Key Program

As an important type of the research programs supported by the National Natural Science Fund, the Key Program supports researchers to conduct in-depth, systematic and innovative research in directions with sound research basis or where new growth points of research disciplines emerge, so as to promote disciplinary development and breakthroughs in important areas or scientific frontiers.

Applications for Key Program should be prepared in principle of limited objectives, limited research scope and focused goals, paying attention to intercrossing of disciplines, making effective use of the existing major scientific research bases at national and ministerial levels, and conducting active international cooperation and exchange with concrete contents.

Applicants should have the following qualifications:
(1) Experience of undertaking basic research projects;
(2) Senior academic position (title).
Post-doc researchers and graduate students are not qualified for application of the Key Program.

Research areas and directions for the Key Program are annually announced in the *Guide to Programs*. Applicants should follow the guidelines to write proposals, determine project title according to research content, and avoid using research area as project title. Applications are advised to have clear research orientation and specific content, and not to cover all areas.

In general, one Key Program project is conducted by only one research institution. If necessary, two institutions at maximum are allowed as collaborators. The duration of a Key Program project is 5 years.

In 2013, NSFC funded 564 Key Program projects, with a total funding of 1.663billion yuan and an average funding of 2.9486 million yuan per project (please refer to the table below for details). In 2014, about 570 Key Program projects will be funded, and the average funding will be about the 3.5 million yuan per project.

Funding of the Key Program Projects in 2013

Unit: 10,000 yuan

Department	Applications	Funding and projects approved				Funding rate (%)
		Projects	Funding	Average funding per project	Percentage of the total (%)	
Mathematical and Physical Sciences	224	63	19,100	303.17	11.49	28.13
Chemical Sciences	251	59	17,950	304.24	10.79	23.51
Life Sciences	458	82	24,710	301.34	14.86	17.90
Earth Sciences	430	76	23,210	305.39	13.96	17.67
Engineering and Materials Sciences	364	82	24,830	302.80	14.93	22.53
Information Sciences	273	82	23,700	289.02	14.25	30.04
Management Sciences	146	30	6,680	222.67	4.02	20.55
Health Sciences	481	90	26,120	290.22	15.71	18.71
Total	2,627	564	166,300	294.86	100.00	21.47

Please refer to the respective sections in each department for research areas and orientations of the Key Program.

Department of Mathematical and Physical Sciences

In 2013, the Department of Mathematical and Physical Sciences announced 84 areas for the Key Program, and received 224 applications. 63 projects were funded with funding of 191 million yuan and about 3.0317 million yuan per projects.

In 2014, the Department plans to fund 60-71 Key Program projects with more than 3 million yuan per project for 5 years.

To ensure the high quality of research projects, applicants are required to have ever chaired and completed national projects, and strong research teams.

Please give the title of the proposed research directions in the note section of the application form, otherwise the application will not be accepted.

The funding scope and research directions for the Key Program of the Department of Mathematical and Physical Sciences in 2014 are described and classified in different divisions below.

In 2014, the Division of Mathematics plans to fund 12-14 Key Program projects, ranging from 2 to 3 million yuan per project and 2.8 million yuan on average.

Main research directions are as follows:
1. Problems in arithmetic and algebraic geometry
2. Lee theory and its application
3. Symplectic geometry and symplectic topology
4. Geometry and topology of low dimensional manifold
5. Studies on frontier problems in complex analysis and complex geometry
6. Analysis in functional space
7. Theory and application of operator space
8. Theory of operator algebra classification
9. Theory of stability of partial differential equations
10. Ergodic theory and application
11. Nonlinear diffusion equation
12. Stochastic method in complex fluid and statistical mechanics
13. Statistic method and computation in large data and experimental designs
14. Theory and algorithm of large scale optimizing problems
15. Multi target optimization of complex systems
16. Theory and application of stochastic control
17. Mathematical theory and method of image merging and recognition and orientation process
18. Theory and application of fractal geometry
19. Discrete mathematical model and its application
20. Numerical methods and theory of partial differential equations on manifold

In 2014, the Division of Mechanics plans to fund 13-16 Key Program projects, ranging from 3 to 4 million yuan per project and 3.8 million yuan on average.

Main research directions are as follows:
1. Nonlinear and uncertainty system dynamics
2. Modeling, analysis and control of complex system dynamics
3. Deformation and damage mechanism of advanced materials
4. Theory, method and application of structural completeness and reliability
5. Mechanical behaviors of material and structure in multi field conditions
6. Unsteady complex flow mechanism and control
7. Hydro dynamics of ships, marine and coastal engineering
8. Flow and propulsion mechanism of aircraft and space craft
9. Biomechanical problems in human health and clinical medicine
10. Transient response of structures, explosive and impact dynamics
11. Numerical methods and software for complex mechanical problems
12. New methods and technology in experimental mechanics
13. Key mechanical problems in environmental evolution and catastrophe
14. Key mechanical problems in major equipment and advanced manufacturing
15. Key mechanical problems in non-conventional conditions
16. Key mechanical problems in new energy areas

In 2014, the Division of Astronomy plans to fund 7-10 Key Program projects, ranging from 3 to 4 million yuan per project.

Main research directions are as follows:
1. Formation and evolution of first generation celestial body and large scale cosmic structure and measurement of its cosmic parameters
2. Formation, structure and evolution of galaxies, interstellar matter
3. Violent activities in active galaxy center and galaxy levels
4. Structure and evolution of very early Galaxy and different stellar populations
5. Star formation, structure and evolution, inter stellar matter
6. Star evolution in late period, compact stellar bodies and its related explosive phenomena and radiation mechanism
7. Celestial bodies in solar system and planetary systems outside the solar system
8. Fine structure, basic magnetic element diagnosis and property, magnetic field topology in active region and evolution of solar magnetic field
9. Origin, dynamical evolution, multi band electromagnetism and particle radiation of solar activity and solar earth physical property
10. Structure, heating and fluctuation of solar atmosphere
11. Basic theory and methods of astrometry and astro-mechanics
12. High precision astronomical parameter measurement and astronomical reference frame

13. Techniques and method for astronomical observation in space and extreme environment
14. Low noise and array receiving technology, digital signal processing and large aperture radio telescope technology
15. Autonomous optics, self-adaptive optics, optical interference and very large aperture telescope technology

In 2014, the Division I of Physics plans to fund 14-16 Key Program projects, ranging from 3 to 4 million yuan per project.

Main research directions are as follows:

1. Physical problems in new sources of energy

(1) Exploration and physical studies of new energy materials
(2) Physics of advanced energy saving materials and devices
(3) Physical problems in efficient energy conversion and storage

2. Physical basis of quantum information

(1) Physical problems in quantum state generation, control and measurement
(2) Physical realization and measurement of quantum entanglement and multi composition association
(3) Quantum information processing and solid quantum computation based on specific physical system
(4) Theory, scheme and experiment of quantum simulation

3. Physics of advanced functional materials

(1) Surface, interface and artificial micro structure physics
(2) New functional materials and device physics of self- spin information carrier
(3) New materials and new effect of linear optics

4. Physical problems in confined or relevant quantum systems

(1) Properties of electric transport, thermal transport and self-spinning transport in low dimensional system
(2) Dimension and topological physical properties in quantum system
(3) Ultra-fast interference control of quantum state in micro nano structures
(4) Novel quantum state and quantum phase change in relevant electron systems

5. Physical problems in soft matter systems

(1) Structure, property and regulations of interface system
(2) Microstructure and interactions of soft matter

(3) Physical problems related to life sciences

6. Computation and simulation of matter structures and properties
(1) Computational design and physical property prediction of new types of functional materials
(2) Computational simulation of structure and properties of complex system and in extreme conditions
(3) Exploration and application of computation methods

7. Atomic and molecular multi body interaction and physical process under extreme conditions
(1) Atomic and molecular property in high temperature and dense conditions
(2) Highly charged atom, high excitation state atomic molecules and impact process
(3) High precision theoretical method and computation of atomic molecular multi body relevant effect

8. Quantum dynamic process of atomic molecular system
(1) Multi pieces relevance of large molecular system and quantum process of multi bodies
(2) Ultra-fast atomic molecular process and measurement and control of regulated light pulse and quantum state evolution
(3) Physical property of large molecule and cluster system and relevant quantum process

9. Cold atomic molecular physics and precision measurement
(1) Cold atom molecule and ion preparation and control
(2) Cold atomic system and quantum simulation
(3) Measurement of atomic and molecular precision spectrum and physical parameter

10. Optical field regulation and imaging
(1) Nano optical field regulation mechanism and method
(2) Principles and applications of ultra-high resolution optical imaging

11. New type of light source and new spectrum physics and technology
(1) Spectral method based on new light source
(2) EUV and other ultra-short wave length coherent radiation generation and regulation
(3) New mechanism and new technology of photoelectric, electric photo transformation

12. Ultra-fast, ultra strong light physics
(1) Atto second laser generation, measurement and application
(2) Ultra-fast laser regulation techniques and physics
(3) Interaction of ultra-fast strong optical field with atomic, molecular and micro nano materials
(4) Nonlinear optics in relativistic conditions

13. New phenomena in quantum
(1) Strong photon-atomic coupling and cavity quantum electro dynamics
(2) Quantum optical problems in solid state and manmade structures
(3) Quantum optical problems in open system
(4) Quantum opto-mechanical effect

14. Advanced acoustic material and energy converter
(1) Basic physical problems in advanced acoustic materials and energy converter
(2) Acoustic device, sensor and array

15. Spatial and temporal properties of marine acoustic field and its application
(1) Properties of sound propagation, variation and scattering in 3-D uneven marine environment
(2) New method of marine acoustic chromatography and its applications in fast forecast of speed of sound in sea water

16. Generation, propagation, measurement and interaction of sound wave in complex media
(1) Interaction and effect of acoustic wave and matter
(2) New theory and new methods for quantitative measurement and evaluation of acoustic waves
(3) Noise and vibration control in fluid solid coupled systems

In 2014, the Division II of Physics plans to fund 13-15 Key Program projects, ranging from 3 to 4 million yuan per project and 3.8 million yuan on average.

Main research directions are as follows:
1. Frontier issues in basic theory of mathematical physics and quantum information
2. Frontier issuess in statistical physics
3. Frontier issues in theory related to the nature of gravitation
4. New physics of over the standard models

5. Studies on τ charm physics
6. studies on the properties of hadron spectrum and hadron structure
7. Studies on frontiers of heavy ion physics and new forms of matter
8. physics related to Lepton and photon nuclear reaction
9. advanced techniques and experimental methods of neutron physics and its applications
10. Basic research on nuclear technology applications in environment, material and health sciences
11. Studies on physical problems and key technology in nuclear radiation protection and environmental protection
12. Accelerator physics, accelerator physics and advanced technology
13. Nuclear detection and advanced technology of nuclear electronics
14. frontier issues of inertia confined fusion and laser plasma physics
15. Magnetic confined fusion plasma physics and new methods of diagnosis
16. Basic research on low temperature plasma physics and key technology
17. Studies on advanced technologies and experimental methods of synchrotron and neutron scattering

Department of Chemical Sciences

During the first three years of 12th Five-Year Plan period, the number and the funding intensity of Key Program projects supported by the Department of Chemical Sciences were remained relatively stable. In 2013, the Department funded 59 Key Program projects with 179.5 million yuan and 3.0424 million yuan of average funding intensity per project. The duration of each project is 5 years. In 2014, the Department will announce guidelines and accept proposals in 60 research areas, and the average funding intensity will be from 2.0 to 4.0 million yuan for each project. In order to further improve the quality of projects, proposals from those groups and teams with excellent research resources are welcomed, and proposals for interdisciplinary research suggested by teams which have strong background in cooperation are encouraged.

When filling in the application form, the applicant must indicate the selected research area in 'the column of note', and must select the proper discipline code marked in brackets of the research area.

In 2014, the research areas for Key Program projects funded by the Department are listed as follows:

1. Compounds with multi-hole structure and their function

2. Molecule-base oriented functional materials
3. Inorganic solid functional materials
4. Metal coordinative compounds and its catalytic property
5. Basis of bio-inorganic chemistry
6. Basis of applied inorganic chemistry
7. Function of inorganic nano-materials and their application
8. New reaction and new agent in the organic synthesis
9. Control of selectivity in organic reactions
10. Synthesis and catalysis of metal organic compounds
11. Basis of green and sustainable organic chemistry
12. Intermedia in organic reaction and its reaction mechanism
13. Molecular recognition and chemistry of molecular aggregate
14. Material chemistry of organic molecular with function
15. Biological and bionic organic chemistry
16. Interaction between micro-molecule and bio-macromolecule
17. Discovery and modification of bio-active molecule as well as its application
18. Experiment research of structure chemistry oriented by function
19. New methods in theoretical and computational chemistry and their application
20. Physicochemical basis of catalytic materials and catalytic process
21. Research on molecular reaction kinetics
22. Physicochemical basis of colloid and interface
23. Electrochemical basis in the process of energy conversion and storage
24. Physicochemical basis of photochemistry and photoelectrical chemistry
25. Experiment and theoretical research of chemical thermodynamics
26. Experiment research of bio-physical chemistry
27. New spectrum methods used for studying physical chemistry
28. Physicochemical basis in optimized utilization of resource/energy
29. Physicochemical basis of solid and surface
30. Synthetic chemistry of polymers
31. Structure and properties of polymers
32. Polymers with photoelectric function
33. Biological and medical polymers
34. Theoretical computation and simulation of polymer
35. Structure on condensed state of polymers
36. Polymers with echo function
37. New methods of separation and analysis of complex samples
38. Image formation and *in-situ* analysis of living body
39. Analytic chemistry of mono-molecule and mono-cell
40. Analytic chemistry basis of the chemical sensors and bio-sensors

41. New methods and new principle for analysis of controllable nano-micro-fluidics
42. Detection and determination of proteins and their functional study
43. New methods for detecting markers of major diseases
44. Key scientific issues in the area of bio-chemical engineering
45. Chemical engineering basis in the area of foods and medicines
46. Chemical engineering foundation for the high effective clean utilization of fossil energies
47. Chemical engineering foundation in the explore and utilization of new type energies
48. Key scientific issues related to chemical product engineering
49. Design of new materials for chemical engineering and their functional regulation
50. Chemical engineering basis related to the high effective utilization of resources
51. Scientific and engineering basis of typical chemical reaction and scale-up of reactor
52. Scientific foundation for environment and safety of chemical engineering
53. Transfer process and separation process
54. State existed, movement and conversion of permanent pollutants with poison in water environment
55. Interface process of pollutants and biological utilization
56. New methods for pollution control
57. Exhausting characteristics and environmental behavior of chemical pollutants (e.g. PPCPs and so on), and principle of new technology for reducing exhaust
58. Environmental exposure and toxicological mechanism of chemical pollutants and their health risk
59. Chemical modification and functional regulation of bio-macromolecules in the plants

    It is to study of new methods for chemical modification and marker of bio-macromolecule in plants and to explore regulation of its bio-function
60. Research on interfacial material system with bionic, intelligence and super-soakage function and its application

    This is a project cluster, that is encouraged to carry out basic research on interfacial material system with bionic and intelligence function oriented by practical use. Its focuses are to study material composition, micro/nano-structure, as well as relation and rule between them and function through extracting bionic parameters from living system, and to design and prepare new interfacial material with bionic intelligence.

The directions of the project cluster are:
(1) Fresh water collected by using bionic intelligence fiber;
(2) Intelligence nano-material for separation between oil and water;
(3) Anti-biological adherence interface with multi-scale bionic;
(4) Advanced energy conversion material with bionic nano-passageway and assembly of devices;
(5) Intelligence micro/nano-material used for regulating therm-energy.

The 59th research direction in above is a Key Program project driven by disciplinary frontier, while the 60th is a Key Program project cluster driven by Department. The applicant may form his/her research team to apply one of them according to international development trend and combining the basis and interest of self-studying work. When filling in the application form, the applicant should select corresponding code according to mainly studying content. The General Office of the Department will accept and handle the proposals.

Department of Life Sciences

The Department of Life Sciences continues to accept two types of applications for the Key Program. One of them, as the major part in total applications, is guided by designated areas (ADA for short) and the other, which is a complementary part, is to freely select research areas (ANA for short). In 2013，the Department of Life Sciences received 458 applications, among which, 349 applications were for ADA and 321 were accepted, with 61 projects being funded at a funding rate of 19.00%, and 109 applications were for ANA and 102 were accepted, with 21 projects being funded at a funding rate of 20.59% (counting by applications accepted).

In 2014, the Department of Life Sciences will continue to accept applications for ANA, so the applicants should read carefully the type of acceptance in each subject of this *Guide to Program*. Subjects which will accept the projects in two patterns (both ADA and ANA) include 10 subjects: microbiology, botany, forest science, biophysics, biochemistry and molecular biology, neuroscience, cognitive science and psychology; genetics and bioinformatics; cell biology, developmental biology and reproductive biology; plant protection; horticulture and plant nutrition. Tensubjects will accept the projects only for ADA, and refuse application for ANA, including ecology, immunology, biomechanics and tissue engineering; physiology and integrative biology; basic agriculture and crops, food sciences; zoology;

animal husbandry and grassland science; veterinary and aquatic science. Applicants should carefully read the application requirements, notes, and the funding plan of the department in this chapter for Key Program in 2014, to apply for the Key Program in line with the requirements of this guide. Moreover, since the research areas in the Department of Life Sciences covers biology, basic medicine and agricultural science, the designated areas of key program in each subject is closely related with the funding scope of the subject. Please note that applicants should correctly apply for the Key Program according to the funding scope and the category not supported described in the General Program part of this *Guide to Program*. The rules for categories not funded by the General Program will also apply to the Key Program.

Applicants for ADA should correctly fill in the corresponding application code listed in each Division when writing application. Proposals for ANA may choose autonomously the application code pertaining to its research content. The concrete requirements for application to the Key Program projects of life sciences are as follows:

(1) Applications to the Key Program projects in designated areas (ADA).

For designated areas, applicants should propose research topics and compose application texts in reference to the guidelines of designated areas issued by the Department in 2014. In the column of Annotations on the basic information table of the application form, applicants should fill in the applied research areas, and fill in the corresponding application code lined out in each Division's designated areas correctly. Please note that the designation of application codes for the Key Program projects is just done for the sake of efficient management, whereas the application codes appointed may not include all the research contents of the designated areas, so applicants should not be restricted by the application codes appointed in ascertaining their research themes according to the relevant contents of designated areas.

(2) Requirements for Applications to Key Program projects for free application of non-designated areas (ANA).

Applicants who have achieved great progress, and urgently in need of key support, while their research contents is not included in ADA of the Department of Life Sciences this year. Study belongs to the area of new frontline or new orientations of the subject, and which is not covered in ADA of the year, and applicants have sound basis of research work in this field, and urgently need intensive support in order to further their research.

Applicants for this category shall specify with "Application for Free Areas" in the column of "Annotations". Moreover, a statement with about 800 Chinese characters on the important innovative progresses already achieved is required in addition to the routine application text for ANA. In the statement, applicants are required to elaborate and emphasize the rationale for ANA, the important innovative progress closely related to this application, relevant research basis and papers published in international important academic journals, etc. Papers representing the "significant progress achieved" in the application should be those published in recent years, and applicants must be the first author or corresponding author.

(3) Applicants for the Key Program (including both ADA and ANA) of the Department are required to attach the first pages of five representative papers relating to the applications.

In 2014, based on the overall arrangement for the Key Program of NSFC, the Department will arrange a budget of 250 million yuan, and support about 83 Key Program projects. The funding intensity is around 3 to 4 million yuan per project, Applicants should put forward reasonable budget according to the actual needs of their research. Besides, in filling in the budget in the application, applicants need to add detailed justification for the budget in the proposal for the peer review and final approval of funding. Applications will not be approved for funding without such budget justifications or with obviously unreasonable budget. The duration of the Key Program project is 5 years.

The designated areas of each Division in the Department of Life Sciences in 2014 are as follows:

1. Biological characteristic of important human pathogenic microbe and its pathogenesis
2. Division, differentiation of plant cell and regulation mechanism of organ formation
3. Biodiversity function and its maintaining mechanism of ecosystem
4. Degeneration and restoration of ecosystems
5. Formation, increase and maintaining mechanisms of forest productivity
6. The structure, function and regulation mechanisms of non-coding RNA
7. Cellular and molecular mechanisms of immunological tolerance
8. Cell and molecular regulation of immunological recognition
9. Biology/mechanic mechanisms of interactions between biomaterial stuff and organisms
10. Multiscale, multimode biomedical image and signal transduction
11. Physiological and pathological mechanisms of cell functional

abnormality
12. Interaction between tissues(or organs) during the maintaining of organism function stability
13. Development of nerve cells and its function
14. Molecular genetic basis of quantity or complex traits
15. The establishment and maintaining mechanism of cell polarity
16. Epigenetic regulation mechanisms of organ development of model organisms
17. Formation and its regulation mechanisms of important agricultural traits of crops
18. Response and resilience mechanisms of crops to abiotic environment
19. Biological basis of food processing
20. Occurrence, migration and control of hazardous substance of food
21. Immunological mechanisms of crops
22. Response mechanisms and control of gardening crops to adversity
23. Physiological and molecular mechanisms of domestic animal reproduction
24. Gastrointestinal microbesof domestic animals and nutrient metabolism
25. Etiology of important epidemic disease of poultry and its infectious mechanisms
26. Basic research of new method of testing animal epidemic diseases
27. Etiology of aquatic animals and the anti-diseases mechanisms of host
28. Genetic basis of good traitsof aquatic animal
29. Biogeography of important fauna
30. Reproduction biology of rare and endangered animals

Moreover, in view of the problems existing in the past, the Department particularly reminds applicants of avoiding any of the cases listed below in 2014. Otherwise, their proposals may be refused during the preliminary checking procedure:

(1) Applications for ADA do not specify the title of designated research areas in the column of “Annotations” of the basic information table in the application text.
(2) Applications for ADA do not fill in the corresponding application code claimed by this guide.
(3) Applications for ANA do not specify “ANA” in the column of “annotations” of the basic information table in the application text.
(4) Applications for ANA do not offer an around-800-Chinese-character description about the important innovative progresses already achieved claimed by this guide.
(5) Applicants for Key Program projects (including both ADA and ANA) do

not attach the requested first pages of five representative papers to the application documents.

(6) Applicants applying for ANA to certain disciplines but the division do not accept such ANA applications.

(7) Similarity or overlapping with projects already funded by the National Program on Key Basic Research Project (973 Program), National High-Tech R&D Program of China (863 Program) etc., and National Science Fund for Distinguished Young Scholars.

(8) Applications indicate the designated areas in the "Annotation" column, but the actual research contents do not match the scope of funding.

(9) Applications submitted by applicants who are still working abroad, or who cannot ensure necessary time and efforts for implementing the proposed research in China.

For other issues to be noted for writing applications, please refer to the guide to the General Program projects of the Department of Life Sciences.

Department of Earth Sciences

The Department of Earth Sciences announces the guideline for the Key Program according to the major issues in the priority funding areas in earth sciences for the 12th Five-Year Plan period. The criteria to identify priority areas are as follows: (1) to analyze the international trend of the frontier development of the Earth science, to include related results of strategic researches concerned, and to take in account of the inherit of the former priority areas during the 11th Five-Year Plan; (2) guided by the major scientific issues, to put more emphasis on basic and frontier research; (3) with consolidated basis, showing the scientific promising prospection, promoting interdisciplinary research, to foster or even drive the progress of Earth sciences and advance the research level and international role for the Earth science research in China; (4) to pay attention on the major scientific issues related to the economic and social sustainable development of China, and to exert far-reaching impacts on the society and economy. According to the scientific issues listed in the following specified areas, applicants are free to determine their research topics, goals, technical approaches and budget on the basis of summarizing research work carried out both domestically and internationally as well as stating clearly the new breakthrough points and ways for research.

For applicants, previous experience related to the proposed work must be

stated in detail in the proposals. In the part of CVs, working experience, education, former NSFC grants (and results) and publications of all the PIs and co-PIs must be listed in detail. In the publication list, papers published and in press must be listed separately. For the published papers, all of the authors, paper titles, issue numbers of the journals and pages must be presented. All the publications must be classified as books, journal papers, conference papers, etc. In addition, the first pages of 5 representative publications must be attached to the hard copy of the application.

The relevance and academic contribution to the specific priority area must be stated in the proposals. To avoid duplication in funding, applicants shall state clearly the relations and differences between the research and related projects funded by other national agencies.

As one branch of fundamental sciences, the research object of earth sciences is the complex planet of the Earth. The challenges emerging from the research in the past, present and future of the earth system and its habitability have well beyond the capability of any single traditional discipline. Interdisciplinary research has become the fertilizer for innovative ideas and original innovation. It is expected that scientists from various disciplines of earth sciences and scientists from other research areas such as mathematics, physics, chemistry, biology, materials and engineering sciences, information sciences and management sciences jointly provide your proposals for the Key Program in the Department of Earth Sciences. The application codes for interdisciplinary study should be filled in the application form.

In 2013, the Department of Earth Sciences received 430 proposals for the Key Program, and 76 were funded with a total of 232.1 million yuan. In 2014, about 80 projects will be funded, with a preferred range of 300 to 500 million yuan. The required research period of a Key Program project is 5 years.

Special notes for applicants: in 2014, titles of 11 themes to accept proposals for the Key Program in the Department of Earth Sciences are as follows: “Environmental evolution and life processes on the planet Earth”, “Origin, evolution of the continents and geodynamics”, “Theoretical studies on the forming process and exploration of mineral resources, fossil energy”, “Process and mechanism of weather, climate and atmospheric environment change” , “Global environmental change and multi-sphere interaction of the Earth”, “The effect of human activities on environment and its mechanism”,

"Processes and mechanisms of the changes in terrestrial surface system", "Evolution and regulation of the water and soil resources", "Marine processes, resources and environmental effects", "Solar-terrestrial space environment and space weather", and "Earth observation and information processing".

In regard to the problems emerged when applying Key Program projects, applicants must fill in "Annotations" in the proposal sheet with ONE of the above 11 titles of the themes. Proposals with incorrect "Annotations" or without "Annotations" will not be accepted.

1. Environmental evolution and biological processes on the planet Earth

The scientific objectives of this field include: Reevaluating the processes of major geological events and their environmental implications under the consistent high-resolution temporal framework based on the complete stratigraphic sequences and diverse fossil resources from China and multidisciplinary studies from geochemical, sedimentological, mineralogical, tectonic, paleontological and geobiological aspects, maintaining the advantage levels in our established directions, and striving to obtain achievements with originality in solving major scientific issues in geosciences.

Key scientific issues:

(1) Systematic paleontology of major fossil groups
(2) Macroevolution of life and high-resolution integrative stratigraphy
(3) Environmental backgrounds for global changes during critical transitions
(4) Life in extreme environments, geomicrobiology
(5) Biomarkers and their environmental implications
(6) Biogeochemical processes and evolution of surface environment

Research orientations in 2014:

(1) Biodiversity and evolution of ecosystems during critical transitions
(2) Reconstruction of life evolution and environment under the high-resolution temporal framework
(3) Origin and systematic evolution of important fossil groups and their environmental implications
(4) Geomicrobiology, biogeological processes and their environmental implications
(5) Biogeochemical processes in the Earth's history
(6) Life in extreme geological environments and its adaptive mechanisms
(7) Process of sedimentation during critical geological period

About 6 to 8 projects will be funded.

2. Origin, evolution of the continents and geodynamics

Scientific objectives: Research on the origin, evolution and geodynamics is an important approach to better understand the processes inside the Earth, and also a theoretical support for the natural hazard mitigation and natural resource capability. How the deep Earth components work and how the surface be affected by geodynamic processes are challenging issues faced by Earth sciences. The challenges for scientific innovation includes: accurately describing the spatial and temporal trajectory of the movement of the continental materials, calculating and correlating their links, establishing a basic framework to characterize the structure and evolution of the continents in the global scale, in the temporal and spatial dimension, and from the surface to deep mantle for understanding the history of the Earth, and predicting the effects on the natural resource, hazard and environment.

Key scientific issues:

(1) Crust-mantle structure, composition and interaction
(2) Origin and evolution of the continents and intra-continent processes
(3) Continental collision and geodynamics of the orogenic belts
(4) Interaction between the oceanic plate and continental margins
(5) The coupling of the deep Earth and surficial process

Research orientations in 2014:

(1) 3-D structure of the crust-mantle and deep-Earth dynamic process
(2) 3-D structure of mantle velocity discontinuity, lithosphere-asthenosphere interaction and inter-layer material exchange
(3) Forming, growth and rebuilding of the continents
(4) Dispersion of the continent and the role of mantle plume
(5) Rheological property of the continent and its effect on the continental deformation
(6) Convergence of plates and the dynamic of the orogenic process
(7) Basin and range system evolution and basin dynamics
(8) Oceanic plates and continental margin (and marginal sea) process
(9) Relation between the deep Earth and surface process
(10) Mechanism of magmatic activities and metamorphic process
(11) Deep Earth fluid and water-rock interaction
(12) Volcano and geothermal activities and related deep processes
(13) Cenozoic structural deformation, seismogenic process and geoharzard mechanisms

(14) Correlation and interaction between the Earth and near earth objects
(15) Experimental petrology and simulation of geological processes

About 6 to 8 projects will be funded.

3. The formation mechanism and the application of detection methods for mineral resources and fossil energy

The scientific objectives of this field are to realize the breakthrough of the metallogenic theory in shallow crustal structures using ore field tectonic analysis, regional ore-forming fluid tracers, unique metallogenic system and continental geodynamics; to carry out research on large-scale basin dynamics associated with oil and gas accumulation theory and non-conventional natural gas reservoir forming dynamics; to improve oil and gas geological system theory which is suitable to the complex geological conditions in China; to establish and improve the detection method and the theory of concealed ore deposits and deep oil and gas reservoirs; to reveal the evolution characteristics of regional groundwater flow system and identify factors influencing formation and evolution mechanisms of the groundwater dynamic field and chemical field.

The main research direction in this field as follows: continental geology and mineralization; metallogenic models; metallogenic system and mineralization mechanisms; the dynamics of sedimentary basins and hydrocarbon accumulation; regional groundwater hydrology and environmental geology evolution; deep and large deposit (pool) ore-bearing information detection and extraction.

Key research directions to be supported in 2014:

(1) The massively enrichment mechanism of the ore-forming materials in sedimentary basin and magma systems.
(2) Mineralization and metallogenic regularity of unique metallogenic units.
(3) Metallogenic specialization in different continental geo-dynamic environments.
(4) Regional fluid system tracing and metallogenic system evolution in areas where large ore bodies are concentrated.
(5) The characteristics, structural model and exploration indicators of different types of metallogenic system.
(6) Regional geo-dynamics evolution of large basin and hydrocarbon accumulation.
(7) Systematic evolution of the Earth and the sedimentary environment of

hydrocarbon reservoirs in basins.
(8) The formation, evolution mechanism, geophysical response and characterization of concealed mine and deep, non-conventional oil and gas reservoirs.
(9) The principle and method of ore bearing information detection and extraction of large, deep ore deposits.
(10) The regional groundwater flow system and the space distribution law & detection theory of groundwater.
(11) Groundwater hydrological process and its evolution in different geographical units.

About 6 to 8 projects will be funded.

4. Process and mechanism of weather, climate and environment change

The scientific objectives of this research area are to investigate various physical, chemical and biological processes of disastrous weather and climate dominated by climate system, to understand their spatial and temporal characteristics, variability rules, mutual relations and physical mechanisms, to obtain early symptoms of significant weather and climate events, to improve the accuracy of weather forecast, and to develop new versions of climate model, forecasting methods and climate prediction theory. During the 12th Five-Year Plan period, innovative studies shall focus on the process of climate system, theory of modeling and prediction, theory of dynamics and predictability of disastrous weather, atmospheric chemistry, boundary layer physics and atmospheric environment, middle and upper atmospheric dynamics, cloud and mist physics, and so on. Significant and advanced progress in the mechanism of weather and climate system change is expected.

Key scientific issues:
(1) New theories and methods for critical atmospheric variables detection, observations system optimization and data integration
(2) Dynamical mechanism and predictability of the weather and climate change
(3) Processes of atmospheric physics and atmospheric chemistry, as well as the mechanism of their mutual influences
(4) Interactions among weather variations, climate change and atmospheric environment in Asia
(5) Exchange and cycling between substance and energy in climate system

Research orientations in 2014:
(1) New theories and methods for critical atmospheric variables detection
(2) Data integration among the atmospheric and other observations of the earth system
(3) Numerical coupled model Development
(4) Evolution and dynamical mechanism of weather and climate systems
(5) Process andmechanism of regional air pollution
(6) Research on the dynamical-physical-chemical-radiative processes within the planetary boundary layer, the middle or upper atmospheric levels, and those interactions between the middle and upper atmospheric levels.
(7) Interactions among ocean, land and atmosphere in Asian Monsoon area and their impacts on climate system
(8) Impacts of the climate change on the ecology, hydrology and cryosphere, etc.

About 6 to 8 projects will be funded.

5. Global change and interactions among different spheres of the Earth system

The scientific objectives of this area are to improve the understanding of global change regulations and future change trends, and explain the cause of formation of global change and its current situation and future prediction by focusing on key scientific issues in the Asian monsoon and arid regions for providing scientific and technical supports for addressing the enormous environment problems and challenges faced by human society.

Key scientific issues:
(1) Environmental system in the Asian monsoon and arid regions and global change
(2) Regional water cycle (including the cryosphere) and climate change
(3) Dynamical variations of the sea level and sea-land transitional belt, as well as their future trend regulations
(4) Key processes of the biosphere, mutual feedback with other spheres, as well as elemental biogeochemistry cycle and Earth system
(5) Causes of the global change induced by natural and anthropogenic activities
(6) Key scientific issues in Earth system simulations

Research orientations in 2014:
(1) Causes of formation of decadal-to-centennial-scale Asian monsoon system

(2) Characteristic and mechanism of the typical climate events in warm periods in Asia
(3) Regulations of regional water cycle and the linkage to climate change
(4) Regulation and mechanism of precipitation and dry-wet transform in westerly areas
(5) Mechanism of the marine environment change and its interactions with the climate system
(6) Key processes of the biosphere under the background of global change
(7) Characteristics of the biogeochemical cycle, and the interactions with the climate system
(8) Causes of the global change induced by natural and anthropogenic activities
(9) Causes and mechanism of global warming within the recently 10-15 years.
(10) Development in the Earth system model and relevant simulations
(11) Short-term Prediction or long-term projection of the global climate change

About 6 to 8 projects will be funded.

6. Mechanisms of human activities' effect on environment

The scientific objectives of this area are to study the effect mechanisms of human activities on environment, such as industrial and agricultural production, infrastructure construction, resources and energy exploitation, urbanization process etc., by multi-disciplinary and intercrossing disciplinary research, and understand the role of human activities in global and regional environmental evolution and the potential catastrophic consequence in the Earth system caused by human activities, for providing scientific basis to reduce global disaster, protect earth environment and promote sustainable development of society with the guidance of the scientific development concept of human-nature harmonization.

Key scientific issues:

(1) Earth engineering and global changes; environmental effects of resource utilization
(2) Mechanisms of environmental impact due to major geological disasters and large-scale engineering activities
(3) Regional environmental process and control; interactions between natural processes and human activities
(4) Regional sustainable development

Research orientations in 2014:
(1) Revitalization of cultivated land, change of land use and their environmental effects
(2) Urban and regional development and the environmental changes
(3) Process of groundwater pollution and its environmental remediation
(4) Environmental process of pollutants and impact mechanisms of ecological health
(5) Geological environmental and hazardous effect in major infrastructural projects and major geological disaster prevention and control
(6) Mechanisms of geological hazards caused by the exploitation of resources and prevention and control
(7) Vulnerability and recoverability research of the system with the Earth's surface, human activities and environment

About 6 to 8 projects will be funded.

7. Processes and mechanisms of changes in terrestrial surface system

The scientific objectives of this field are to reveal the interaction mechanisms, interfacial processes and their tempo-spatial evolution principles of key components, such as water, soil, air and organisms, in the terrestrial surface system, to enhance the understanding of relations between structure and function of terrestrial surface system, and elucidate the interaction processes and coupling mechanisms between human and nature for providing the scientific basis to the regional sustainable development.

Key scientific issues:
(1) The interaction and interfacial processes of key natural components on the terrestrial surface
(2) Migration and transformation processes of terrestrial surface materials
(3) The coupling processes of natural and human components
(4) Theory and methodology of integrated researches about the terrestrial surface system

Research orientations in 2014:
(1) Interactions between climate and landform, and the environmental and disaster effects
(2) Processes and effects of cryosphere
(3) Geomorphologic processes and regional geomorphologic evolution
(4) Interactions between soil and vegetation and their spatial heterogeneity
(5) Biogeochemical cycle processes of key zones in the terrestrial surface system

(6) Migration and transformation of materials in typical ecosystem
(7) Mechanisms of ecosystem degradation and restoration
(8) Ecosystem processes and services
(9) Interaction mechanisms between patterns and processes of terrestrial surface system
(10) Scaling and scale effect in key geographic processes
(11) Synthetic integration and simulation of terrestrial surface system processes

About 6 to 8 projects will be funded.

8. Evolution and regulation of water and soil resources

The scientific objectives of this field are to elucidate the evolution processes of water and soil and their coupling mechanisms, to reveal the principles of formation and evolution of water and soil resources, and to develop the sustainable using approaches and conservation patterns of water and soil resources.

Key scientific issues:
(1) Soil processes and evolution
(2) Soil quality and resource effect
(3) Watershed hydrological processes and their ecological effects
(4) Formation mechanisms of regional water cycle and resource
(5) Coupling of regional water and soil resources and their sustainable utilization

Research orientations in 2014:
(1) Tempo-spatial variation of soil properties and informatization of soil resource
(2) Interaction mechanisms and effects of soil processes
(3) Soil biodiversity and its function
(4) Nutrient elements cycle and fertility evolution of soil
(5) Mechanisms of soil degradation and soil remediation
(6) Soil quality and safety and regulation of agricultural products
(7) Regional soil erosion and conservation of water and soil
(8) Hydrological processes of ecosystem, cryosphere and frozen soil
(9) Watershed hydrological processes and their simulation
(10) Interactions between ground water and surface water
(11) Environmental effects and regulations of water and soil under the intensive land use
(12) Carrying capacity and safety of regional water and soil resources

(13) Valuation and ecological compensation of water and soil resources
(14) Formation and transformation of regional water resource

About 6 to 8 projects will be funded.

9. Ocean processes, resources and environmental impact

Scientific objectives: Applications should be focused on the scientific problems closely related to the key national demands and international research frontiers. The marginal sea along the Asia continent as well as the adjacent open ocean should be the key regions to be studied. By studying the oceanic physical, chemical, geological and biological processes as well as the interactions among them on different timescales and spatial scales, the researches should enhance the understanding on the oceanic processes and mechanisms, promote the fundamental research on oceanology in China and extend ocean researches in China from marginal seas to deep oceans.

Key scientific issues:
(1) Multi-scale processes in the western Pacific Ocean and the interactions between the low and high latitudes
(2) Ocean-Continent interaction in the maritime China
(3) Oceanic microbiologic and biogeochemical cycle
(4) Oceanic ecosystem and eco-security
(5) Theory on mineral deposits of resources on the ocean bottom
(6) Environmental change and related oceanic process in the polar regions

Research orientations in 2014:
(1) Dynamical mechanisms of the meso-small scale ocean processes
(2) Multi-scale air-sea interactions and their impact on the regional climate
(3) Shelf circulation and mass transport
(4) High resolution recording the environmental evolution in the marginal seas and the comparison of ocean-continent records
(5) Marine magmatism and tectonic evolution
(6) Formation of oil-gas system in the deep ocean and the subsidence processes
(7) Environmental impacts of development and utilization of submarine resources
(8) Biogeochemical cycle of carbon, nitrogen, sulphur and phosphorus from microbiology
(9) Ocean physical-biogeochemical interaction
(10) Carbon cycle and ocean acidification
(11) Process and mechanism of coastal ocean environmental evolution and

ecosystem disaster
(12) Adaptation mechanism of marine biology to environmental changes
(13) Oceanic process and ecosystem evolution in the Antarctic region

About 6 to 8 projects will be funded.

10. Sun-Earth space environment and space weather

The scientific objectives of this area are to form a theoretical frame of the global cause-effect chain of space weather processes so as to achieve new original knowledge based on the study of space weather processes among the different layers of the solar-terrestrial system; to establish the cause-effect chain model of the space events and develop the integrated method for prediction based on physics for serving the safety of astronautic activities; to conduct the interdisciplinary research with mathematics, physics, information, material and life sciences on the exploration of the mechanism of space weather effects on human activities for providing scientific basis in the policy making of administrations; to develop new concept and method in space explorations and new schemes of space weather satellite series for a new era of space weather study; to encourage fundamental research on space weather combined with national key projects; to encourage analysis, theoretical and simulation study based on the newest space borne or ground-based data from both home and abroad; to encourage studies on the space weather by using of the data from the 120^{o} E Meridian Project observations and to encourage studies on hazardous space weather events during the 24^{th} solar cycle.

Key scientific issues:
(1) Basic space weather physical processes
(2) The coupling among solar-terrestrial space
(3) Space weather modeling
(4) Effects of space weather on human activities

Research orientations in 2014:
(1) Solar driving source of space weather, related physical mechanisms and activities during the solar cycle 24
(2) Fundamental physical process in space weather and Sun-Earth connection
(3) Multi-scaled spatial and temporal structures in solar wind, magnetosphere, ionosphere and upper atmosphere; their evolution and couplings
(4) Prediction model and method in space weather, early warning of

hazardous space weather
(5) Investigations of effects of space weather on astronautics, telecommunication, navigation, materials and human health
(6) New concept, principle, method and technique in space weather exploration, project pre-research in space exploration
(7) Theory of geodetic survey, and the process and mechanism of mass transport of the Earth
(8) New theory and techniques for integrated geodetic observation by land, sea, air and space-based Earth observation systems
(9) Theory of multi-source geodetic data fusion and its applications
(10) New theory and methodology for time-variable geodesy and theory of geodetic inversion

About 4 to 6 projects will be funded.

11. Earth observation and its information processing

The scientific objectives of this field are to orient toward the scientific research and synthetic monitoring of the Earth system based on the researches about the scientific issues in fields of the Earth observation, GIS and GPS, develop the basic theory and methodology of the data acquisition, processing and analysis originated from the Earth system elements observation, construct parameter set of geometric and physical boundary conditions in the Earth system analysis and simulation, and provide scientific and technical supports for promoting the ability of cognition and early-warning about the Earth system and resolving the key issues in resource, environment, ecology, hazard, human health and public security faced in the sustainable development.

Key scientific issues:
(1) Surface effects and transmission mechanisms of electromagnetic wave
(2) Distributed and reconfigurable Earth observation and synthetical Earth observation system
(3) Confirmation and maintenance of high precision time benchmark and space datum
(4) Geo-spatial cognition, tempo-spatial information model and theory of digital earth construction
(5) Multi-source Earth observation data fusion and synergistic inversion and assimilation of the Earth system parameters
(6) Multi-dimensional tempo-spatial processes analysis and synthetic simulation and prediction and warning of the Earth surface system

Research orientations in 2014:

(1) Interaction mechanisms between electromagnetic waves and complex land surface and theory of remote sensing modeling
(2) High precision inversion model and parallel efficient computing method of global Earth surface parameters
(3) Theory and methodology of the remote sensing inversion of complex Earth surface parameters, and the validation in remote sensing inversion products
(4) Theory and methodology of determination of high precision time benchmark and space datum
(5) Tempo-spatial framework and its construction theory and method for the digital Earth and smart Earth
(6) Model and structure of new spatial-temporal GIS data
(7) Geographical data sampling and spatial-temporal statistical analysis method
(8) Methodology of the assessment and integration of ubiquitous geographic information
(9) High precision remote sensing inversion of atmospheric composition and footprint analysis of greenhouse gases
(10) Remote sensing analysis and systematic simulation of the cycle of global water, carbon and nitrogen
(11) GIS analysis and simulation of human and natural processes

About 4 to 6 projects will be funded.

Department of Engineering and Materials Sciences

In 2013, the Department received 364 proposals for the Key Program, and among them, 82 proposals were supported in 83 fields including 3 Key Program projects in the prioritcy areas of the Department. The total funding is 248.3 million yuan and the average funding is 3,028,000 yuan per project.

Up to 80 projects will be supported in 2014 in 82 fields with an average funding of 3 million to 400 millionyuan per project for 5 years.

Key Program projects of the respective Divisions as follows:

1. Design and micro-structure regulation of high-performance steel materials
2. Preparation, performance and related scientific issues of intermetallic

compounds based on new features
3. Magnetic or/and electrical properties and related mechanisms of new metallic materials
4. Toughening mechanisms and high-temperature performances of metal matrix composites
5. Interactions and protective mechanisms of metallic materials in special environments
6. Preparation, performance, and computer simulation of nuclear materials
7. Performance enhancing and key issues of metallic intelligent materials
8. Key scientific issues of metallic biomedical materials
9. Key scientific issues of metallic microelectronic materials
10. Fundamentalresearch on the nano-piezo electronics and devices
11. Research on key materials ofhigh-performancelithium-air batteries
12. Basic research on inorganic-organic hybrid infrared nonlinear optical materials
13. Exploration inthe photoelectric effect and ultraviolet detector of two-dimensional atomic crystals
14. Research on the meso-scales split-phase evolution rule of ceramics
15. Basic research on the hierarchical porous carbon materials based on biological templates
16. Basic research on high performance rare-earth doped nitride luminescent materials
17. Structure design and property manipulation of broadband-spectrum laser materials
18. Basic research on low temperature preparation technology of ceramic/glass ceramic materials
19. Controllable growth and strengthening and toughening mechanism of carbon nanotubes in C/C composite preforms
20. Basic research on the chemistry of polymer materials: improve the material properties through molecular design
21. Basic research on the relationship between structure and properties, and the structure regulation of polymer materials
22. New theories and new methods for polymer material processing (including micro-nano processing
23. Basic issues on biomedical polymer materials
24. Fundamental research on opto-electronic organic polymer materials and devices with high efficiency and stability
25. Basic research on polymer materials related to energy, environment and resource utilization
26. Structure regulation of polymer composites and their properties
27. Research on key technology of marine deep water drilling

28. Mechanism of low permeability unconventional gas extraction
29. Surrounding rocks breaking and stability control of deep (tunnel) roadways
30. Theory and application of safety science
31. Research on key technology of deep submarine metal mineral mining
32. Physical separation theories and methods of secondary resources
33. Energy saving and control of long life and large-scale aluminum electrolytic cell
34. Physical chemistry in pressure hydrometallurgy
35. High pressure metallurgy theory of the special steel process
36. High-performance titanium alloy under multi-field
37. Preparation theory of amorphous alloys (glassy alloys)
38. Innovative principle and performance synthesis of modern mechanisms and machines
39. New principle and methodology for efficient and precise actuation and transmission
40. Theory on the stability and assurance of complex electromechanical system
41. Failure mechanism and reliability design of typical parts/components
42. Mechanical surface/interface behaviors and the control mechanism
43. Innovative design theory and methodology for electromechanical system
44. New principle and method for bio-manufacturing and bionic manufacturing
45. Novel principle, method, process and equipment for integrated high-performance precision manufacturing
46. Novel theory and method for high energy-density beam and nontraditional energy field manufacturing
47. Theory/technology/methodfor high efficiency and precision machining of parts/components
48. New process, equipment, and mode for digital and intelligent manufacturing systems
49. Novel principle and methodology for mechanical measurement and sensing systems
50. Thermodynamic system analysis, control and optimization for energy conservation
51. Turbulent flow mechanism and flow control in fluid machinery
52. Research on mass and heat transfer in power systems
53. Research on flow and combustion in power plant
54. Mechanism of combustion, pollution and emission reduction of solid fuel
55. Thermo-physical issues of multi-phase fluid under the special

environment
56. Key thermo-physical issues on the utilization of renewable energy
57. Interdisciplinary research on thermo-physical problems
58. Fundamental research on high efficient conversion and large scale storage of electric power
59. Key issues on the pulse power and discharge plasma
60. Fundamental research on the advanced power transmission equipment and related electric materials
61. Key issues on the smart grid
62. Fundamental research on electromagnetic-biological effects
63. Key issues on the efficiency and reliability of power electronic devices and its system
64. Principles and methods of urban planning for typical disasters
65. Improving principles and methods of urban climate
66. Energy-efficiency design methods of large-space buildings in typical climates
67. Conversion processes and control principles of the nitrogen-containing pollutants in urban water supply systems
68. Process mechanisms and working principles for novel electrochemical wastewater treatment technologies
69. Novel technologies and their working principles for the advanced treatment of toxic, hazardous and bio-refractory substances in municipal wastewater
70. New types of structural systems and their design theories for civil engineering
71. High performance or recycled materials and structures of civil engineering
72. Geotechnical problems in major sea-crossing transport infrastructure
73. Damage mechanism and performance control of engineering structures under hazard loads
74. Agricultural water transform and its efficiency improvement
75. Evolution and conservation of eco-hydrological system of large reservoirs or lakes
76. Dynamics and mitigation of flash flood
77. Characteristics and mitigation of urban flood and inundation
78. Flow instability and its controlling in centrifugal pumps
79. Dynamic catastrophe and its controlling in surrounding rocks for nuclear power plant
80. Slope deformation and failure as well as slope protection
81. Performance evolution of concrete dams in whole life cycle
82. Structure strength or performance and reliability for bathy vessel

Department of Information Sciences

In 2013, the Department of Information Sciences announced 68 areas and 4 priority funding areas for the application of the Key Program, and received 273 applications, of which, 82 projects were funded with a total of 237 million yuan, and average funding intensity of 2.89 million yuan per project. The success rate is 30.04%

In 2014, the Department announces 67 areas for application, of which 4 areas are the departmental key funding areas. 70-85 Key Program projects will be funded with average funding of about 3.5 million yuan per project for 5 years. Applicants should follow the guidelines for research directions in relevant areas, in accordance with the trend of development in the research area and basis of their research team and the actual research object or process, propose key scientific problems and conduct systematic and in-depth theoretical studies or experimental verifications. Apart from high level papers, research results should be verified in experimental system or in practical applications.

Please provide proper application code in the application form, and refer to NSFC's website: http://www.nsfc.gov.cn/ for details.

The deadline for proposing areas of the Key Program for 2015 is April 30, 2014; please refer to the department website
http://www.nsfc.gov.cn/cen/oo/kxb/xx/tztg.htm for details.

Key priority funding areas of the Department

1. Basic research on the hydro acoustic sensor network for mobile node
The development of underwater communication and sensor network are greatly required by the marine environment monitoring, marine resources exploitation and the protection of national marine right and interests. This cluster of projects plans to study basic scientific problems such as large time delayed reliable transmission in dynamic variable hydro acoustic channel, high speed hydro acoustic transmission in limited band width, automatic connection of large scale random dynamic nodes and efficient group network in limited resources, as well as to develop basic platform and research environment for important applications of monitoring of light underwater vessels, so as to promote the development of hydro acoustic sensor networks in China.

Main research directions include:
(1) Data acquisition and reliable transmission for mobile node of underwater sensors
(2) Theory and key technology for high speed communication in underwater node
(3) Basic research on automatic connection of underwater multi dynamic nodes

2. Researches on the challenging problems in big data technology and application

Wide existence and explosive growth of massive, heterogeneous and mixed big data has given unprecedented challenges to the transmission, storage, computation and applications of data processing techniques. How to transmit accurately, store and compute various big data and dig up valuable knowledge from the existing or dynamically changing big data becomes an urgent problem. This key cluster of projects plans to ask applicants to consider specific application, break the limit of traditional research ideas to develop novel method and new technologies that meet the needs of big data transmission, storage, computation and processing; major research results should be verified on specific big data set. About 8 projects will be funded.

Main research directions are:
(1) Theory and method of expression, reasoning and online learning of knowledge from big data
(2) Method of big data analysis based on cognitive computation
(3) Theory and method of granular computation for big data
(4) Analysis, push and display of complex multimedia content in big data environment
(5) Theory and method of evaluation criteria od big data management system
(6) Theory and method of efficient transmission of multilevel multi region network big data
(7) Efficient storage and management of big data
(8) Architecture and key technology of time efficient computation of big data
(9) Discovery of big data structure and relationship and simple computation method
(10) Prediction and control of complex system behavior based on big data

3. Photon integration technology for optical interconnection on chips

This key cluster of projects is to study optical interconnected core

photoelectric devices and the integration technology on high speed chips, as well as properties of new types of photoelectric functional materials, and explore new mechanism and new technology in the regulation, reuse and reception of wide band optical signals, and the integration technology of active and inactive multifunctional photoelectric devices.

Main research directions are:
(1) High speed optical regulation technology based on new types of photoelectric functional materials
(2) Reuse technology and core optical devices for optical interconnection
(3) Integrated chip technology for high speed optical receivers
(4) Integrated chip technology for multifunctional active and inactive photoelectric devices

4. Middle inferred laser light source

Laser at 2 ～ 5μm band has important applications in medical, communication, remote sensing, bioengineering, and pollution monitoring areas. This key cluster of projects plans to support studies on acquiring laser light sources in this bandwidth using various methods.

Main research directions are:
(1) 3 micro band high power antimonite quantum well laser
(2) Basic problems of 3 micron band high power ceramic laser
(3) Studies on middle inferred laser based on cascade structure
(4) Key technologies for high power middle inferred Raman optical fiber laser

Key funding areas by Divisions as follows:

1. Bio mechanical measurement, analysis and simulation of human body movement
2. Plasma sheathe model for near space hypersonic aircraft and its electromagnetic properties
3. High flux integrated measurement method and technology for bio and physical chemical properties of cancer cells
4. Modeling and fast algorithm of multi physical process in electro-magnetic excitation conditions
5. Method of analyzing cognitive functions based on task operation in micro gravity environment
6. Security analysis of new types of communication network systems
7. Theoretical studies on the security at physical level for information transmission in wireless communications

8. Basic theory and key technologies for integrated optical fiber and wireless access systems
9. Structure and key technology of future wireless network access
10. Theory and key technology for marine wireless transmission and mobile communication networking
11. Theory of super resolution imaging associated microwave staring based on spatial and temporal 2-D random radiation field
12. Multi angle SAR imaging theory and method
13. Key technology for modeling visual characteristics of two eyes and 3-D video processing
14. Key technology of coordinated processing of space land multi source data for cloud detection
15. Information feedback mechanism, computation modeling and application based on neural metabolic signals
16. Information feedback computation modeling and application based on neural electric signals
17. Theory and method of neural feedback system for improving cognition function of brain
18. Scalable parallel algorithm and optical method for large scale heterogenic nuclear system for major application field
19. Organization, analysis and application of software life cycle data
20. Method and technology of coordinated modeling of software needs in network environment
21. Method and technology of analyzing vulnerability of networking structure software
22. Easy programming hetero parallel architecture
23. Basic theory and method of error tolerant computation devices
24. New principles and method of 10Tb/in^2 level superfast hard disk
25. Efficient generation of geometric model and content for 3-D printing
26. Evaluation of visual computation and image quality for multi spatial integration
27. Theory and technology of big bio data analysis based on data integration
28. Theory and method of emotional interaction based on wearable computing
29. Study and realization of machine translation for multilevel chapter syntax
30. Theory and method of next generation of network defense based on syntax
31. Basic theory and key technology of inactive sensing network
32. Theoretical modeling, architecture and control mechanism of software defining network

33. Method and application of hysteretic nonlinear system modeling and control
34. Unified modeling and control for system of car use fuel cell and dynamics system of cars
35. Method and application of key mechanical parameters of new types of equipment and unified design of controllers
36. Method of distributed coordinated control and applications in the internet of things
37. Method and application of modeling control for efficient operation of batch process
38. Modeling and analysis of multi genetic functions of synthesized bio devices
39. Basic theory and key technology for information security of industrial control systems
40. Alarm design and method of clearance for security and efficient operation of large industrial systems
41. New method of real time target image identification for terminal guidance on high speed aircrafts
42. Autonomous coordination and control of multi robots for nano device processing and manufacturing
43. Automatic detection of multi-dimensional cell information and related automatic micro nano operations
44. Autonomous operation and control methods for mission accomplishing unmanned rotor crafts
45. Basic theory and key technology for environmental sensing and autonomous control of submarine robots
46. Cognitive mechanism and computing model for internet utterance understanding
47. Processing mechanism and computing model of Chinese language cognition
48. Diluted magnetic semiconductor of self-spin injection and carrier regulation and separation
49. Basic research on applications of self-powered low power micro nano sensors
50. High speed CMOS visual chips based on bionic mechanism
51. High temperature operation vertical cavo surface emission laser
52. Basic research on terahertz HEMT devices
53. Studies on harmonic gyro of silicon surface structure
54. Basic research on anti-radiation integrated circuits based on node below 65nm
55. Alternating weak magnetic sensor based on Hetero junction magneto

electric effect
56. Studies on Cavity optical mechanics for quantum base state on chips
57. Key technology of optical devices based on chalcogenide glass
58. Regulation code pattern and parameter analysis of new generation optical network performance monitoring
59. Key technology and new method of precision measurement based on cold atom
60. Key technologies of semiconductor array optical fiber coupled output high power high light narrow line width laser
61. New method and mechanism of high-speed wide field of view micro nano manufacturing by femto second laser
62. Photo electric properties and applications of new artificial micro structure liquid crystal materials
63. Key technologies of optical fiber bio sensor for in vivo immunology tests

Department of Management Sciences

The Department of Management Sciences received a total of 146 Key Program applications in 2013, in which 24 projects were funded. The total funding is 53.00 million yuan and the average 2.21 million yuan per project. Besides, 13 Key Program Cluster applications were received and 6 of them were finally funded with a total budget of 13.80 million yuan and the average funding of 2.30 million yuan per project.

In accordance with the development planning and priority area of the 12thFive-Year Plan period, the Department of Management Sciences will release its research areas for the Key Program year by year and duly issue research areas for the Key Programs cluster and the number of the Key Program projects to be funded. The number of Key Program projects and the average funding intensity will be increased to some extent compared with the 11th Five-Year Plan period. Key Program will focus on the economic and social development and opening up policy of the country, as well as frontier scientific issues which may achieve innovative results with international impact and promote disciplinary development and some key theoretical and applied issues, which are urgently needed and possibly resolved in the improvement of the comprehensive competitiveness of the country. The research should be oriented toward scientific issues exploring management theories and laws with Chinese characteristics, and systematically carried out in the fields with sound research background and good potential to achieve theoretical and innovative breakthroughs.

The priority funding areas listed below outline the main contents, scopes and basic requirement of research work. It is not required that all areas or contents stated below should be covered in a specific proposal. On the contrary, applicants are encouraged to edge their academic thoughts, set concrete goals, conduct a thorough investigation into one or more key scientific issues, and bring about possible theoretical breakthroughs on the basis of their own academic advantages. Due attention should be paid to the linkage of theory with practice, and applicants are encouraged to detect key scientific issues on the basis of the status quo of China and try to present new management approaches and methods after in-depth investigation. Scientific methodology is emphasized and real data and cases are defined as the basic information foundation for research, and subjective assumption must be avoided.

Research proposals for Key Program may refer to requirements for the application of the General Program which could be applied for both Key Program and General Program.

Key Priority Areas of the Department of Management Sciences

In 2014, the Department proposes 25 priority areas for Key Program, and is planning to fund about 24 projects with an average funding intensity of 2.2-3.0 million yuan per project, and 8 projects of each Division (including Key Program Cluster of Division). The duration for each Key Program project will be 5 years.

1. Environmental management-oriented embedded service decision theory and support platform

Study on the environmental management-oriented embedded service decision model and mechanism, big data of environmental monitoring analysis methods, environmental management multi-objective decision method, simulation method for the effect of decision, and environmental management-oriented decision support platform development, etc. The research should provide comprehensive decision support for the environmental monitoring and management of the government and enterprise.

2. Carbon-oriented urban transport system optimization and management

Study on the mechanism, measure method and evaluation system of carbon emissions in urban transport system, based on a combination of travel theories and models of low-carbon objectives, multi-collaborative

optimization and management based on low-carbon transportation goals, the intelligent transportation system based on low-carbon goals, achieve micro guiding strategy and macro development policy of low-carbon travel.

3. Theory and methods of port management and operations

Study on the flexibility configuration and online resource allocation theory of modern port operating, the multimodal transport-oriented port planning design and management theory, port logistics intensive management under conditions of information technology, port services procurement and service quality management and optimization under multi-modal transport, "Sync Mode" and other new operating environment.

4. Operation optimization theory and methods of fresh agricultural products supply chain based on the RFID technology

In view of the perishability, periodic and regional characteristics of fresh agricultural products, study on the “company + farmer” and other typical supply-demand model of supply chain cooperation mechanism, inventory replenishment strategy of the distribution center and shopkeeper, storage scheduling and distribution methods of fresh agricultural products based on the RFID technology, and the coordinate theory of cost and value of RFID application.

5. High-dimensional, nonlinear, non-stationary time-varying financial data modeling and application

Study on the non-stationary and nonlinear financial data modeling and its application in financial markets, high-dimensional and nonlinear return on assets and asset pricing model and its applications, high-dimensional modeling and high-frequency financial data and microstructure of financial markets applications, variability modeling of financial structure relation and its applications in financial markets, variability modeling between financial markets and its applications in financial risk measurement.

6. Smart health information services management

Study on the health information management services to multi-agent intelligent acquisition and management, as well as big data analysis methods to support intelligent health information services management; intelligent health management and monitoring mode, and intelligent health assessment and knowledge management warning; intelligent health information services resources agglomeration model, and intelligent multi-agent coordination of health services management operations model.

7. The reputation awareness and trading decisions of participants in social commerce

Based on China's commercial culture and e-commerce development backdrop, research on the key factors affecting e-commerce participants' reputation in the social network environment, the methodologies for information retrieval and intelligent analyses, the methods to evaluate the reputation of participants, the mechanisms for network trust and its impact on the trading decision behaviors, the transmission mechanisms of participants reputation awareness and network trust, the consumer trading decision mechanisms based on reputation and trust, and the mechanism design of e-commerce trading based on reputation and trust.

8. Measuring service value based on customers' psychology and behaviors

Study on the customers' awareness and preference towards service value and corresponding behavior characteristics, and the relationship among various dimensions and the logic structure framework. The research also aims to combine the Internet or other traditional service modes to detect and assess the dynamic evolution of customers' service value experience from the inter-disciplinary perspective, including Psychology, Cognition, Consumption, Marketing Science etc.

9. The impact of RMB exchange rate volatility on China's enterprise growth

Research on the micro transmission mechanisms of the impact of RMB exchange rate volatility and trade liberalization on China's economy. Specific research contents mainly include the following: the impact of enterprise investment and financing, innovation and R&D, enterprise governance and risk management mechanisms on operating performance, investment efficiency and labor productivity of different types of enterprises; the impact of China's listed enterprises' behaviors and performance on industrial structure optimization and the outside financing environment of enterprises; the impact of tariff and non-tariff barriers and market growth opportunities on product market and enterprise behaviors; and the paths and policies of international competitiveness for China's enterprises etc.

10. Enterprise financing constraints and strategies

Study on the financing constraints of enterprises with different types and different life cycles in China's financing environment and develop the corresponding theories and methodologies for financing strategies. Specific research contents cover the following: the institutional environment of

enterprise financing constraint formation and its impact; the impact of economic environment and commercial cycle on enterprise financing constraints and strategies and the mechanism analysis; enterprise financing strategies and financing innovations under financing constraint conditions; and the optimized financing strategies of enterprises in financial and capital markets and risk control etc.

11. Consumer welfare and decision behaviors

Exploration on the decision behavior theories to optimize the consumer welfare. Specific research contents may cover the following: the behavior mechanisms of consumers' non-optimized and irrational decisions; the in-depth analyses of the reasons for consumers' irrational and non-optimized welfare decisions; the identification, description and analyses of China's consumers' non-optimized and irrational decision behaviors; developing the behavior decision models for optimizing consumer welfare; the intervention mechanisms to improve consumers' decision quality and avoid wrong decision; and the macro policies research on enhancing consumers' welfare etc.

12. Value co-creation modes and platform systems based on emerging information technology

Exploration on the theories and methodologies and co-creation type enterprises' formation in the commercial system stemming from the emerging information technology environment. Specific research contents may include the following: the value co-creation theories and mechanisms of commercial systems based on emerging information technology; the strategies of enterprises' joining the value co-creation platform and their adaptability to the emerging commercial systems; the paths, strategies and organization changes of enterprise transformation from traditional enterprises to value co-creation type enterprises; and enterprise commercial mode innovation strategies based on the value co-creation platform etc.

13. China's enterprise leaders' behaviors in the changing environment

Study on the China's enterprise leaders' behaviors and approaches to address the changes and manage the organizations in the changing environment, in the context of Chinese economic transformation, enterprise upgrade and globalization. Specific research content may include the following: the complexity and characteristics of Chinese economic institutional environment, the structural feature and capability evolution of enterprise leaders or leader groups in the context of Chinese institutions and culture, the connotations, features and behavior modes of transformational

leadership in different layers of enterprises, the environmental adaptability and orientation of transformational leadership in different layers of enterprises etc.

14. Medical and health operation management in the Internet era (Key Program Cluster of Division**)**

This Key Program Cluster of projects in the Division of Business Administration focuses on China's new medical and health system and various public hospitals. It aims to make full use of the advantage of inter-disciplinary cooperation in the field of operational management and conduct in-depth studies on the value-chain integration and management, data analyses and decisions, resource management and quality security and modern logistic management of China's medical and health, in the context that medical and health resource, information and knowledge can be shared and deeply developed and used in the Internet era. The ultimate goal is to develop innovation management theories and methodologies to facilitate China's medical and health resource optimization, scientific decisions, service mode innovation and incentive mechanism innovation, which eventually provide decision support for exploring the affordable and fair medical and health system with high coverage and high quality and the health care management mechanisms in accordance to China's conditions, and improving the effectiveness and efficiency of health care reforms.

In order to realize the overall scientific goals and inter-disciplinary integration in the research, the grantees of funded projects have to promise to comply with the regulations about related data, cases and information management and share. The applicants should also note the cluster of projects title in the Appendix section of the application form, i.e., Medical and health operation management in the Internet era **(**Key Program Cluster of projects of Division**).**

In 2014, the Key Program Cluster in the Business Administration Division plans to fund 4 specific projects, with a research period of five years. And the main research directions are as follows.

(1) Medical and health value chain integration and management

Study on the value chain of medical and health so as to highly effectively integrate and utilize key resources. Specific research contents are proposed to cover the following: the features of medical and health value chain, the design of outcome-based pricing strategies to optimize the coordination among patients, service providers and insurance companies, the share

institutions and standardized designs of value chain-based medical and health information, the matching design of medical and health insurance policies and resources in the value chain perspective, the balance mechanisms of public welfare and fairness of medical and health services and the profitability of medical and health agencies etc.

(2) Medical and health data analyses and decisions

It is to develop the medical and health databases and find the behavior preferences and modes of patients (customers), the features, trends and market segmentation of service providers (hospitals) etc. through modeling, data mining and statistical analyses. Specific research contents may cover the following: the data integration methodologies to measure medical and health service quality, fairness and efficiency, the methodologies of medical and health risk and cost control, the methodologies of medical and health quality indicator design and data analyses, the resource allocation and supply-demand analyses of on-line optimized health care service providers etc.

(3) Medical and health resource management and quality security

Study on the hospital resource optimization management theories and methodologies based on quality, security and efficiency. Specific research contents propose to cover the following: the capability planning of integrated services, the integrated medical and health units and the optimization strategies of medical and health network, the schedule strategies of medical and health resources, the design of real-time executive programs and emergency programs, the operational optimization strategies of life-cycle oriented medical and health, the distribution design of emergency centers, the schedule optimization methodologies of emergency devices like ambulance, the methodologies of effectively matching medical and health resource supply and demand etc.

(4) Medical and health logistic management

Study on the reliable logistic management theories and methodologies for effective medical and health management systems. Specific research contents propose to cover the following: the design methodologies of highly effective medical and health service logistic network and the integration and optimization methodologies of its operational strategies, the design methodologies of resource and benefit share mechanisms among various agents, the game analysis methodologies of various stakeholders, the design of health care resource share mechanisms etc.

15. The global value chain and China's trade competitiveness

It is to reveal the origins of global value chain, the geographic, product and value distribution features, the input-output linkage and product complexity, the new type dependency and interaction of main countries in the global value chain, the advantageous features and interactions of Asian, European and American production bases, the theoretical analyses of implementing global value chain strategies by developing countries, China's positions and changes in the global value chain distribution, the methodologies, paths and strategies to improve China's trade competitiveness, and policy suggestions for China's global trade strategy.

16. Management theory and implementation mechanism for the construction of social credit system

It is to analyze the relationship between the social credit system and economic and social development, develop the social credit system theory framework, and study the core issues of China's social credit system construction such as key technology, standard and implementation mechanism, etc.; establish the evaluation model of social credit suitable for China's national conditions and the development of scientific and reasonable evaluation system of runtime environment for social credit system, as well as the core standard for social credit system construction. On the basis of empirical research, study may put forward the construction mode and realization mechanism for social credit system.

17. Performance Management Research under the background of government functions' transformation

Study on the construction of social value and generation of public value, management organization evolution and strategy path of government performance, management foundation and mechanisms of government performance,government performance leadership and sustainability issues,information asymmetry problems and theoretical paradigm of government performance management,performance management of nonprofit government investment and so on.On the basis of establishing government performance management theory, the research may provide a theoretical basis, decision-making reference and practical guidance for the construction of government performance management system and administrative reform.

18. Research on service equalization and mechanism to achieve basic education equity

Study on all levels' targets of the basic education equalization and achieve

network resources pattern innovation of basic education equity and quality evaluation criteria under the conditions of informatization, based on the theory of education fairness and large sample's reliable data. Based on the public economics theory, education system characteristics and empirical analysis, applicants should study the causes of basic education unfair in China, reveal the formation mechanism of basic education services unequal, propose shared application service equalization theory and shared services pattern in the area of educational resources so that it can promote the equalization of basic education services,improve educational equity reform and policy adjustments.

19. Food safety control strategybased on the quality chain collaboration

Based on food monitoring, supervision, public opinion, and business information data, on the basis of empirical research and typical food case analysis, applicants should study the formation mechanism of food safety and quality chain,analyze the problems in food safety information transfer process, and study the information propagation effects and intervention strategies of food quality chain. Analyze the control parameters of food quality chain and then design collaboration contract for the multi-agent collaborative management needs. The research will propose China's food safety management and control policy recommendations based on the multi-agent collaborative model and simulation research of food quality chain.

20. Study on regional air pollution control and management mechanism innovation

Study on the suitable innovative management mechanism for china's regional air pollution control based on the empirical analysis of regional air pollution control management mechanisms at domestic and abroad. The research contents should include the international comparative study of regional air pollution control, the linkage mechanism study of inter-regional air pollution control, the performance study of air pollution control under different means of environmental regulation, the subjective behavior study of air pollution control,the collaborative control mechanisms study of atmospheric pollutants and carbon dioxide,and design the regional air pollution control management framework to mitigate the health effects of air pollution.

21. Study of conflict management for water resource

Based on China's basic national conditions and water situations, focusing on the characteristics of water resource conflict management under a changing

environment, the research should be focused to analyze the arising and evolution nature of water resource conflicts under environmental changes, examine the demands of different stakeholders as well as the response mechanisms and behavioral laws of conflicts, assesse the cooperative games of various stakeholders under the complex uncertain water conflict management system and the negotiation path and analysis platform for water conflicts, establishes the management theory and methodology for water conflicts with environmental changes, and thus provide scientific rationale and policy recommendations for modern water resource management model.

22. Study on the medium and small town development pattern based on agglomeration of production factors

Taking labor, land and capital as the main production factors to China's urbanization development, the research should be focused on the urbanization evolution at town's level. From the perspective of factor agglomeration, the current status, processes, difficulties and major development patterns and paths of small towns, the research should compare with the international experience of urbanization development model, and analysis several regional urbanization cases and experiences in China, as well as to develop the theoretical system and related policy recommendations for the development of small towns with Chinese characteristics.

Department of Health Sciences

Applications for Key Program in the Department of Health Sciences are accepted only if they are in response to the solicited thematic areas listed in *Guide to Programs 2014*, which are set by the panel scientists on the basis of the Department's priority areas. Applicants are expected to give their own specific project title, research contents and research plans according to the listed areas, the relevant application code corresponding to the given thematic area should be filled in the application form, and the name of the selected thematic area should be written in the "annotated column" of the application form.

Detailed requirement for applications for the Key Program are expected to be referred to that for General Program in the Department of Health Sciences in this guide. Special attention should be given to the following requirement: A copy of the first page of up to 5 relevant representative papers is expected to be attached, along with their clearly scanned electronic

files, otherwise the applications may be declined.

In 2013, 481 applications for the Key Program in responsive to 35 thematic areas are accepted, 90 of them are finally funded, with a total funding of 26.120 million yuan and an average funding intensity of 2.9022 million yuan.

In 2014, approximately 90 applications for the Key Program will be awarded by the Department of Health Sciences; the funding intensity is expected to be 3 to 4 million yuan per project, with an average of 3.5 million yuan. The duration is 5 years. Applicants are expected to fill in the budget form with detailed justification.

The thematic areas for solicited Key Program in the Department of Health Sciences in 2014 are listed as follows:

1. Basic Research on the pathogenesis and intervention of interstitial lung disease
2. Abnormal developments of heart and congenital heart diseases
3. Basic research on the occurrence and intervention of fatty liver disease
4. Regulatory mechanism and intervention of leukemia cell stemness
5. The molecular mechanisms of human infertility
6. The pathogenesis, prevention and treatment of acute kidney injury
7. Environmental and nutritional factors and thyroid diseases (excluding tumors)
8. The pathogenesis and functional reconstruction of visual nervous system injury
9. Development and regeneration of dental and craniofacial tissue
10. The pathogenesis, prevention and treatment of plaque related oral diseases
11. Pathogenesis and early diagnosis of Parkinson's disease
12. Quantitative studies of organ blood flow functional imaging
13. Basic scientific research of interventional navigation based on multi-modality imaging
14. Basic research on vital organ injury induced by special environment (temperature, pressure, gravity, hypoxia, etc.)
15. The occurrence, development and intervention of the key skin diseases
16. Infection and pathogenic mechanism of human parasites
17. The regeneration and repair of trauma in skin/soft tissue and locomotor system
18. The establishment of new indicators, methods and technology in laboratory medicine and the application in diagnosis and therapeutics
19. Protein post-translational modifications (except phosphorylation and

ubiquitination) and tumorigenesis
20. Circulating tumor cells or molecules and their roles in tumor recurrence and metastasis
21. Carcinogenic mechanism of pathogenic microorganisms
22. Interactions between extracellular matrix and cancer cells
23. Aberrant cancer metabolism and its role in tumorigenesis and cancer development
24. The effects of radioactive damage on health and their mechanisms
25. The mechanisms of health impairment caused by occupationally harmful factors
26. The pathogenesis and intervention strategies of major endemic diseases
27. The mechanism underlying immune clearance or immune escape of pathogens
28. The mechanism underlying immune imbalance and autoimmune diseases
29. Forensic study of the mechanisms of injury and death
30. Poisons associated forensic toxicological and forensic pathological questions
31. Key scientific problems in basic research on drug metabolism
32. Medicinal chemistry research on regulation of active molecules on the basis of protein-protein interaction
33. Key scientific problems in research on druggability of biomacromolecules
34. Basic research on mechanism of drug toxicity and safety prediction
35. Systematic biology research on spleen deficiency syndrome
36. Therapeutic principle and method of TCM and tissue microenvironment
37. Characteristics and mechanism study of TCM's preventative and therapeutic effects on its clinically-effective diseases and syndromes
38. Systematic analytical methodology research on *in-vivo* bioactive components of Chinese herbal medicine
39. Chemical and biological basis of the function of five taste of Chinese herbal medicine