application		Peer-reviewed applications	20
			Patents	293
			Technology dissemination	16
	Awards		International awards	20
			National awards	15
			Ministerial or provincial awards	48
Talent training			Post-docs	358
			PhD students	2,520
			Master students	2,756

6.5 Completion of Young Scientists Fund Projects

Research Outputs of Young Scientists Fund Projects Completed in 2015

Table 6-4

Projects completed				12,932
Research outputs	Publications	Invited presentations	International conferences	12,732
			Domestic conferences	9,134
		Academic articles and monographs	International journals	43,904
			Domestic journals	34,301
			Monographs	6,039
	Technology innovation and application	Peer-reviewed applications	248	
		Patents	6,383	
		Technology dissemination	348	
	Awards	International awards	197	
		National awards	85	
		Ministerial or provincial awards	943	
Talent training			Post-docs	1,186
			PhD students	10,851
			Master students	37,129

6.6 Completion of Projects of the Fund for Less Developed Regions

Since 2011, the funding period of the Fund for Less Developed Regions has been extended from 3 years to 4 years. Therefore no project of the Fund for Less Developed Regions has been completed in 2015.

6.7 Completion of Projects of the National Science Fund for Distinguished Young Scholars

Research Outputs of Projects of the National Science Fund for Distinguished Young Scholars Completed in 2015

Table 6-5

Projects completed				198
Research outputs	Publications	Invited presentations	International conferences	1,283
			Domestic conferences	883
		Academic articles and monographs	International journals	4,706
			Domestic journals	1,277
			Monographs	284
	Technology innovation and application	Peer-reviewed applications	13	
		Patents	722	
		Technology dissemination	37	
	Awards	International awards	30	
		National awards	28	
		Ministerial or provincial awards	83	
Talent training			Post-docs	360
			PhD students	2,281
			Master students	2,267

6.8 Completion of Projects of the Science Fund for Creative Research Groups

Research Outputs of Projects of the Science Fund for Creative Research Groups Completed in 2015

Table 6-6

Projects completed				121
Research outputs	Publications	Invited presentations	International conferences	3,518
			Domestic conferences	2,556
		Academic articles and monographs	International journals	10,992
			Domestic journals	1,836
			Monographs	515
	Technology innovation and application		Peer-reviewed applications	22
			Patents	1,982
			Technology dissemination	152
	Awards		International awards	95
			National awards	97
			Ministerial or provincial awards	177
Talent training			Post-docs	1,203
			PhD students	7,515
			Master students	8,542

6.9 Statistics of NSFC's Support to Awardees of the State Natural Science Award of 2015

In 2015, 1 project was awarded the first prize and 41 projects were awarded the second prize of the State Natural Science Award. All awardees were previously supported by NSFC grants.

NSFC's support to Awardees of the First Prize of the State Natural Science Award of 2015

Table 6-7

No.	Award Title	Principal Investigators	Nominator	Leading Projects Previously Funded by NSFC	Number of NSFC Grants
1	Multiphoton entanglement and interferometry measurement	Pan Jianwei (University of Science and Technology of China), Peng Chengzhi (University of Science and Technology of China), Chen Yuao (University of Science and Technology of China), LU Chaoyang (University of Science and Technology of China), Chen Zengbing (University of Science and Technology of China)	Anhui Province, Chinese Academy of Sciences	<ul style="list-style-type: none"> Physics and technologies of quantum information with photons and cold atoms Quantum information science 	32

NSFC's support to Awardees of the Second Prize of the State
Natural Science Award of 2015

Table 6-8

No.	Award Title	Principal Investigators	Nominator	Leading Projects Previously Funded by NSFC	Number of NSFC Grants
1	Nonlinear expectation method in asset pricing theory	Chen Zengjing (Shandong University)	Guo Boling, Chen Mufa, Peng Shige	<ul style="list-style-type: none"> • Reserch on some stochastic analysis problems in mathematical finance 	9
2	Self-normalized limit theory and Stein's method	Shao Qiman (Hong Kong University of Science and Technology), Jing Bingyi (Hong Kong University of Science and Technology)	Hong Kong Special Administrative Region	<ul style="list-style-type: none"> • Shrinkage estimation and likelihood inference in high dimensional data analysis • The strong limit theorem of stochastic process 	8
3	Study on scientific issues of high-temperature superconductivity by means of vacuum ultraviolet laser-based angle-resolved photoemission	Zhou Xingjiang (Institute of Physics, CAS), Liu Guodong (Institute of Physics, CAS), Zhao Lin (Institute of Physics, CAS), Chen Chuangtian (Technical Institute of Physics and Chemistry, CAS), Xu Zuyan (Technical Institute of Physics and Chemistry, CAS)	Chinese Academy of Sciences	<ul style="list-style-type: none"> • Spin-resolved photoemission spectroscopy on electronic structure and spin texture of topological insulators • Study on the crystal structure and electronic structure of superconducting materials 	23
4	Structures and properties of Sodium, Lithium and their binary compounds at high pressures	Ma Yanming (Jilin University), Wang Hui (Jilin University), Wang Yanchao (Jilin University), Li Quan (Jilin University), Cui Tian (Jilin University)	Ministry of Education	<ul style="list-style-type: none"> • New structures and new effects of condensed matters under high pressure • The new generation of large volume high pressure equipment 	32
5	Study on photoelectron spectroscopy of iron-based superconductor's electronic structure	Feng Donglai (Fudan University), Zhang Yan (Fudan University), Xie Binping (Fudan University), Chen Fei (Fudan University), Yang Lexian (Fudan University)	Shanghai Municipality	<ul style="list-style-type: none"> • Synchrotron angle resolved photoemission spectroscopy study on unconventional superconductivity and related materials • Microscopic properties of the novel quantum states in iron based superconductors 	26

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(continued)

No.	Award Title	Principal Investigators	Nominator	Leading Projects Previously Funded by NSFC	Number of NSFC Grants
6	Study on new theories and methods of layer-by-layer acquisition of quantitative chemical signals for living biosystems	Mao Lanqun (Institute of Chemistry, CAS), Yu Ping (Institute of Chemistry, CAS), Zhang Meining (Institute of Chemistry, CAS), Yan Yiming (Institute of Chemistry, CAS), Lin Yuqing (Institute of Chemistry, CAS)	Beijing Municipality	<ul style="list-style-type: none"> Analytical methods to probing signal transduction Novel methodology development for signal transduction 	25
7	Study on the design, synthesis, sieving properties and catalytic performance of molecular sieving inorganic membranes	Yang Weishen (Institute of Chemical Physics, CAS), Li Yanshuo (Institute of Chemical Physics, CAS), Wang Haihui (Institute of Chemical Physics, CAS), Xiong Guoxing (Institute of Chemical Physics, CAS), Lin Liwu (Institute of Chemical Physics, CAS)	Liaoning Province	<ul style="list-style-type: none"> Chemical engineering basis of membrane catalytic reactions Inorganic membrane separation and catalysis in membrane reactors 	34
8	Synthesis of non-classical fullerenes	Xie Suyuan (Xiamen University), Tan Yuanzhi (Xiamen University), Zheng Lansun (Xiamen University), Lv Xin (Xiamen University), Huang Rongbin (Xiamen University)	Ministry of Education	<ul style="list-style-type: none"> Preparation and functionalization of novel fullerenes Theoretical Investigation on the structures and chemical properties of endohedral metallofullerenes 	45
9	Graphene in electroanalytical chemistry and bioanalytical chemistry	Li Jinghong (Tsinghua University), Wang Ying (Tsinghua University), Liu Yang (Tsinghua University), Chen Da (Tsinghua University), Tang Longhua (Tsinghua University)	Ministry of Education	<ul style="list-style-type: none"> Bio-functional graphene interface and its biosensor and bioanalysis Investigation of electrogenerated chemiluminescence immunosensor based on graphene nanostructure 	14
10	Analytical chemistry basis of biomolecular recognition	Yang Xiurong (Changchun Institute of Applied Chemistry, CAS), Lu Lehui (Changchun Institute of Applied Chemistry, CAS), Xu Guobao (Changchun Institute of Applied Chemistry, CAS), Wang Erkang (Changchun Institute of Applied Chemistry, CAS), Wang Zhenxin (Changchun Institute of Applied Chemistry, CAS)	Chinese Academy of Sciences	<ul style="list-style-type: none"> Research on the integrated biochemical analytic system of micro-nanofluidics New principle and method of biosensor based on biomolecular interaction 	56

(to be continued)

(continued)

No.	Award Title	Principal Investigators	Nominator	Leading Projects Previously Funded by NSFC	Number of NSFC Grants
11	The development of continental collision metallogeny and its application	Chen Yanjing (Peking University)	Zhai Yusheng, Sun Shu, Zhai Mingguo	<ul style="list-style-type: none"> • Metamorphism and orogenic evolution • Study of Mesozoic fluidization and its metallogenic features of Xiong'er Mountains 	12
12	Lithospheric structure and deep process of uplift of Qinghai-Tibet an Plateau	Wang Chengshan (China University of Geosciences (Beijing)), Wei Wenbo (China University of Geosciences (Beijing)), Zhu Dicheng (China University of Geosciences (Beijing)), Mo Xuanxue (China University of Geosciences (Beijing)), Jin Sheng (China University of Geosciences (Beijing))	Ministry of Land and Resources	<ul style="list-style-type: none"> • Geological study on the structure zone of Yarlung Zangbo River • Upper cretaceous oceanic red beds and its paleoceanographical change in Tethys Himalayas. 	39
13	Functions of microbiota in oceanic carbon reservoir and climate change	Jiao Nianzhi (Xiamen University), Zhang Yao (Xiamen University), Luo Tingwei (Xiamen University), Zhang Rui (Xiamen University), Zheng Qiang (Xiamen University)	Xiamen Municipality	<ul style="list-style-type: none"> • Marine biogeochemical processes and mechanisms • Marine microbial ecology 	35
14	Environmental behavior and ecotoxicology effects of typical endocrine disruptors	Hu Jianying (Peking University), Wan Yi (Peking University), Zhang Zhaobin (Peking University), Chang Hong (Peking University)	Ministry of Education	<ul style="list-style-type: none"> • Environmental biogeochemistry • Pollution eco-chemistry 	19
15	Driving forces and process of ionospheric variability	Wan Weixing (Institute of Geology and Geophysics, CAS), Liu Libo (Institute of Geology and Geophysics, CAS), Ning Baiqi (Institute of Geology and Geophysics, CAS), Zhao Biquang (Institute of Geology and Geophysics, CAS), Ding Feng (Institute of Geology and Geophysics, CAS)	Chinese Academy of Sciences	<ul style="list-style-type: none"> • Investigation on the ionospheric variability and the relative processes • Investigation on the regional properties of ionospheric structure and disturbances over China 	41

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(continued)

No.	Award Title	Principal Investigators	Nominator	Leading Projects Previously Funded by NSFC	Number of NSFC Grants
16	Study on genome linkage disequilibrium dissection of East Asian populations and mixed populations	Jin Li (Fudan University), Xu Shuhua (Shanghai Institutes of Biological Sciences, CAS), Huang Wei (Human Genome Center at Shanghai), He Yungang (Shanghai Institutes of Biological Sciences, CAS)	Shanghai Municipality	<ul style="list-style-type: none"> Genetic diversity of East Asians and its evolutionary/phenotypic implications Development of molecular genetic marker system of Chinese population genomic variation 	35
17	Antiviral innate immunity signal transduction mechanism	Shu Hongbing (Wuhan University), Zhong Bo (Wuhan University), Wang Yanyi (Wuhan University), Li Ying (Wuhan University), Lei Caoqi (Wuhan University)	Ministry of Education	<ul style="list-style-type: none"> Cellular antiviral innate immunity The molecular mechanisms of cellular antiviral response 	21
18	Study on the functions of silkworm genomics	Xia Qingyou (Southwest University), Zhou Zeyang (Southwest University), Lu Cheng (Southwest University), Wang Jun (BGI Shenzhen), Xiang Zhonghuai (Southwest University)	Ministry of Education	<ul style="list-style-type: none"> Study on the silkworm genetic resources and genetic improvement Research on molecular mechanism of sex regulation and its fundamental application in the silkworm <i>bombyx mori</i> 	30
19	Study on pathogenesis and new targeted therapy of myeloid leukemia	Chen Saijuan (Ruijin Hospital, Shanghai Jiao Tong University), Chen Zhu (Ruijin Hospital, Shanghai Jiao Tong University), Wang Yueying (Ruijin Hospital, Shanghai Jiao Tong University), Hu Jiong (Ruijin Hospital, Shanghai Jiao Tong University), Shen Yang (Ruijin Hospital, Shanghai Jiao Tong University)	Shanghai Municipality	<ul style="list-style-type: none"> Systems biological study on targeted therapy of leukemia Molecular mechanism of the occurrence and blast crisis of chronic myelogenous leukemia 	57
20	Applied basic research on the regulation mechanism of breast cancer metastasis and targeted therapy	Song Erwei (Sun Yat-sen University), Wang Jun (China University of Science and Technology), Yao Herui (Sun Yat-sen University), Yao Xuebiao (China University of Science and Technology), Su Fengxi (Sun Yat-sen University)	Ministry of Education	<ul style="list-style-type: none"> Study on RNA interference targeting alternatively activated macrophages in the treatment of breast cancer Toward the treatment of breast cancer by targeting breast tumor initiating cells with miRNAs 	54

(to be continued)

(continued)

No.	Award Title	Principal Investigators	Nominator	Leading Projects Previously Funded by NSFC	Number of NSFC Grants
21	Magnetic resonance imaging analysis and its application in major mental disorders	Gong Qiyong (Sichuan University), He Yong (Beijing Normal University), Sun Xueli (Sichuan University), Lv Su (Sichuan University), Huang Xiaoqi (Sichuan University)	Sichuan Province	<ul style="list-style-type: none"> Brain fMRI visual stimulation and eye movement analysis system based on real time feedback Human brain connectome with neuroimaging 	43
22	Theory and methods of non-uniformity correction of images	Wu Feng (China University of Science and Technology), Li Houqiang (China University of Science and Technology), Wang Meng (China University of Science and Technology), Liu Dong (China University of Science and Technology), Hong Richang (China University of Science and Technology)	Chinese Academy of Sciences	<ul style="list-style-type: none"> High-efficient coding for data, image and video Clustering image/video representation and processing in cloud era 	18
23	Control and application of complex dynamical coupling system	Duan Zhisheng (Peking University), Huang Lin (Peking University), Li Zhongkui (Peking University), Wang Jinzhi (Peking University), Yang Ying (Peking University)	China Association for Science and Technology	<ul style="list-style-type: none"> Control and application of complex coupled systems Theories on dynamics and control of nonlinear systems with uncertain parameters 	30
24	Study on micro-phonic devices for functional integration	Li Baojun (Sun Yat-sen University), Xing Xiaobo (Sun Yat-sen University), Zhang Yao (Sun Yat-sen University), Zhao Xinhong (Sun Yat-sen University), Yu Huaqing (Sun Yat-sen University)	Guangdong Province	<ul style="list-style-type: none"> Micro-nano-optoelectronic device integration and microfabrication 	11
25	Identification and control of systems with uncertainty	Zhang Jifeng (Academy of Mathematics and System Sciences, CAS), Liu Yungang (Shandong University), Zhao Yanlong (Academy of Mathematics and System Sciences, CAS), Liu Shujun (Southeast University), Ma Cuiqin (Qufu Normal University)	Chinese Academy of Sciences	<ul style="list-style-type: none"> Adaptive control of nonlinear hybrid systems with uncertainties Study on several key basic issues in control science 	39

(to be continued)

(continued)

No.	Award Title	Principal Investigators	Nominator	Leading Projects Previously Funded by NSFC	Number of NSFC Grants
26	Theory and methods of visual media geometric computing	Hu Shimin (Tsinghua University), Huang Jiwu (Sun Yat-sen University), Ai Haizhou (Tsinghua University), Xu Kun (Tsinghua University), Chen Tao (Tsinghua University)	Ministry of Industry and Information Technology	<ul style="list-style-type: none"> Intelligent processing of internet visual media Theory and methods of intelligent information processing 	46
27	Theory and methods of local modeling and retrieval of nonlinear characteristics of visual patterns	Chen Xilin (Institute of Computing Technology, CAS), Shan Shiguang (Institute of Computing Technology, CAS), Gao Wen (Peking University), Wang Ruiping (Institute of Computing Technology, CAS), Chai Xiujuan (Harbin Institute of Technology)	Chinese Academy of Sciences	<ul style="list-style-type: none"> High fidelity audio-video system: Theory and methods Visual pattern analysis and recognition 	28
28	Theory and application of parametric design of control systems with constraints	Duan Guangren (Harbin Institute of Technology), Lin Can (Hong Kong University), Liu Guoping (Harbin Institute of Technology), Zhou Bin (Harbin Institute of Technology), Wu Aiguo (Harbin Institute of Technology)	Sun Jiadong	<ul style="list-style-type: none"> Theory and application of the control of time-delay systems with constraints Truncated predictor feedback based approaches to the control and constrained control of time-delay systems 	19
29	Dynamics and control of the evolution of complex network	Wang Xiaofan (Shanghai Jiao Tong University), Li Xiang (Fudan University), Su Housheng (Huazhong University of Science and Technology), Rong Zhihai (Shanghai Jiao Tong University), Lu Wenlian (Fudan University)	Shanghai Municipality	<ul style="list-style-type: none"> Analyses and control of collective behaviors of complex networks Control theory and methods: Design, control and optimization of network systems 	27
30	Study on the design, preparation and new properties of phononic crystals and other manmade band gap materials	Chen Yanfeng (Nanjing University), Lu Minghui (Nanjing University), Zhang Shantao (Nanjing University), Feng Liang (Nanjing University), Min Naiben (Nanjing University)	Jiangsu Province	<ul style="list-style-type: none"> Preparation and band calculation of perfect photonic crystals and photonic crystals with defects Preparation and physical effects of novel microstructure materials 	22

(to be continued)

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No.	Award Title	Principal Investigators	Nominator	Leading Projects Previously Funded by NSFC	Number of NSFC Grants
31	Theoretical system of microdomain-macrodomain transition of relaxor ferroelectrics and performance improvement of related materials	Yao Xi (Xi'an Jiaotong University), Xu Zhuo (Xi'an Jiaotong University), Wei Xiaoyong (Xi'an Jiaotong University), Li Zhenrong (Xi'an Jiaotong University), Li Fei (Xi'an Jiaotong University)	Ministry of Education	<ul style="list-style-type: none"> Study on the microdomain-macrodomain transition of relaxor ferroelectric ceramics Study on piezoelectric performance and origin and optimization of size dependency in relaxor ferroelectric single crystals 	25
32	Study on the fabrication fundamentals of discontinuously reinforced metal matrix composites for aerospace applications	Zhang Di (Shanghai Jiao Tong University), Fan Tongxiang (Shanghai Jiao Tong University), Lv Weijie (Shanghai Jiao Tong University), Zhang Xiaonong (Shanghai Jiao Tong University), Zhang Guoding (Shanghai Jiao Tong University)	Shanghai Municipality	<ul style="list-style-type: none"> Biomimetic fabrication of metal matrix composites and properties Advanced structural ceramics 	31
33	Study on the carrier regulation and functionalization of low-dimensional zinc oxide materials	Liu Yichun (Northeast Normal University), Shen Dezhen (Changchun Institute of Optics, Fine Mechanics and Physics, CAS), Xu Haiyang (Northeast Normal University), Shao Changlu (Northeast Normal University), Chen Shijian (Northeast Normal University)	Jilin Province	<ul style="list-style-type: none"> The material characterization and device research of zinc oxide based monocrystal thin films Research on basic issues in three dimensional heterojunction solar cells based on oxide nanowire array 	37
34	Wettability of engineering material surfaces and its regulation	Zhou Feng (Lanzhou Institute of Chemical Physics, CAS), Guo Zhiguang (Lanzhou Institute of Chemical Physics, CAS), Wang Daoai (Lanzhou Institute of Chemical Physics, CAS), Zhang Zhaozhu (Lanzhou Institute of Chemical Physics, CAS), Liu Weimin (Lanzhou Institute of Chemical Physics, CAS)	Gansu Province	<ul style="list-style-type: none"> Research on the development strategy of the design and fabrication science and engineering application of the high-end lubricating material Lubricating materials and technology for space application 	32

(to be continued)

(continued)

No.	Award Title	Principal Investigators	Nominator	Leading Projects Previously Funded by NSFC	Number of NSFC Grants
35	New polymeric materials and device structure for high-efficiency organic solar battery	Cao Yong (South China University of Technology), Wu Hongbin (South China University of Technology), Huang Fei (South China University of Technology), Chen Junwu (South China University of Technology), He Zhicai (South China University of Technology)	Ministry of Education	<ul style="list-style-type: none"> Fundamental scientific problem of highly efficient photovoltaic Study on high-efficiency organic polymer photovoltaic cells 	42
36	Theory and methods of complementary combustion control of low-carbon fuels for internal combustion engines	Huang Zuohua (Xi'an Jiaotong University), Wang Jinhua (Xi'an Jiaotong University), Hu Erjiang (Xi'an Jiaotong University), Tang Chenglong (Xi'an Jiaotong University), Zhang Yingjia (Xi'an Jiaotong University)	Shaanxi Province	<ul style="list-style-type: none"> Basic theory of multiphase flow for high-efficiency energy conservation and renewable conversion and utilization Study on combustion in spark-ignition engine 	31
37	Study on theory and methods of monolithic configuration design of mechanical structural systems	Zhang Weihong (Northwest Polytechnical University), Zhu Jihong (Northwest Polytechnical University), Gao Tong (Northwest Polytechnical University), Wang Dong (Northwest Polytechnical University), Xu Yingjie (Northwest Polytechnical University)	Shaanxi Province	<ul style="list-style-type: none"> Theories and methods of engineering feature oriented structural topology optimization Integrated design optimization of dynamic structural layout 	21
38	Study on the dual-K theory and crack control performance in the crack propagation process of concrete structures	Xu Shilang (Zhejiang University), Liang Jianning (Hong Kong University of Science and Technology), Li Qinghua (Dalian University of Science and Technology), Lv Zhaofeng (Zhejiang University), Li Gengying (Shantou University)	Zhejiang Province	<ul style="list-style-type: none"> Research on the mechanism of cracks formation and propagation in concrete structures and the cracking restriction method Research on the dynamics of fracture evolution of heterogeneous faults 	25

(to be continued)

(continued)

No.	Award Title	Principal Investigators	Nominator	Leading Projects Previously Funded by NSFC	Number of NSFC Grants
39	The process and mechanism of the influence of runoff and sedimentation conditions on water quality in watershed	Xia Xinghui (Beijing Normal University), Yang Zhifeng (Beijing Normal University), Shen Zhenyao (Beijing Normal University), Guo Xuejun (Beijing Normal University), Chen Jingsheng (Peking University)	Beijing Municipality	<ul style="list-style-type: none"> Water environment, water ecology and management in watershed Water pollution control in watershed 	36
40	Deformation mechanism and mechanical behavior of shape memory and electro-active polymer composites	Leng Jinsong (Harbin Institute of Technology), Liu Yanju (Harbin Institute of Technology), Lv Haibao (Harbin Institute of Technology), Du Shanyi (Harbin Institute of Technology), Liu Liwu (Harbin Institute of Technology)	Heilongjiang Province	<ul style="list-style-type: none"> Mechanical behavior of large deformation intelligent composites Light-activated shape memory polymer and its application in morphing aircraft 	26
41	Behavior mechanism of thermal-electric-mechanical coupling of teeth and skin	Lu Tianjian (Xi'an Jiaotong University), Xu Feng (Xi'an Jiaotong University), Hu Gengkai (Beijing Institute of Technology), Lin Min (Xi'an Jiaotong University)	Ministry of Education	<ul style="list-style-type: none"> Skin biothermo mechanics and thermal pain Investigation of the mechanics underlying Erbium laser assisted caries prevention and cariostatic effect by thermal-mechanical and thermal-chemical coupling method 	29

6.10 Statistics of NSFC's Support to Awardees of the State Technological Invention Award of 2015

In 2015, 1 project was awarded the first prize of the State Technological Invention Award. The awardees were previously supported by multiple NSFC grants.

Statistics of NSFC's Support to Awardees of the First Prize of the State Technological Invention Award of 2015

Table 6-9

No.	Award Title	Principal Investigators	Nominator	Leading Projects Previously Funded by NSFC	Number of NSFC Grants
1	High optical efficiency GaN based blue LED on silicon substrate	Jiang Fengyi (Nanchang University), Liu Junlin (Nanchang University), Wang Li (Nanchang University), Sun Qian (Lattice Power, Jiangxi Corporation), Xiong Chuanbing (Nanchang University), Wang Min (CECEP Lattice Lighting Co., LTD)	Jiangxi Province	<ul style="list-style-type: none"> Study of the influence of internal electric field in active region on internal quantum efficiency of GaN Based green LED Research on the key chip fabrication technology of GaN based high power blue LED on silicon substrate 	13

6.11 Statistics of NSFC's Support to Awardees of the National Science and Technology Progress Award of 2015

Awardees of 2 special prize projects and 10 first prize projects of the National Science and Technology Progress Award of 2015 were previously supported by NSFC grants.

Statistics of NSFC's Support to Awardees of the Special Prize of the National Science and Technology Progress Award (the General Category)

Table 6-10

No.	Project Title	Principal Investigators	Principal Host Institution	Nominator	Leading Projects Previously Funded by NSFC	Number of NSFC Grants
1	Beijing-Shanghai High-Speed Railway	He Huawu, Lu Chunfang, Cai Qinghua, Zhao Guotang, Zheng Jian, Li Zhiyi, Liu Xuewen, Sun Shuli, Wang Yuze, Kang Xiong, Gao Zongyu, Jiang Ming, Cheng Xiangdong, Xu Haifeng, You Zhongtao, Ma Yunshuang, Zhao Minghua, Jiang Chunlin, Li Shude, Guo Zhiyong, Wang Lan, Zhang Zhihui, Yi Lunxiong, Wen Wusong, Gao Zhishuang, Yang Zhong, Li Haijian, Li Changning, Du Jiajun, An Aijun, Wi Guo, Hao Youmeng, Sun Fuyang, Wang Feng, Li Guanglin, Liu Bo, Sun Bangcheng, Ning Bin, Zhang Weihua, Tian Hongqi, Zhao Weigang, Yang Guowei, Rong Zhiln, Zhang Han, Jing Shiyuan, Yao Jianwei, Song Xiaofeng, Liang Jianying, Li Jun, Wang Yueming	China Railway; Beijing-Shanghai High-Speed Railway Corp.; The Third Railway Survey and Design Institute Group Corporation; China Railway Siyuan Survey and Design Group Co., Ltd; China Academy of Railway Sciences; China Railway Major Bridge Reconnaissance and Design Institute Co., Ltd; China Railway Signal and Communication Co., Ltd; CSR Qingdao Sifang Co., Ltd; Changchun Railway Vehicles Co., Ltd; China Railway Electrification Survey Design and Research Institute Co., Ltd; China Railway Major Bridge Engineering Group Co., Ltd; China Railway 12th Bureau Group Co., Ltd; Sinohydro Corporation; China Railway 3rd Engineering Group Co., Ltd; China Railway First Group Co., Ltd; China Railway 17th Bureau Group Co., Ltd; China Communications Construction Company Limited; China CREC Railway Electrification Bureau Group; China Railway 4th Bureau Group Co., Ltd; China Railway 6th Bureau Group Co., Ltd; Shanghai Railway Bureau; Jinan Railway Bureau; Beijing Railway Bureau; Tangshan Railway Vehicle Co., Ltd; Beijing Jiaotong University; Southwest Jiaotong University; Central South University; Shijiazhuang Tiedao University; Institute of Mechanics, Chinese Academy of Sciences; CSR Zhuzhou Electric Locomotive Research Institute Co., Ltd	China Railway Company	<ul style="list-style-type: none"> • Safety, economy, environmental protection research of rail transit • Dynamics of wheel-rail system of high-speed railway 	47

(to be continued)

(continued)

No.	Project Title	Principal Investigators	Principal Host Institution	Nominator	Leading Projects Previously Funded by NSFC	Number of NSFC Grants
2	Development and application of a complete set of high-efficiency and environmental-friendly aromatic hydrocarbon technology	Dai Houliang, Sun Lili, Wang Huiguo, Peng Guangqin, Zhang Minglong, Kong Dejin, Xiu Zhendong, Liu Yongfang, Wang Dehua, Wang Shaobing, Wang Qi, Wu Defei, Yu Haibin, Yang Xudong, Li Qiang, Su Weiqun, Dong Changhong, Xing Bo, Li Xucan, Yang Weisheng, Zang Jiazhong, Yu Fuhai, Yu Xiangzhen, Leng Jiachang, Zhang Jianghong, Li Xiaodong, Zhu Zhenxing, Xia Zhiwu, Liang Zhanqiao, Ren Kuifu, Mao Junyi, Fang Zhiping, Yang Renjian, Jiang Xiaohua, Cheng Xiangmin, Zhao Jinbo, Guo Hongli, Zhu Bing, Ma Jian, Ma Jianfeng, Cai Jianguang, Feng Xu, Zhu Ning, Dong Haifang, Hou Qiang, Wang Yubo, Xu Xiangrong, Zhou Hui, Qin Yongqiang, Gu Haohui	Sinopec Research Institute of Petroleum Processing; Sinopec Engineering Incorporation; Sinopec Yangzi Petrochemical Company Ltd.; Sinopec Hainan Petrochemical Co., Ltd; Sinopec Shanghai Research Institute of Petrochemical Technology; CNOOC Tianjin Chemical Research and Design Institute; Sinopec Luoyang Petrochemical Engineering Corporation Ltd; Sinopec Catalyst Co., Ltd; Sinopec Tianjin Company; Sinopec Zhenhai Refining and Chemical Company	China Petrochemical Corporation	<ul style="list-style-type: none"> Study on the pulse cleaning mechanism of ceramic candle filter under the oscillating tidal effects 	2

Statistics of NSFC's Support to Awardees of the First Prize of the National Science and Technology Progress Award (the General Category)

Table 6-11

No.	Award Title	Principal Investigators	Principal Host Institution	Nominator	Leading Projects Previously Funded by NSFC	Number of NSFC Grants
1	Exploration, and technological innovation development of 50-million-ton ultra-low-permeability and dense oil & gas fields and major theoretical	Yang Hua, Li Anqi, Zhang Minglu, He Shunli, Zhu Tianshou, Li Zhongxing, Fu Jinhua, Xu Yonggao, Lei Qun, Tan Zhongguo, Shen Fuxiao, Zhao Yong, Lu Tao, Mu Lijun, Zhao Jiyong	PetroChina Changqing Oilfield Company; Research Institute of Petroleum Exploration and Development, China National Petroleum Corporation; China University of Petroleum-Beijing; CNPC Chuanqing Drilling Engineering Company Limited; CNPC Logging Co., Ltd; CNPC BNP ING., Southwest Petroleum University; Shiyou University	China National Petroleum Corporation	Unsaturated fluid migration mechanism and the mathematical characterization of relative permeability in ultra-low permeability rock	3
2	Key technology and complete equipment for high-quality and high-efficiency laser welding and cutting in automobile manufacturing	Shao Xinyu, Li Bin, Huang Yu, Duan Zhengcheng, An Jin, Deng Jiake, Cheng Yuaning, Tan Mingqiang, Yu Miao, Wang Chunming, Peng Huiping, Fu Yuanbing, Huang Zhengkun, Li Jianjun, Li Yanbo	Huazhong University of Science and Technology; Wuhan Huagong Laser Engineering Co., Ltd; Dongfeng Peugeot Citroen Automobile Company Ltd; Ahui Jianghuai Automobile Co., Ltd; SAIC General Motors Corporation Limited; Jiangling Motors Co., Ltd; Great Wall Motor Co., Ltd; Wuhan Farley Laserlab Cutting Welding System Engineering Co., Ltd; AVIC Hubei Aviation Precision Machinery Technology Co., Ltd; Lingyun Industrial Corporation Limited	China Machinery Industry Federation	Basic research on high-performance digital manufacturing equipment	38

(to be continued)

(continued)

No.	Award Title	Principal Investigators	Principal Host Institution	Nominator	Leading Projects Previously Funded by NSFC	Number of NSFC Grants
3	Theory, methods and application of performance-based and seismic-resistant design of architectural structure	Xie Lili, Zhai Changhai, Ma Yuhong, Zheng Wenzhong, Xu Longjun, Lou Yu, Sun Jingjiang, Feng Yuan, Hu Jinjun, Li Shuang, Han Miao, Li Yaqi, Gong Maosheng, Yang Yongqiang, Zhou Baofeng	Institute of Engineering Mechanics, China Earthquake Administration; Harbin Institute of Technology; China Electronics Engineering Design Institute; China Southwest Design and Research Institute Co., Ltd; Beijing University of Civil Engineering and Architecture	China Earthquake Administration	Study on performance-based seismic-resistant design standards and design ground motion for large complex	53
4	Key technologies and application for safety guarantee of reservoir dam	Zhang Jianyun, Cai Yuebo, Li Yun, Jia Jinsheng, Wang Xiaogang, Sheng Jinbao, Li Lei, Gu Chongshi, Xuan Guoxiang, Yang Zhenghua, Wang Shijun, Wei Yingqi, Lu Zhengchao, Peng Xuehui, Wang Xiaogang	Nanjing Hydraulic Research Institute of Ministry of Water Resources, Ministry of Transport and National Energy Administration; China Institute of Water Resources and Hydropower Research; Hohai University; Changjiang River Scientific Research Institute of Changjiang Water Resources Commission; Yellow River Institute of Hydraulic Research of Yellow River Water Resources Commission; Changjiang Survey, Planning, Design and Research Co., Ltd; Nanjing University, PLA University of Science and Technology; Century Information Technology Co., Ltd; Administrative Office of Qingshan Reservoir	Ministry of Water Resources	Identifying attribution of runoff variation in climatically different catchments under changing environment	26

(to be continued)

(continued)

No.	Award Title	Principal Investigators	Principal Host Institution	Nominator	Leading Projects Previously Funded by NSFC	Number of NSFC Grants
5	Development, commercialization and promotion of a small-molecular targeted anticancer drug; Icotinib hydrochloride tablets	Ding Lieming, Shi Yuankai, Sun Yan, Huang Yan, Zhang Li, Hu Bei, Liu Xiaoqing, Zhang Ling, Hu Yunyan, Zhou Jianying, Zhao Qiong, Zhang Shucui, Qin Shukui, Zhang Yiping, Wang Dong	Betta Pharmaceuticals Co., Ltd, Cancer Hospital Chinese Academy of Medical Sciences, Sun Yat-sen University Center (Affiliated Cancer Hospital of Sun Yat-sen University, Institute of Cancer of Sun Yat-sen University), Peking Union Medical College Hospital of Chinese Academy of Medical Sciences, The First Affiliated Hospital of Zhejiang University Medical School (The First Hospital of Zhejiang Province), 307th Hospital Peoples Liberation Army, Shanghai Pulmonary Hospital (Shanghai Occupational Diseases Hospital), Zhejiang Cancer Chest Hospital of Capital Medical University, The Third Affiliated Hospital of Third Military Medical University	Zhejiang Province	The interaction between miRNAs and APE1 implicates in chemosensitivity of osteosarcoma	30
6	New pathogenetic characteristics, prevention and treatment of chronic cutaneous wounds of Chinese people; Innovative theory and key measures	Fu Xiaobing, Cheng Tianmin, Lu Shuliang, Li Xiaokun, Liu Xiancheng, Lv Guozhong, Jiang Yufeng, Ran Xinze, Xie Ting, Xiao Jian, Xu Zhangrong, Xu Yan, Lv Qiang, Yang Jiyong, Zhang Hongyu	First Affiliated Hospital of the General Hospital of People's Liberation Army, Third Medical University, Ruijin Hospital of Shanghai Jiao Tong University, Wenzhou Medical University, Lifotronic Technology Co., Ltd, Third People's Hospital of Wuxi, 306th Hospital of Peoples Liberation Army, Ninth People's Hospital of Shanghai Jiao Tong University, Soochow University, General Hospital of People's Liberation Army	Beijing Municipality	Study of skin and important splanchnic organ repair and regeneration	49

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No.	Award Title	Principal Investigators	Principal Host Institution	Nominator	Leading Projects Previously Funded by NSFC	Number of NSFC Grants
7	Development and industrialization of artificial musk	Yu Dequan, Zhu Xiuyuan, Liu Xuemei, Li Shifen, Yao Qianyan, Yan Chongping, Liu Houqi, Gao Yimin, Wang Wenjie, Cheng Guifang, Shen Xianglong, Xiao Xuan, Guo Jing, Yu Shishan, Zhang Shu	Institute of Materia Medica, Academy of Medical Sciences; China TCM, Co.; Shandong Hongjitang Pharmaceutical Group Co., Ltd; Shanghai Traditional Chinese Medicine Co., Ltd; Beijing Lianxin Pharmaceutical Co., Ltd.	National Health and Family Planning Commission	Study on the anti-inflammatory mechanism of musk	35

Statistics of NSFC's Support to Awardees of the First Prize of the National Science and Technology Progress Award (the Innovation Team)

Table 6-12

No.	Award Title	Principal Investigators	Principal Host Institution	Nominator	Leading Projects Previously Funded by NSFC	Number of NSFC Grants
1	The innovation team of the comprehensive diagnosis and treatment of end-stage liver diseases of the First Affiliated Hospital of Zhejiang University	Zheng Shusen, Li Lanjuan, Wang Weilin, Chen Zhi, Xu Xiao, Zhang Min, Shen Yan, Zhou Lin, Wu Jian, Xu Kaijin, Yan Sheng, Yu Jun, Du Weibo, Li Jun, Hu Zhenhua, Ma Weiming, Xiao Fei, Wang Dong	Zhejiang University	Zhejiang Province	<ul style="list-style-type: none"> • The applied basic research on the treatment of end-stage liver diseases by artificial liver support system and liver transplantation • The role and mechanism research of liver dendritic cells in the regional immunity of transplanted liver graft 	51
2	The innovation team of electric power integration of Naval University of Engineering	Fu Lijun, Lu Junyong, Wang Guangsen, Zhao Zhihua, Nie Ziling, Zhang Lei, Meng Jin, Pan Qijun, Li Weichao, Ma Fan, Liu Dezhi, Hu An, Wu Jiangxing, Chen Hongchang, Ji Xinsheng	Naval University of Engineering	PLA General Armament Department	<ul style="list-style-type: none"> • Compatibility in power system • Dynamic characteristics of hybrid systems of power electronic devices and their combinations with multiple time scales 	36
3	The innovation team of network communication and information exchange technology of PLA Information Engineering University	Guo Yunfei, Luo Xingguo, Lu Guoying, Wang Binqiang, Lan Julong, Peng Jianhua, Jin Liang, Tang Hongbo, Chen Fucai, Liu Qinrang, Huang Kaizhi, Liu Caixia	The PLA Information Engineering University	PLA General Staff	<ul style="list-style-type: none"> • Research on the basic theory of mimic defense for cyber space 	10



Part VII
International (Regional)
Cooperation and Exchange

In 2015, centering around the core tasks of the national natural science fund, NSFC made further progresses and achievements in studying and developing the 13th Five-Year Development Plan of international cooperation, implementing the strategy of open cooperation, continuously expanding and extending cooperative networks, strengthening MoU-based joint research, and organizing major international joint research programs.

Firstly, strengthen high-level exchanges and promote strategic cooperation.

High-level visits between science funding agencies indicate the significance they attach to closer and tighter mutual cooperative relations and effectively deepen and enhance bilateral and multilateral relations, raising the profile of NSFC internationally. High-level visits are conducive to expanding cooperation channels and diversifying patterns for cooperation and are intended to promote bilateral and multilateral strategic cooperation.

President Yang Wei led a delegation and visited Brazil and Argentina, delivering a keynote speech at the 4th World Conference on Research Integrity (WCRI) and paying an official visit to the Consejo Nacional de Investigaciones Científicas Técnicas (CONICET) during which an MOU was signed. President Yang Wei also led a delegation and visited Israel, Singapore and Thailand, attending the 10th Meeting of International Academic Advisory Panel (IAAP). Vice President Shen Yan led a delegation to visit Kenya and paid a working visit to the International Livestock Research Institute (ILRI) and the World Agroforestry Center (ICRAF). Vice President He Minghong led a delegation to visit South Korea and attended the 19th Meeting of China-Korea Joint Committee for Basic Scientific Research. Vice President He Minghong also paid a visit to Russia and Sweden, attending the workshop in celebration of 20 years of collaboration between NSFC and the Russian Foundation for Basic Research and delivered a speech at the opening ceremony. Vice President Liu Congqiang led a delegation and visited Belgium, the UK and Ireland, attending the 2nd China-EU High-Level Dialogue on Innovation Cooperation and delivering a key-note speech, signing an implementing arrangement

between NSFC and the European Research Council on joint research programs as well as an MOU with the Research Foundation-Flanders (FWO). Vice President Liu Congqiang also led a delegation and attended the 4th Global Research Council (GRC) meeting held in Japan, visited the International Institute for Applied Systems Analysis, and attended the Young Leading Talents Program Workshop to develop concrete implementation plan. Vice President Gao Wen led a delegation and visited Portugal, Germany and Switzerland, and attended the 13th Meeting of Heads of Research Councils in Asia (A-HORCs) and the 9th Asian Heads of Research Councils (ASIAHORCs) General Meeting. Vice President Gao Ruiping visited Ecuador and attended the 1st China-CELAC Forum on Science, Technology and Innovation, delivering a speech at the forum. She also paid an official visit to the Ministry of Science and Technology of Cuba. These high-level visits strengthened strategic partnerships and enhanced NSFC's impact on the bilateral, multilateral and regional collaborations.

The high-level leaders of foreign partners that visited NSFC in 2015 included: Benjamin Geiger, Chairman of Israel Science Foundation (ISF), Low Teck Seng, CEO of National Research Foundation of Singapore (NRF), Muhammad Ashraf, President of Pakistan Science Foundation (PSF), Hazem Mansour, Minister of Science and Research of Egypt, Rene Ramirez, Ecuador's National Secretary of Higher Education, Science, Technology and Innovation, Susan Desmond-Hellmann, CEO of Bill & Melinda Gates Foundation, Kath McPherson, CEO of New Zealand Health Research Council (HRC), Jason Wilde, CEO of American Institute of Physics (AIP), Jean-Pierre Bourguignon, President of the European Research Council (ERC), Peter Strohschneider, President of German Research Foundation (DFG), Jos Engelen, Chairman of Netherlands Organisation for Scientific Research (NWO), Hans de Groene, Executive Director of Netherlands Organisation for Scientific Research (NWO), Sir Mark Walport, Chief Scientific Adviser to UK Government, Jane Elliot, Chief Executive and Deputy Chair of the Economic and Social Research Council (ESRC), Anita Lehtikainen, Executive Secretary of the

Ministry of Education of Finland, Heikki Mannila, President of the Academy of Finland, Stefania Giannini, Minister of Education, Universities and Research of Italy, Illugi Gunnarsson, Minister of Education, Science and Culture of Iceland, Ma Zhiyi, President of the Administrative Committee of the Macao Foundation of Science and Technology Development, and Benjamin Wah, President of Hong Kong Research Grants Council (RGC).

Secondly, complete the review and funding of various international cooperative projects.

In 2015, NSFC received a total of 2,622 applications under varied international cooperative programs and approved 744 applications for funding with a total funding amount of 673 million yuan. Among them, 148 joint research projects were selected from 25 rounds of calls for proposals launched between NSFC and its 22 foreign partners for funding with NSFC's total investment of 343 million yuan. Besides, NSFC also approved 151 mobility projects selected from 17 calls for proposals jointly launched with 17 foreign partners as well as 231 bilateral or multilateral workshops with 19 foreign partnering funding agencies or research institutions.

Thirdly, actively carry out investigation and research to promote the optimization of cooperative mechanisms and strengthen strategic planning.

By analyzing the present situation of domestic and international scientific and technological cooperation, summing up the achievements of the open cooperation strategy during the 12th Five-Year period, and analyzing the opportunities and challenges for international cooperation, NSFC initially drafted its 13th Five-Year Strategic Plan for International Cooperation, putting forward that in the next five years, it will strengthen top-level design and research on international collaboration strategy and national policy research, so as to more actively integrate into the global network of innovation, attract global innovation resources to promote the development of science and technology diplomacy and build an open cooperation at

a higher level the new pattern.

International scientific organizations play a unique role in international cooperation. In order to strengthen cooperation with international organizations, NSFC set up an Advisory Panel on Cooperation with International Organizations chaired by Liu Congqiang, Vice President of NSFC, attaching importance to putting into full play the think-tank role of experts, actively promoting and deepening the cooperation with international organizations, and raising China's profile on the platforms of international organizations. In early June 2015, the first meeting of the Advisory Panel on Cooperation with International Organizations was held in Beijing to conduct discussions on how to strengthen cooperation with the International Institute for Applied Systems Analysis and the Belmont Forum and other international organizations. During the meeting, the panel members offered their advice and suggestions, fully playing the think-tank role.

A Shuangqing forum was organized on the theme of "Optimizing the funding system for international cooperation and comprehensively pushing on with the internationalization strategy". Experts participating in the forum analyzed the development trend of domestic and international scientific and technological cooperation from the global perspective, wrapped up the evolution of NSFC's international cooperation, and prospectively proposed advice and suggestions on optimizing NSFC's funding system for international cooperation so as to promote the implementation of NSFC's internationalization strategy. The forum also exerted great impact on the drafting of NSFC's 13th Five-Year Plan for international cooperation, the optimization of NSFC's funding system for international collaboration and the comprehensive implementation of NSFC's internationalization strategy

Fourthly, strengthen collaboration with countries in South America and the "One Belt, One Road" region so as to expand the network of international partnerships

In 2015, with the strategic cooperation with the United States and Europe being strengthened, NSFC further

expanded its network of international partnerships by signing MOUs with Singapore's National Research Foundation, International Integrated Mountain Development Center, Bill & Melinda Gates Foundation, Argentina National Science and Technology Research Council, UK Science and Technology Facilities Council, Italian Ministry of Foreign Affairs and International Cooperation, Iceland Research Center, and concluding a memorandum of understanding with the European Commission and the European Research Council to fund Chinese scientists to visit Europe and conduct scientific cooperation. The MOU with the U.S. National Institutes of Health was renewed to continue substantive cooperation in biomedical research in the next five years. On the basis of the cooperation agreements signed with Brazil, Chile on relevant institutions in 2014, new cooperative agreements were signed with partnering agencies in Ecuador and Argentina, laying a solid foundation for strengthening collaboration with South America. Cooperative ties were also established with the International Integrated Mountain Development Centre based in Nepal and the National Research Foundation of Singapore, which promoted the cooperative relations with Thailand, South Korea, Japan, Pakistan, Europe and other countries along the "One Belt, One Road" region.

Witnessed by China's President Xi Jinping and Dutch King Willem Alexander, NSFC President Yang Wei and Jos Engelen, President of the Netherlands Organization for Scientific Research signed a new bilateral MOU. Witnessed by China's Premier Li Keqiang and European Commission President Jean-Claude Juncker, NSFC Vice President Liu Congqiang and Carlos Moedas, European Commissioner for Research, Innovation and Science, signed the implementation agreement to invite Chinese scientists to join the projects funded by the European Research Council. Besides, witnessed by China's Vice Premier Liu Yandong and Jeremy Hunt, Minister of Health in the United Kingdom, NSFC Vice President Liu Congqiang and Andrew Taylor, Executive Director of the U.K. Science and Technology Facilities Council signed a bilateral MOU on cooperation.

By 2015, NSFC has signed 85 cooperation agreements or MOUs with science foundations or research funding agencies located in 40 countries or regions around the world.

Fifthly, continue to promote bilateral and multilateral cooperation under MOU frameworks so as to enhance the influence of the National Natural Science Fund.

The cooperation with overseas scientific or research funding agencies and international organizations is an important way to achieve the strategic objectives of NSFC international cooperation. For cooperation and exchange projects under the framework of MOUs, the priority funding areas, call for proposals, project review, funding decisions and post-funding management are jointly conducted by NSFC and its foreign partners, which reflects mutual strategic needs and goals, and therefore they played a science leading role of the Fund. In 2015, NSFC jointly organized more than 40 rounds of bilateral or multilateral cooperative programs with foreign partnering institutions in different fields, nurturing a good situation for all-round development.

In 2015, NSFC and the UK Natural Environment Research Council and the Medical Research Council jointly launched two major international cooperation Programs in the fields of critical zones observatory research and air pollution and human health. The joint calls for proposals received a total of 56 pre-applications and 22 full applications, and after 7 review meetings, workshops and project defense meetings, granted 10 projects with a total funding of 97.372 million yuan. The implementation of the program provided good reference for NSFC in organizing or joining major international scientific programs and helped accumulate initial experience, which will open a new chapter for NSFC's international cooperation.

Sixthly, explore and improve the funding mechanisms for talent fostering.

The year 2015 marks the first year of the implementation of the Measures on the Management of the Research Fund for International Young Scientists.

Since 2015, the Research Fund for International Young Scientists will launch only one call for proposals per year, rather than two calls for proposals per year in the past. Besides, this program was further opened up to all applicants rather than only those from CAS or MOE affiliated institutes or universities, and the funding period is also prolonged from 6–12 months to 12–24 months. The cap on the age of applicants is also raised from 35 to 40 years old. Meanwhile, to further strengthen the regulation and management review, including the translation of the new English version of the report concluding the balance sheet and accounts instructions. After the implementation of the new measures, more institutions and foreign young scholars are invited to apply and benefit from this program, so the program becomes more competitive. In addition, in order to continue the stable funding for foreign young scholars, NSFC started to explore the possibility of joint funding with the State Administration of Foreign Experts Affairs, and reached a consensus to start concrete work in 2016.

In 2015, the Research Fund for International Young Scientists received 188 applications, an increase by 27% over that in 2014, and accepted 151 of them. After peer review, 90 were approved with a total funding of 23.09 million yuan for direct costs. Besides, 17 renewed applications were approved with a total funding of 4.91 million yuan for direct costs.

Seventhly, serve the overall national situation and steadily promote cooperation with Hong Kong, Macao and Taiwan regions.

In 2015, NSFC steadily promoted cooperation with Hong Kong, Macao and Taiwan regions. On the basis

of communication and coordination mechanisms in recent years, NSFC and the Science and Technology Development Fund of Macao signed an MOU, which will usher in comprehensive cooperation in the future. The NSFC-RGC Joint Research Program received 202 applications and funded 23 with an average funding rate of 11.4%, maintaining comparatively high competitiveness. NSFC maintained closer cooperation and exchanges with Taiwan. In 2015, four workshops were held in mainland China, and one workshop was held in Taiwan region. NSFC and KT Li Technology Development Foundation jointly received 17 applications in the field of management research in response to an aging society and approved 5 for joint funding.

Eighthly, continue enhancing the function of the Sino-German Center for the Promotion of Science as a bridge and window in promoting the Sino-German cooperation and exchanges.

In order to enhance the influence of the Sino-German Center for the Promotion of Science, a workshop between Chinese and German universities and research institutions as well as their science department chiefs and a seminar among bilateral collaborative groups were held so as to wrap up successful experience, follow instructive advice and enhance the management of the center. In 2015, the center received 108 applications for funding for workshops, joint research and collaborative groups, and 90 of the applications were granted. Besides, a number of outstanding Chinese PhD candidates were selected to attend the annual Nobel Laureate Meeting held in Lindau, Germany.

International Cooperation Events

Jan. 7 Vice President Liu Congqiang met with the delegation headed by Adelino Canario, Professor of Universidade do Algarve in Portugal and Professor Li Weiming, Professor of Shanghai Ocean University and exchanged views on how to deepen bilateral collaboration in ocean sciences.

Jan. 8 Vice President Liu Congqiang received a Hong Kong Science and Technology Delegation, headed by Professor Li Xingwei, Vice President of Hong Kong University of Science and Technology. Discussions were held on the eligibility for applying for NSFC programs by the researchers in Hong Kong. Both sides also held in-depth discussion on issues such as the strengthening the future cooperation between the mainland and Hong Kong in the field of basic research

Jan. 8 Vice President Liu Congqiang received a delegation headed by Mr. Ma Zhiyi, President of the Administrative Committee of the Macao Foundation of Science and Technology Development. Both sides held in-depth discussion on issues about the expansion of the fields of cooperation between the mainland and Macao.

Jan. 10 President Yang Wei met with Dr. Subra Suresh, President of Carnegie Mellon University and both sides exchange views on Sino-US cooperation in science and education.

Jan. 21 Vice President Liu Congqiang attended the preparatory meeting chaired by Vice Premier Liu Yandong for the first China-Israel Innovation Cooperation Joint Commission Meeting.

Jan. 26 Vice President Shen Yan held a meeting with an Ethiopian biotechnology delegation headed by His Excellency Ambassador Dr. Kassu Ashame, Advisor to the Prime Minister and Head (ministerial level) of Ethiopia Policy and Research Institute. Both sides carried out extensive exchanges and discussions on issues of common interests such as talents training, funding mechanism, priority areas selecting, peer

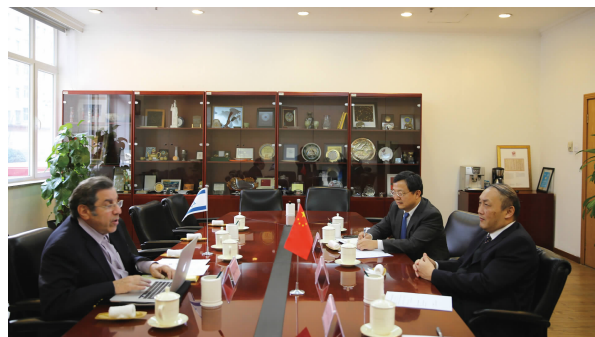
review mechanism and project management, and explored possibilities of cooperation.

Jan. 27-29 Vice President Liu Congqiang attended the 6th Sino-Thai Joint Workshop on Renewable Energy in Guangzhou. Dr. Soottiporn Chittmittrapap, Secretary General of NRCT attended the workshop. Agreement between the two organizations was reached on the initial plan for substantial joint research, laying a solid foundation for future cooperation.



Vice President Liu Congqiang attends the 6th Sino-Thai Joint Workshop on Renewable Energy

Jan. 28 President Yang Wei met with Professor Benjamin Geiger, Chair of Academic Board of the Israeli Science Foundation (ISF). The two sides reviewed and highly appreciated the implementation of NSFC-ISF Joint Research Program (JRP), and mainly discussed such issues as expanding collaborative areas, regularly holding bilateral symposia and science-policy forum, and jointly supporting research centers.



President Yang Wei meets with Benjamin Geiger, Chair of ISF Academic Board

Feb. 7–9 Vice President Liu Congqiang attended the Sino–Thai Joint Workshop on Watershed Sustainable Development in the Context of the “Future Earth” Program held in Xiamen. Consensuses were reached on the cooperative framework, prioritized areas for bilateral cooperation and initial plans for short-term and long-term cooperation.

Feb. 12 Vice President Liu Congqiang met with the delegation headed by Professor Wu Ning from the International Centre for Integrated Mountain Development (ICIMOD). Both sides exchanged views on the conclusion of a bilateral MOU and related concrete issues.

Feb. 12 Vice President Liu Congqiang met with the delegation headed by Professor YUTANI Yasuaki, Director of Office of Beijing Affairs, Institute of Physical and Chemical Research(RIKEN). Both sides exchanged views on expanding bilateral cooperation in the future.

Mar. 13 Vice President Liu Congqiang attended the panel review meeting of the pre-applications for the China-UK joint major research program on the critical zone observatory research held in Beijing. Twelve panel reviewers conducted review on the 36 pre-applications jointed accepted by NSFC and the UK Natural Environment Research Council.

Mar. 17 President Yang Wei met with the delegation headed by Thomas F. Rosenbaum, President, California Institute of Technology and both sides exchanged views on promoting the collaboration



President Yang Wei meets with the California Institute of Technology delegation

between Chinese universities and California Institute of Technology in environmental sciences.

Mar. 20 Vice President Liu Congqiang attended the panel review meeting of the pre-applications for the China-UK joint major international cooperation program on air pollution and human health held in Beijing. Ten panel reviewers conducted review on the 20 pre-applications jointed accepted by NSFC and the UK Natural Environment Research Council and the UK Medical Research Council.

Mar. 27 Vice President Liu Congqiang met with Dr. Dong Hailiang, Program Director, NSF Directorate of Geosciences. Both sides exchanged views on bilateral cooperation in critical zones observatory research.

Mar. 30 President Yang Wei met with the delegation headed by Andrew Petter, President and Vice-Chancellor of Simon Fraser University. Both sides exchanged views on promoting the establishment of international joint research centers and other topics.

Apr. 7 Vice President Lin Congqiang attended and chaired the NSFC-NERC-MRC major international cooperation program on the air pollution and human health working meeting. Twelve Chinese PIs that passed the review of pre-applications were invited to participate in the meeting. The research content, key scientific issues to be solved, as well as expected goals were outlined during the meeting.

Apr. 15–18 Vice President Liu Congqiang chaired in Nanjing the Workshop on China-UK Major International Cooperation Program —“Using Critical Zone Science to understand sustaining the ecosystem service of soil and water”. Ten Chinese PIs that passed the review of pre-applications were invited to participate in the meeting to exchange views on the bilateral cooperation under the framework of the joint program.

Apr. 19–26 Vice President Liu Congqiang led an NSFC delegation and visited New Zealand and Australia to attend the 4th China-New Zealand Joint Commission Meeting on Science and Technology and paid working visits to Australian Research Council,

National Health and Medical Research Council, as well as the University of Sydney.

Apr. 20 President Yang Wei met with the American Physical Society (APS) delegation led by Dr. Gene Sprouse, editor-in-chief of APS journals. Professor Chen Jiaer, former President of NSFC also attended the meeting.

May 6–8 Vice President Liu Congqiang attended the Shuangqing Forum under the title of “Optimizing NSFC’s Funding System for International Cooperation and Comprehensively Implementing NSFC’s International Cooperation Strategy” held in Xiamen.

May 11 Vice President Liu Congqiang received a Taiwan delegation headed by Professor Wan Qichao, Secretary-General of K.T. Li Foundation for the Development of Science and Technology. Both sides discussed specifically about joint programs and seminars to be held in 2016.



Vice President Liu Congqiang meets with the K.T. Li Foundation delegation

May 20 Vice President Liu Congqiang met with Ms. Joanna Frances Newman, Vice President of King’s College London and Professor David Willetts, Policy Institute of King’s College London, former British Minister of Science and Technology. Both sides discussed the issue on how to further enhance the China-UK cooperation within the framework of Newton Fund.

May 20–23 Vice President He Minghong led the NSFC delegation and attended the 19th Meeting of China-Korea Joint Committee for Basic Scientific



Vice President He Minghong attends the 19th Meeting of China-Korea Joint Committee for Basic Scientific Research

Research, which was successfully held in Seoul, Korea. Professor Min K.Chung, President of NRF, also attended the meeting.

May 29 Vice President Shen Yan met with the delegation headed by Dr. Yinuo Li, China Director of Bill & Melinda Gates Foundation. In-depth views were exchanged between both sides on such topics as promoting bilateral cooperation in health and agricultural sciences, and preliminary agreement was reached on relevant cooperative plans.

Jun. 2–3 Vice President Liu Congqiang attended the NSFC-DFG Workshop between Chinese and German universities and research institutions as well as their science department chiefs. Vice President Liu delivered an opening speech at the workshop.

Jun. 3 Vice President Liu Congqiang held a meeting with the delegation headed by Mr. Ibrahim Thiaw, UN Assistant Secretary General and UNEP Deputy Executive Director. While highly appreciating the current NSFC-UNEP cooperation, both sides agreed to strengthen the collaboration in the framework of South-South cooperation and the implementation of the international cooperation initiative of One Belt and One Road.

Jun. 5 The first meeting of the Advisory Panel on NSFC’s Collaboration with IIASA, Belmont Forum and other international organizations was held in Beijing. Vice President Liu Congqiang attended the meeting and

delivered a speech. From the perspective of personal experience in joining the cooperation with international organizations, the panel members conducted discussions on how to raise China's profile on the international arena and proposed constructive advice and suggestions.

Jun. 11–20 Vice President Liu Congqiang led the NSFC delegation and visited the Czech Republic and Austria. The delegation paid working visits to the Academy of Sciences of the Czech Republic, the Institute of Geological Research, Academy of Sciences of the Czech Republic, the Science Foundation of the Czech Republic, the Science Foundation of Austria, Medical University of Vienna, and Austrian Institute of Molecular Medicine. Besides, the delegation also attended the 86th Council meeting of IASA.

Jun. 21–30 President Yang Wei led a delegation to visit Israel, Singapore and Thailand, attending the 10th Meeting of International Academic Advisory Panel (IAAP) and meeting with Professor Benjamin Geiger, Chair of Academic Board of Israel Science Foundation, Professor Soottiporn Chittmittrapap, Secretary General of the National Research Council of Thailand, and Professpr Suthipun Jitpimolmard, Director of Thailand Research Foundation.

Jun. 30–Jul. 7 Vice President Liu Congqiang led a delegation to Belgium, UK and Ireland. While in Belgium, Professor Liu and FWO Secretary General Dr. Elisabeth Monard held discussions on the topic of bilateral cooperation and signed the new MoU between the two organizations. While in the UK, and Ireland Professor Liu met with the Scottish Government Cabinet Secretary for Education. He also visited the Scottish Funding Council and the Innovation Center of Remote Sensing and Imaging System, the Innovation Center of Industrial Biotechnology, the Scottish Alliance for Geoscience, Environment and Society at the University of Edinburgh, Ireland Science Foundation, as well as University College Dublin.

Jul. 8 President Yang Wei met with a Springer Nature delegation led by its Chief Scientist Officer

Annette Thomas. Both sides held discussions and exchanged views on open access, researcher training and data acquisition.

Jul. 30 Vice President He Minghong met with the delegation headed by Muhammad Ashraf, President of Pakistan Science Foundation. In-depth discussions were held on how to promote substantial bilateral cooperation and consensus was reached on the launch of joint research programs.

Aug. 3–6 Vice President He Minghong met with the delegation headed by H. von Kalm, Deputy Secretary General of DFG and exchanged views on the operation of the Sino-German Center for the Promotion of Science.

Aug. 12, Vice President Liu Congqiang met with the delegation led by Jean-Pierre Bourguignon, President of the European Research Council. Both sides exchanged views on how to continue bilateral cooperation under the new MOU.

Aug. 17–19 Vice President Liu Congqiang attended the project defense meetings of the NSFC-NERC-MRC major international cooperation program and human pollution on health as well as the NSFC-NERC major joint research program on the critical zones observatory research.

Aug. 30–Sep. 4 Vice President Shen Yan led the NSFC delegation and visited Kenya. During the visit, Vice President Shen held talks with Jimmy Smith, Director of the International Livestock Research Institute (ILRI) and Tony Simons, Director of the World Agroforestry Center (ICRAF), and attended the academic seminar jointly organized by NSFC and ILRI and made a speech at the opening ceremony of the seminar.

Aug. 31 Vice President He Minghong met with Dr. Martin Kropff, Director of the International Maize and Wheat Improvement Center (CIMMYT) and exchanged their opinions on strengthening substantial bilateral collaboration.

Sep. 1 Vice President Liu Congqiang delivered a



President Yang Wei meets with the Chief Scientific Adviser to UK Government

lecture to the staff of NSFC Bureau of International Cooperation on “Three Stricts and Three Honests”.

Sep. 7 President Yang Wei met with the delegation led by Sir Mark Walport, the Chief Scientific Adviser to UK Government. Both sides spoke highly of the achievements NSFC, Research Councils UK and the Royal Society have achieved under the China-UK Joint Fund for Research and Innovation (Newton Fund) in recent years and held discussions on topics for future cooperation.

Sep. 7 Vice President Liu Congqiang attended the conference on “Promoting Excellence through Enhanced EU-China Researchers’ Mobility and Cooperation” and made a keynote speech. The conference was co-organized by NSFC, the Ministry of Science and Technology (MOST), Chinese Academy of Sciences (CAS), the DG Research and Innovation of European Commission and the Delegation of the European Union in China.

Sep. 7 Vice President Liu Congqiang met with the delegation led by Jane Elliot, Research Councils UK International Champion and both sides exchanged views on bilateral cooperation.

Sep. 7 Vice President Liu Congqiang met with the delegation headed by Kath McPherson, CEO of New Zealand Health Research Council (HRC). Both sides briefed each other the latest development of the agencies and discussed potential collaboration in the future.

Sep. 8 Vice President Liu Congqiang met with the

delegation headed by Hans de Groene, Director General Netherlands Organisation for Scientific Research (NWO). Both sides spoke highly of the achievements of NSFC-NWO bilateral joint research programs launched during the past 6 years and exchanged views on the priority funding areas for the next few years to come.

Sep. 10 Vice President Liu Congqiang met with the delegation led by Sun Zhaohua, Deputy Secretary of Party Leadership Group and Deputy Administrator, State Administration of Foreign Experts Affairs. Both sides exchanged views on jointly funding foreign experts to conduct research in China.

Sep. 11 Vice President Shen Yan met with the delegation headed by Dr. Ted Trimble, Director of NCI Center for Global Health, NIH. The two sides exchanged their views about continuing the bilateral cooperation programs and reached consensus on relevant priority areas for future cooperation.

Sep. 12–16 Vice President Liu Congqiang led the NSFC delegation and attended the Workshop on Young Science Leaders held in Vienna, Austria. He delivered a speech that introduced NSFC’s experience in fostering young talents and proposed some advice on the strategic positioning, selection mechanism and funding mode of the young science leaders program.

Sep. 15–23 Vice President Gao Ruiping led the NSFC delegation and visited Ecuador and Cuba. In Ecuador, Vice President Gao attended the 1st China-



Vice President Gao Ruiping leads the NSFC delegation to visit Ecuador

CELAC Forum on Science, Technology and Innovation and delivered a speech entitled Boosting China-CELAC Basic Research Cooperation through Enhancing Exchange and Exploring Opportunities. While in Cuba, Vice President Gao conducted in-depths exchanges and discussions with Cuban science & technology administrative authority CITMA on a range of topics, in particular the bilateral cooperation agreement. The delegation also visited the Institute of Cybernetics, Mathematics and Physics.

Sep. 25 President Yang Wei met with the delegation headed by Hua Yunsheng, President of the Research Grants Council (RGC) of Hong Kong. Both sides highly praised the achievements in NSFC-RGC joint scientific programs in the past and held discussions on issues including expanding collaboration, opening up cooperative mechanism and perfecting management, etc.



President Yang Wei and Vice President Liu Congqiang meet with the DFG delegation

Oct. 12 President Yang Wei and Vice President Liu Congqiang met with the delegation headed by Peter Strohschneider, President of German Research Foundation (DFG). On behalf of NSFC, President Yang Wei introduced the latest progress of China's science and technology system reform and the latest developments of NSFC. DFG President Strohschneider introduced DFG's latest developments. Both sides highly praised the collaboration achievements in the past years and held discussions on the on-going Sino-German Joint Research Program, Sino-German Interdisciplinary Joint Program and the Cooperative Networking Program, etc.

President Yang Wei meets with the delegation headed by Hua Yunsheng, President of the Research Grants Council (RGC) of Hong Kong

Oct. 5-8 Vice President Liu Congqiang attended the Sino-US CZO Workshop co-sponsored by NSFC and NSF in Guiyang. Over 50 experts from China and the U.S. participated in the workshop during which they engaged in exchanges and discussions on Sino-US CZO research progress and some key scientific issues. In particular, the attendees conducted profound discussions on the cooperation opportunities and mechanisms between China and US CZO observation stations.

Oct. 18-21 The 18th Joint Committee Meeting of the Sino-German Center for the Promotion of Science was held in Guiyang. Vice Presidents Liu Congqiang and He Minghong attended the meeting as Co-Chair and committee member respectively. DFG Vice President Prof Famulok, Secretary General Ms Dzwonnek also participated in the meeting. During the meeting, the working report of the Sino-German Center for the Promotion of Science in 2014 was deliberated and discussions were held on key topics such as future strategic development, etc.

Oct. 28-30 Vice President Liu Congqiang attended the kick-off meeting of the NSFC-NERC-MRC major international cooperation program on air pollution and human health. Vice President Liu stressed the importance attached by NSFC to the research and development in this field and made further clarifications on the key scientific issue to be solved and expected goals of the joint program.



Vice President Gao Wen attends the 9th Asian Heads of Research Councils (ASIAHORCs) General Meeting

Nov. 9–12 Vice President Gao Wen led the NSFC delegation and attended the 9th Asian Heads of Research Councils (ASIAHORCs) General Meeting held in Okinawa, Japan. Centering around the theme of funding scientific breakthroughs and science policies in Asian countries, Vice President Gao Wen delivered two speeches that introduced NSFC's practices, experience and plans of funding scientific breakthroughs as well as China's science policy and S&T system reform.

Nov. 17 Vice President Liu Congqiang met with the delegation headed by Professor Heikki Mannila, President of the Academy of Finland. Both sides spoke highly of the achievements of bilateral cooperation, and

exchanged views on how to fund strategic dialogues between the science communities in China and Finland.

Nov. 17 President Yang Wei met with the delegation headed by Anita Lehtikoinen, Permanent Secretary of Education and Culture of Finland. The two sides highly praised the joint efforts of NSFC and AF in promoting collaborative researches between the Chinese and Finnish researchers in the past ten years and held discussions on future collaborations.

Dec. 1–6 Vice President Liu Congqiang led the NSFC delegation and visited the UK to attend the Second High-level Forum on New Paradigms for Future Collaboration in Science and Innovation. During the stay in the UK, Vice President Liu also visited the University of Glasgow.

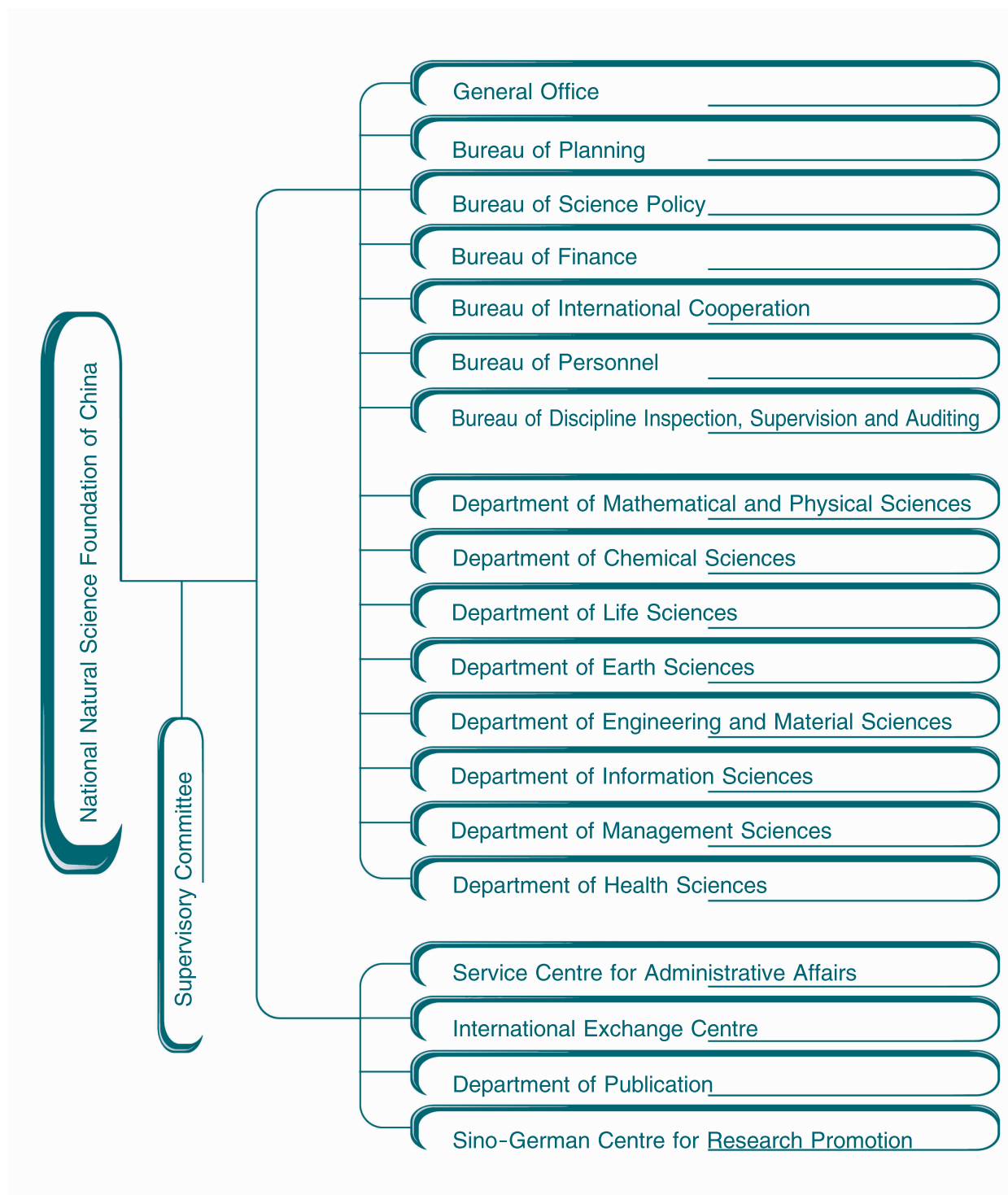
Dec. 6–15 Vice President Liu Congqiang led the NSFC delegation to visit South Africa and Kenya. During the visit, Vice President Liu Congqiang met with Dr Dorsamy Gansen Pillay, Vice President of the National Research Foundation of South Africa, Ibrahim Thiaw, UNEP Deputy Executive Director and Assistant-Secretary-General of the United Nations, and Mr. Liu Xianfa, Chinese Ambassador in the Republic of Kenya.



Part VIII

Organizational Structure and Personnel of NSFC

1. Organizational Structure

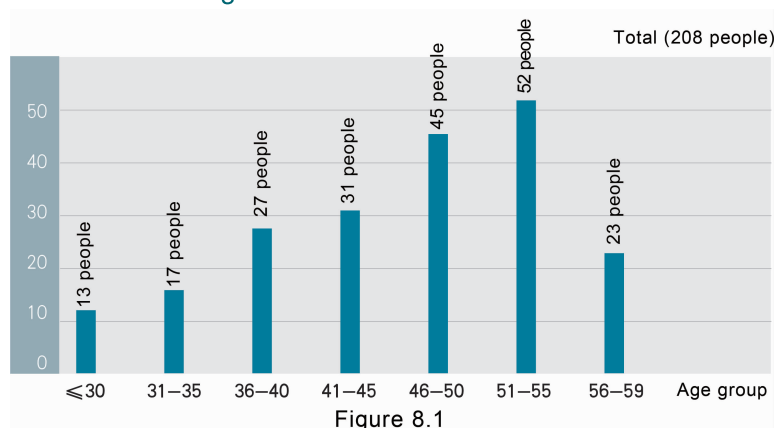


2. NSFC Staff

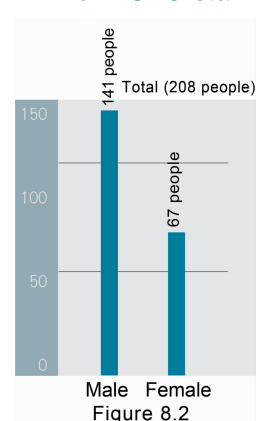
(1) Full-time Staff

The staff quota of NSFC is 230. By December 31, 2015, NSFC has 208 full time staff, with 141 males and 67 females and 197 with professional and technical titles. The average age is 46.

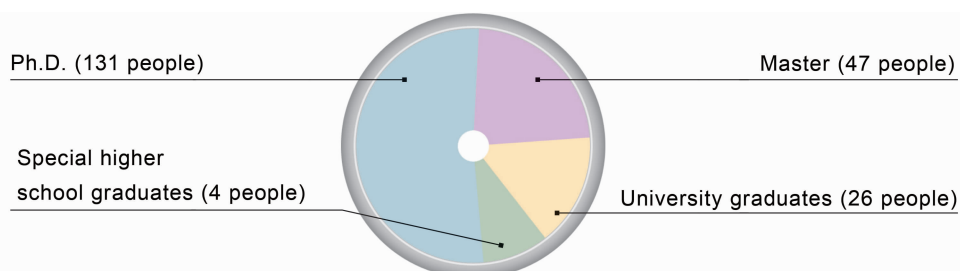
Age distribution of NSFC staff



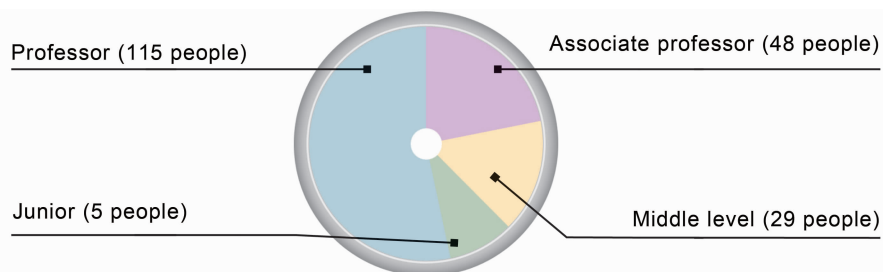
Gender distribution of NSFC staff



Academic degree of NSFC staff



Professional title of NSFC staff



(2) Rotational Program Directors in NSFC

By December 31, 2015, there are 73 Rotational Program Directors on duty, and among them, 72 have Ph.D. degree, 1 has bachelor degree. Among the Rotational Program Directors, 48 are males and 25 females; 23 are professors or research fellows, and 50 are associate professors.

3. Leaders of NSFC's Bureaus, Departments and Subordinate Unit

Leaders of NSFC's Bureaus and Departments

Table 8-1

(by December 31, 2015)

Unit	Director General	Deputy Director General
General Office	Han Yu	Han Zhiyong, Feng Wenan, Li Jianjun (Director of Information Center)
Bureau of Planning	Wang Changrui	Wang Qidong
Bureau of Science Policy		Zheng Yonghe (Responsible, Inspector)
Bureau of Finance	Zheng Zhongwen	Hao Guanwei (F), Xing Hairu (F, Deputy Inspector)
Bureau of International Cooperation	Feng Feng	Lu Rongkai, Zou Liyao
Bureau of Personnel	Zhou Yanze	Tang Longhua, Zhang Xiaohua (F, Director of Office of Retired Staff, Inspector)
Bureau of Discipline Inspection, Supervision and Auditing	Chen Yue	Zhu Weitong (F), Zhang Qing (Deputy Inspector)
Department of Mathematical and Physical Sciences	Xie Sishen (Concurrently)	Meng Qingguo (Executive, Director General Level), Dong Guoxuan
Department of Chemical Sciences	Zhang Xi (Concurrently)	Chen Yongjun (Executive, Director General Level)
Department of Life Sciences	Wu Weihua (Concurrently)	Du Shengming (Executive, Director General Level), Feng Xuelian (F)
Department of Earth Sciences	Fu Bojie (Concurrently)	Chai Yucheng (Executive, Director General Level), Song Changqing, Guo Jinyi (Deputy Inspector)
Department of Engineering and Material Sciences	Wang Guangqian (Concurrently)	Li Ming (Executive, Director General Level), Che Chengwei, Wang Guobiao
Department of Information Sciences	Chai Tianyou (Concurrently)	Qin Yuwen (Executive, Director General Level), Zhang Zhaotian, He Jie (Deputy Inspector)
Department of Management Sciences	Wu Qidi (F, Concurrently)	Li Yijun (Executive, Director General Level), Gao Ziyu (Concurrently)
Department of Health Sciences	Wang Hongyang (F, Concurrently)	Dong Erdan (Executive, Director General Level), Sun Ruijuan (F), Xu Yanying (F)

Leaders of NSFC's Subordinate Unit

Table 8-2

Unit	Director General	Deputy Director General
Service Centre for Administrative Affairs	Zhang Xiangping (F)	Yang Tao, Shi Xinghe, Yuan Youxin (Deputy Inspector)
International Exchange Centre	Shi Xinghe (Concurrently)	
Department of Publication		
Sino-German Centre for Research Promotion	Lu Rongkai (Concurrently)	Chen Lesheng



Part IX

Supervision and Auditing Work of NSFC

The supervision and auditing work of NSFC in 2015 was fully implemented in accordance with the spirit of the 18th CPC National Congress and its 3rd, 4th and 5th Plenary Session as well as an important series of remarks of CPC general-secretary Xi. Under the leadership of the NSFC CPC Leading Group and guided by the strategy of innovation-driven development, to meet the requirement of basic research leading new normal development, we firmly carried out the deployment for supervision work laid down by the 3rd Plenary Session of the 7th NSFC General Assembly and the enlarged meeting of NSFC CPC Leading Group in 2014. Research integrity and funding supervision were greatly improved under the rule of law.

Coordinating the working style and ethics building and strengthening the clean governance building.

Making education and institutional building the starting point to consolidate the ideological foundation for self-discipline and clean governance of NSFC staff. We organized party members and cadres to study and implement the documents of the Party Central Committee, the Central Commission for Discipline Inspection, and the State Council, and learn a series of remarks of CPC general secretary Xi Jinping. We required the party members and cadres to keep up with the CPC central committee in ideology, politics and actions. We compiled the Handbook for New Staff on the basis of the work and integrity building. We organized clean governance and behavior standardization training programs among all party members, permanent and part-time staff and rotators in NSFC.

We further implemented the “regulation on responsibility system for the Clean and Honest Administration” and strengthened the supervision on party members and leaders. We intensified the supervision on the management and use of human and financial resources, key positions and links, government procurement and leader selection process. In this way NSFC staff have checked erroneous ideas at the outset and strictly obeyed the discipline and rules and avoid mistakes with strict self-discipline.

Deepening supervision comprehensively and boosting research integrity building.

First, strengthening guidance and education on academic self-discipline.

We enacted the Code of Conduct for Peer Reviewers to standardize expert behaviors. We introduced the practice of setting supervision teams on review meetings and required reviewers to strictly implement conflicts of interest and confidentiality regulations to ensure the creditability of peer review. We conducted integrity lectures and speaking tours to intensify the integrity consciousness of home institutions, researchers and peer reviewers. We notified the public for the information of academic misconduct in forms of document circulation, internet and media to increase warning effect on society.

Second, strengthening supervision institutional building.

We summarized the work of sending supervision teams to review panels and began to develop the management regulation for supervision teams. We started to formulate the Procedure of Receiving and Investigating Complaint of Research Misconduct, and improve the internal process of investigation.

Third, strengthening supervision and restriction measures.

Thanks to diversified supervision and management means including promotion, warning and investigation, regular false information and replicate application were kept under control. According to statistics, because of the Project Similarity Inspection System adopted since the year of 2012, applications with high similarity to previously funded applications and those in the same year of 2015 have decreased by more than 50 percent.

We continued to improve the mechanism of sending supervision team to review meetings. In 2015 we have sent 31 teams including 62 persons to 202 review panels. The supervision team listened to the advice of panelists, supervised review behavior, received complaint reports and organized evaluation of expert commitment and review creditability.

Fourth, upholding a zero-tolerance attitude and harshly punishing research misconducts.

We received more than 180 reports on research misconduct and 111 of them were filed for investigation. Within the year, we concluded 87 cases and punished 72 people responsible for them; 47 funded projects

were revoked and all their budgets have been recovered; 7 home institutions received a notice of criticism and written warning or other punishment. We responded quickly to the withdrawal of essays from BMC, Springer and Elsevier. Thorough investigation into 27 papers funded by National Science Fund was conducted and 13 new applications were rejected without review. We have announced the Five Things Forbidden in Publishing Academic Papers together with China Association for Science and Technology and six other ministries.

Fifth, strengthening the information-based development of research integrity.

We set an important Q&A section about research integrity prior to online-application. We developed a management system on research misconduct and advanced the



The 7th Plenary Session of the 4th NSFC Supervision Committee held in Beijing on Sept. 9-10, 2015 to deliberate the reported cases of the National Science Fund for Distinguished Young Scholars and daily reports as well as high similarity cases

Implementing auditing work with the focus on strengthening the supervision of funding expenses.

We intensified the major responsibility of home institutions as the grants manager and PI as the user. We organized auditing of concluded projects and the use of their grants. We systematically summarized the random auditing results of projects in Beijing and Tianjin of 2014 and sent the result report to thirty home institutions for further revision. We completed the auditing service procurement of 2015 through patent agencies. We organized random auditing of projects funded in areas of Hubei and Ningxia including 470



Seminar on responsible research conduct held in the Ningxia Hui Autonomous Region on Nov. 12, 2015

information-based management of complaint reports. We improved the case library by selecting typical misconduct cases. We also included the punishment results of misconduct cases in ISISN to build a credit reference.



concluded projects from 20 home institutions with total auditing amount of 420 million yuan.



Preparatory meeting on random audit of grantee institutions in Hubei Province held in Wuhan University during Oct. 11-12, 2015



Part X

Other Work of NSFC

Shuangqing Forum

Shuangqing Forum is a high-level strategic and academic exchange platform sponsored by NSFC to promote interdisciplinary integration, create favorable academic environment, develop innovation culture, and facilitate the strategy of innovation-driven development. Based on science fund management, Shuangqing Forum mainly concentrates on highly cross-disciplinary frontier scientific issues, major basic scientific issues related to the demand of the national strategy, and the management and policy issues in improving the science funding system.

In line with the principle of letting a hundred flowers blossom and a hundred schools of thought contend, Shuangqing Forum strives to create a sound environment for the pursuit of truth and fair competition, advance constructive academic critics and ensure that participants can fully enjoy the exchange of thoughts and ideas. Compared with general academic workshops, the forum has four features: (1) Interdisciplinary contents. Each forum is jointly organized by more than two departments. (2) Effective results. The results are highly relevant, because the themes of the forums are closely related to the national natural science fund and its management. (3) Innovative organizing forms. The fundamental task of the forum is to explore new ways for academic exchange so as to inspire innovative ideas. (4) Standardization. The forums have clear positioning and standard organizing procedures.

In 2015, Shuangqing Forum sponsored 22 sessions (from the 131th to 152th session). The total number of participants reached 890, among which 90 participants were members of CAS and CAE. NSFC's science departments were responsible for 21 sessions, and administration bureaus held one session. The themes of 12 sessions were related to frontier basic scientific issues, which were: Wound repair and regenerative medicine; The multidisciplinary approach of big data analysis and processing; Basic research on the river network structure and the runoff features in the river source area; The intelligent network combining computing, storage and transmission; New method and technology of *in vivo* chemical analysis; Science of synthesis oriented to sustainable development demand;

The theoretical innovation and academic frontier in the process of economic transformation in new normal period; The micro ecology and human health; Cellular heterogeneity and major diseases; Key scientific problems and countermeasures of interdisciplinary development of horticulture; The meta-analysis of toxicity and validity of Chinese medicine; The technological research of new device in post-Moore era. There were 7 sessions focusing on deep-level scientific issues addressing the demand of the national development strategy, which were: National security management; Key fundamental science issues of nuclear data; The efficient water use in agriculture in arid area and its ecological and environmental effect; Internet finance and the management of its service operation; Key fundamental science issues of the urban sewage regeneration and recycling; Robot of future: outlook and scientific challenges; The scientific problem and technology bottleneck of deepwater oil and gas engineering. The themes of 3 sessions were related to major policy and management issues in the development and improvement of science funding system, which were: Optimizing the funding system of international joint funds and advancing the strategy of internationalization in an all-round way; Research on new technology and instrumentation to promote the development of life sciences; The funding strategy of science research center.

Shuangqing Forum not only provided a platform for the exchange and cooperation among researchers from different disciplines, promoted the exchange of academic ideas and the expansion of academic vision, but also helped the fund managers to learn about the frontier scientific issues and carry out strategy research, thus enriching the dialogue mechanism between managers and scientists. The scientific issues and policy suggestions summarized during the forums are fully reflected in the national natural science funding and management. For example, the topics discussed in 109th session and 133th sessions were listed as priority area in the major research plan; the topic of 140th session was listed as priority area in the funding direction of major project; and the outcomes of 142th session and 151th session were listed in NSFC's relevant sections of Guide to Programs of 2016.

Topics of Shuangqing Forum in 2015

- The 131th Session: Wound repair and regenerative medicine (Departments of Health Sciences, Life Sciences, Engineering and Materials Sciences, and Bureau of Policy)
- The 132th Session: The multidisciplinary approach of big data analysis and processing (Departments of Mathematical and Physical Sciences, Information Sciences, Management Sciences, and Bureau of Policy)
- The 133th Session: Basic research on the river network structure and the runoff features in the river source area (Departments of Engineering and Materials Sciences, Earth Sciences, and Bureau of Policy)
- The 134th Session: National security management (Departments of Management Sciences, Information Sciences, and Bureau of Policy)
- The 135th Session: Optimizing the funding system of international joint funds and advancing the strategy of internationalization in an all-round way (Bureau of International Cooperation, Departments of Mathematical and Physical Sciences, Earth Sciences, Engineering and Materials Sciences, and Bureau of Policy)
- The 136th Session: Key fundamental science issues of nuclear data (Departments of Mathematical and Physical Sciences, Engineering and Materials Sciences, Bureau of International Cooperation, and Bureau of Policy)
- The 137th Session: The intelligent network combining computing, storage and transmission (Departments of Information Sciences, Management Sciences, and Bureau of Policy)
- The 138th Session: New method and technology of *in vivo* chemical analysis (Departments of Chemical Sciences, Health Sciences and Mathematical and Physical Sciences, and Bureau of Policy)
- The 139th Session: The efficient water use in agriculture in arid area and its ecological and environmental effect (Departments of Engineering and Materials Sciences, Management Sciences, and Bureau of Policy)
- The 140th Session: Internet finance and the management of its service operation (Departments of Management Sciences, Mathematical and Physical Sciences, and Bureau of Policy)
- The 141th Session: Science of synthesis oriented to sustainable development demand (Departments of Chemical Sciences, Engineering and Materials Sciences, and Bureau of Policy)
- The 142th Session: The theoretical innovation and academic frontier in the process of economic transformation in new normal period (Departments of Management Sciences, Information Sciences, and Bureau of Policy)
- The 143th Session: Key fundamental science issues of the urban sewage regeneration and recycling (Departments of Engineering and Materials Sciences, Earth Sciences, Chemical Sciences, Life Sciences, and Bureau of Policy)
- The 144th Session: The micro ecology and human health (Department of Health Sciences, and Bureau of Policy)
- The 145th Session: Cellular heterogeneity and major diseases (Departments of Health Sciences, Life Sciences, Chemical Sciences, and Bureau of Policy)

- The 146th Session: Robot of future: outlook and scientific challenges (Departments of Engineering and Materials Sciences, Information Sciences, Mathematical and Physical Sciences, Health Sciences, and Bureau of Policy)
- The 147th Session: The scientific problem and technology bottleneck of deepwater oil and gas engineering (Departments of Engineering and Materials Sciences, Mathematical and Physical Sciences, Earth Sciences, and Bureau of Policy)
- The 148th Session: Key scientific problems and countermeasures of interdisciplinary development of horticulture (Departments of Life Sciences, Information Sciences, and Bureau of Policy)
- The 149th Session: The meta-analysis of toxicity and validity of Chinese medicine (Departments of Health Sciences, Chemical Sciences, Life Sciences, and Bureau of Policy)
- The 150th Session: The technological research of new device in post-Moore era (Departments of Information Sciences, Mathematical and Physical Sciences, Engineering and Materials Science, and Bureau of Policy)
- The 151th Session: Research on new technology and instrumentation to promote the development of life sciences (Departments of Life Sciences, Information Sciences, and Bureau of Policy)
- The 152th Session: The funding strategy of Science Research Center (Departments of Earth Sciences, Life Sciences, and Bureau of Policy)



131th Shuangqing Forum



132th Shuangqing Forum



136th Shuangqing Forum



141th Shuangqing Forum



142th Shuangqing Forum



147th Shuangqing Forum



148th Shuangqing Forum



152th Shuangqing Forum