

Key Program

The Key Program constitutes an important type of research project series supported by the National Natural Science Fund. It 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.

Key Program projects should follow the principle of limited objectives, limited research scope and focused goals, pay attention to intercrossing of disciplines, make effective use of the existing major scientific research bases at national and ministerial levels, and conduct 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.

Key Program projects are planned in every five years. Each year, research areas or directions are determined and 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. Please make sure to have clear research orientation and be specific in 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 has now been extended to 5 years (previously 4 years).

In 2010, NSFC funded 436 Key Program projects, with a total funding of 964.50 million yuan and an average funding of 2.2122 million yuan per project (please refer the table below for details). In 2011, 450 Key Program projects will be funded, and the estimated funding intensity is about 3 million yuan per project.

Funding of Key Program projects in 2010

Unit: 10,000 yuan

Scientific department	Applications	Funding and projects approved				Funding rate (%)
		Projects	Funding	Percentage of the total (%)	Average funding per project	
Mathematical and Physical Sciences	188	50	11,250	11.66	225.00	26.60
Chemical Sciences	229	48	11,500	11.92	239.58	20.96
Life Sciences	331	66	13,750	14.26	208.33	19.94
Earth Sciences	352	66	14,250	14.77	215.91	18.75
Engineering and Materials Sciences	253	63	14,750	15.29	234.13	24.90
Information Sciences	240	59	13,750	14.26	233.05	24.58
Management Sciences	61	18	2,700	2.80	150.00	29.51
Health Sciences	466	66	14,500	15.03	219.70	14.16
Total	2,120	436	96,450	100	221.22	20.57

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

Department of Mathematical and Physical Sciences

According to the funding of Key Program projects in the Department of Mathematical and Physical Sciences in the Eleventh Five-Year Plan period (236 projects funded with 470.26 million yuan, and an average of 1.9926 million yuan per project) and the Twelfth Five-Year Plan, in 2011, 60-65 Key Program projects will be funded. The estimated funding intensity will be 3 million yuan per project for 5 years.

To ensure the high caliber quality of projects, applicants are required to have ever held national projects, and relatively large research teams.

Please give the title of the area of proposed research in the Note section of the application form.

In 2011, the Division of Mathematics plans to fund 12-13 Key Program projects, with an average funding of 1.8 million yuan per project. Main research orientations are listed as follows:

- 1. Representation of group and algebra and its categorization (A0102)**
- 2. Geometry and analysis on manifold (A0103)**

3. Topological studies of manifold (A0103)
4. Teichmuller space theory and classical analysis (A0105)
5. Differential dynamical systems (A0107)
6. Studies on Hamilton system solution orbit (A0107)
7. Nonlinear elliptic and hyperbolic equations and their applications (A0108)
8. Symplectic topology and mathematical invariant in gauge field (A0109)
9. Markov process and related problems (A0110)
10. High dimensional data statistical modeling and analysis (A0111)
11. Studies on optimal problems in complex network (A0112)
12. Mathematical modeling and analysis of typical problems in neural science (A0114)
13. Mathematical theory and methods for sparse information processing (A0114)
14. High performance computational method for multi physical process (A0117)
15. Numerical method for reverse problem and its applications (A0117)

In 2011, the Division of Mechanics plans to fund 12-13 Key Program projects, and the funding intensity will be 2.6 to 4 million yuan per project, and 2.8 million yuan in average per project. Priority research orientations for funding are as follows:

1. Nonlinear uncertainty system dynamics and control (A0202)
2. Multi body system dynamics and control (A0202)
3. Deformation and damage mechanism of advanced materials (A0203)
4. Theory, method and application of structural completeness and endurance (A0203)
5. Mechanical behaviors of material and structure in multi field coupling conditions (A0203)
6. Unsteady complex flow mechanism and control (A0204)
7. Hydro dynamical problems for water crafts (A0204)
8. Flow and propulsion mechanism of aircraft and space craft (A0204)
9. Mechanics of bio-materials and sport and bionics (A0205)
10. Structural response, explosive and impact dynamics in aeronautical and space engineering (A0206)
11. Numerical methods and software for complex mechanical problems (A02)
12. New methods and technology in experimental mechanics (A02)
13. Characteristics of complex media and its interaction with environment in environmental evolution and catastrophe (A02)
14. Key mechanical problems in major equipment (A02)
15. Key mechanical problems in advanced manufacturing (A02)
16. Key mechanical problems in extreme conditions (A02)

In 2011, the Division of Astronomy plans to fund 7-8 Key Program projects, and the funding intensity will be 2.6 to 4 million yuan per project, and 3 million yuan in average per project. Priority research orientations for funding are as follows:

- 1. Formation and evolution of first generation celestial body and large scale cosmic structure and measurement of its cosmic parameters (A0301)**
- 2. Formation, structure and evolution of galaxies, interstellar matter (A0302)**
- 3. Violent activities in active galaxy center and galaxy levels (A0302)**
- 4. Structure and evolution of very early Galaxy and different stellar populations (A0303)**
- 5. Star formation, structure and evolution (A0303)**
- 6. Star evolution in late period, inter stellar matter and matter cycling, compact stellar bodies and its related explosive phenomena and radiation mechanism (A0303)**
- 7. Fine structure, basic magnetic element diagnosis and property, magnetic field topology in active region and evolution of solar magnetic field (A0304)**
- 8. Origin, dynamical evolution, multi band electromagnetism and particle radiation of solar activity and solar earth physical property (A0304)**
- 9. Corona fluctuation, coronal ring structure and heating (A0304)**
- 10. Basic theory and methods of astrometry and astro-mechanics (A0306, A0307)**
- 11. High precision astronomical parameter measurement and astronomical reference frame (A0306)**
- 12. High precision time frequency (A0306)**
- 13. Low noise and array receiving technology, radio digital signal processing (A0308)**
- 14. Autonomous optics, self adaptive optics and optical interference (A0308)**

In 2011, the Division I of Physics plans to fund 12-13 Key Program projects, and the funding intensity will be 2.6 to 4 million yuan per project, and 3 million yuan in average per project. Priority research orientations for funding are as follows:

- 1. Physical problems in solar energy, hydrogen energy and other new forms of energy (A04)**
 - (1) Physical properties and devices of new energy materials
 - (2) Physical problems in energy conversion and storage
- 2. Physical basis of quantum information and future information devices (A04)**
 - (1) Physical problems in quantum information form, generation, conversion 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 new functional materials (A0402 and A0404)

(1) Physical properties of new functional materials such as ferro electric, dielectric, thermoelectric and multi ferrous materials

(2) Physical mechanism of new types of magnetic electric resistance and electric induced resistance materials

(3) Physical properties of new magnetic functional materials and their heterogeneous structures

(4) Physical properties of new types of high efficiency luminescent and photoelectric conversion materials

(5) Micro nano structure and surface plasma excimer

4. Physical problems in confined quantum systems (A0402)

(1) Properties of electric transport, thermal transport and self spinning transport in low dimensional system

(2) Studies on the preparation and physical properties of topological insulation materials

(3) Ultra fast control of quantum state in micro nano structures

5. New phenomena and micro mechanism in relevant electronic systems (A0402)

(1) Novel quantum state and quantum phase change in strong relevant electronic system

(2) Exploration of non-standard superconductors, abnormal physical properties and superconducting mechanism

(3) Quantum magnetism and related physical problems in relevant systems

6. Computation and simulation of matter structures and properties (A0402)

(1) Computational design and physical property prediction of new types of functional materials

(2) Computational simulation of structural properties of matter of complex system and in extreme conditions

(3) Exploration and application of multi body quantum computation methods

7. Atomic and molecular multi body interaction and physical process under extreme conditions. (A0403)

(1) Atomic and molecular state 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 bodyrelevant effect

8. Quantum dynamic process of atomic molecular system (A0403 and A0404)

- (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 basis of applications (A0403 and A0404)

- (1) Cold atom molecule and ion preparation and control
- (2) Cold atomic system and quantum simulation
- (3) Cold atomic quantum state (control) physics and key technology

10. New type of light source and new spectrum physics and technology (A0404)

- (1) THz radiation source, spectrum and its applications
- (2) EUV and other ultra short wave length coherent radiation generation
- (3) New mechanism and new technology of photoelectric, electric photo transformation

11. Frontier problems in nonlinear optics (A0404)

- (1) Nonlinear optical physics of new materials
- (2) Weak light nonlinear optical process
- (3) Nonlinear regulation of optical field

12. ultra fast, ultra strong light physics (A0403, A0404)

- (1) Atto second laser generation, measurement and application
- (2) Ultra short laser pulse regulation and carrier wave phase regulation technology and physics
- (3) Atomic, molecular and cluster behavior in ultra fast strong optical field

13. New phenomena in quantum (A0403, A0404)

- (1) Confined photon-atomic interaction and cavity quantum electro dynamics
- (2) Quantum optical problems in solid state and man made structures
- (3) Preparation, control and measurement of optic field quantum state
- (4) Quantum optical problems in open system

14. New acoustic energy converter and array (A0405)

- (1) New types of acoustic energy conversion materials and wide band, high power acoustic energy converter
- (2) Acoustic micro nano sensor and array

15. Spatial and temporal properties of marine acoustic field and its application (A0405)

- (1) Properties of sound propagation, variation and scattering in 3-D uneven marine environment
- (2) Laws and properties of ultra low frequency (100 Hz and below) sound wave propagation in long distance

16. Generation, propagation, measurement and interaction of sound wave in complex media(A0405)

- (1) Generation, propagation property and characterization method of sound wave in complex media
- (2) New theory and new methods for quantitative measurement and evaluation of acoustic waves

In 2011, the Division II of Physics plans to fund 12-13 Key Program projects, and the funding intensity will be 2.6 to 4 million yuan per project, and 2.7 million yuan in average per project. Priority research orientations for funding are as follows:

- 1. Problems of statistical physics in complex system (A0501)**
- 2. Theoretical studies on accelerated expansion of the universe in the current stage (A0501)**
- 3. Studies on new higher order perturbation computational methods using quantum field theory (A0501, A0502)**
- 4. TeV energy zone physics theory and experiment (A0502)**
- 5. Studies on frontier problems in lepton and neutrino physics (A0502)**
- 6. Hadron structure and new hadron state studies (A0502, A0503)**
- 7. Properties of matter in mid high energy heavy ion collision and strong interactions (A0502, A503)**
- 8. Radioactive nuclear beam physics, nuclear astrophysics (A0503)**
- 9. Neutron physics and basic research on its applications (A0504)**
- 10. Basic research on new methods of nuclear technology and its applications (A0504)**
- 11. Studies on basic physical problems in nuclear radiation protection and environmental protection (A0504)**
- 12. Advanced technology in accelerator and detectors (A0505)**
- 13. Studies on plasma magnetic reconnection process (A0506)**
- 14. Basic research on fusion plasma physics and diagnosis technology (A0506)**
- 15. Basic research on low temperature plasma physics and key technology (A0506)**
- 16. Studies on advanced technologies and experimental methods of synchrotron (A0507)**

Department of Chemical Sciences

During the Eleventh Five-Year Plan period, there was a large increase in the number and funding intensity of Key Program projects supported by the Department of Chemical Sciences. In the period, the Department funded 228 Key Program projects in total, including 48 Key Program projects funded with 11.5 million yuan in 2010. In 2011, the Department will announce guidelines and accept proposals in 58 research areas, in which around 50 projects would be granted, and the average funding intensity will be from 2 to 4 million yuan for each project. The duration of each project is 5 years. 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 of basic information table, and must select the proper discipline code marked at brackets of the research area.

In 2011, the research areas of Key Program projects funded by the Department are listed as follows:

- 1. Molecule-base oriented functional materials (B01)**
- 2. Preparation and function of clusters and their compounds (B01)**
- 3. Compounds with multi-hole structure and their properties (B01)**
- 4. Functional compounds of rare earth elements (B01)**
- 5. New materials used to energy conversion and storage (B01)**
- 6. Inorganic solid functional materials (B01)**
- 7. Basis of bio-inorganic chemistry (B01)**
- 8. Research on organic synthesis agent contained double-metal (B02)**
- 9. Study of synthesis and relation between structure & efficacy of complex natural products with outstanding bioactivity (B02)**
- 10. Green chemistry of major virus oriented pesticide (B02)**
- 11. Activation of small molecules promoted by rare earth elements (B02)**
- 12. Finding of active natural products with new-type structure as well as their functions (B02)**
- 13. Tectonics and transformation of properties of newly organic conjugated compounds as well as their devices (B02)**
- 14. Finding and synthesis of carbohydrate and its application (B02)**
- 15. Functional reaction of fullerene and its application (B02)**
- 16. Synthesis, structure and function of new large-ring host-molecule with multi-dimension and multi-hollow (B02)**
- 17. Study of active small molecule with regulating and controlling erroneous conformation of protein (B02)**
- 18. New methods of theoretical and computational chemistry (B03)**

19. Application of theoretical and computational chemistry in the energy/materials/life fields (B03)
20. Study of the nature of catalytic action of catalyst (B03)
21. Key physicochemical issues related to optimum utilization of carbon resource (B03)
22. Key physicochemical issues related to the process of energy conversion (B03)
23. Physicochemical issues related to the molecular levels of surface/interface (B03)
24. Research on molecular reaction dynamics (B03)
25. Research on molecular photochemistry and molecular photophysics (B03)
26. New method of spectrum (B03)
27. Chemical thermodynamics of new-type system (B03)
28. Basic research of bio-physical chemistry (B03)
29. Physicochemical issues related to air molecules and suspended particles in the process of climate change (B03)
30. Methodology of polymer reaction (B04)
31. Polymers used in the field of bio-medicine (B04)
32. Surface and interface of macromolecules (B04)
33. Polymers with optic/electric function (B04)
34. Structure and properties of polymers (B04)
35. Theory, computation and simulation of polymers (B04)
36. Orderly condensed state structure of polymers (B04)
37. Separation and analysis of complex samples (B05)
38. Image formation and *in-situ* analysis used in determination of living body (B05)
39. Mono-molecular and unicellular analysis (B05)
40. Analytical chemistry basis of the bio-sensors (B05)
41. New methods and new techniques used in the study of bio-macromolecules (B05)
42. New methods and new techniques for pre-warning and diagnosis of major diseases (B05)
43. New methods for high-output, multi-scale and multi-parameter analysis and magnanimous data handling (B05)
44. Key scientific issues in the area of bio-chemical engineering (B06)
45. Chemical engineering basis in the area of food and medicines (B06)
46. Chemical engineering foundation for the high effective clean utilization of fossil energies and exploitation of new energy (B06)
47. Key scientific issues related to chemical product engineering (B06)
48. Design of new materials for chemical engineering and their functional integration/control (B06)
49. Scientific basis related to the high effective utilization of resources and the optimization of chemical engineering system (B06)
50. Scientific foundation of transfer process under extreme conditions (B06)
51. Scientific and engineering basis of typically chemical reaction and scale-up of

reactor (B06)

- 52. Scientific foundation of environmental chemical engineering and safety (B06)**
- 53. High-purely separation without phase change and its key scientific issues (B06)**
- 54. Process and mechanism on chemical pollution of water environment (B07)**
- 55. Toxicological mechanism of environmental pollutants and its health risk (B07)**
- 56. Techniques and principles of controlling environmental pollutants (B07)**
- 57. Process and mechanism of the environmental complex pollution (B07)**
- 58. Reduction of green gas emission and controlling principles (B07)**

Department of life Sciences

In 2011, the Department of Life Sciences will accept two types of applications for Key Program. One of them, which is the major part occupied of the total applications, should be guided by designated areas (ADA for short) and another, which is a complementary part, could freely select their research areas (ANA for short).

Applicants should carefully read the application requirements, notes and the funding plan of the Department in this chapter for Key Program.

Applicants for ADA shall correctly fill in the corresponding application code lined out in each division when making application. Proposals for ANA may choose autonomously the application code relevant to its research content.

The concrete requirements for application to Key Program projects of life sciences are as follows:

(1) Applications to 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 2011. In the column of “Annotations” on the basic information table of the application form, applicants should write down the applied research areas, and fill in the corresponding application code lined out in each division’s designated areas. Please note that the designation of application codes for Key Program projects is just done for the sake of effective management, whereas the application codes appointed may not include all the research contents of the designated areas, so applicants should not be affected by the application codes appointed in ascertaining their research themes according to the relevant contents of designated areas.

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

Applications for ANA should meet the requirements as follows: (i) Applicants who have

achieved great progress, and need key support, while their research contents is not included in ADA of this year; (ii) study should be in 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. 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 Key Program (including both ADA and ANA) are required to attach the first pages of five representative papers to the applications.

In 2011, the Department will support about 70 Key Program projects (10 for ANA). The funding intensity is around 2 to 4 million yuan per project, and the average intensity is about 3 million yuan per project for 5 years. The 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.

The designated areas of each division in the Department of Life Sciences in 2011 are as follows:

- 1. Secondary metabolism route of microbe and its molecular regulating mechanisms (C010201)**
- 2. Molecular mechanisms of microbe adapting to extreme environment (C0105)**
- 3. Molecular mechanisms of plant cell proliferation and polarity formation (C020102)**
- 4. Genetic analysis and appraisal of biological characteristics of important wild plant resources (C020601)**
- 5. The response and adaptation of C-N cycling processes of ecosystem to globe change (C0308)**
- 6. Ecological effects between species interaction (C030502)**
- 7. Animal phylogeny and molecular evolution (C040204)**
- 8. The neuron and genetic basis of animal behavior (C040302)**
- 9. Specific Modification of protein and its functions (C050201)**

10. Self metabolites and repair of nucleic acid (C050202)
11. Genetic analysis of complex trait (C060503)
12. New theory and method for the study and analysis of genetic information (C0608)
13. Molecular mechanisms of cell differentiation (C0704)
14. Molecular mechanisms of cell communication (C0709)
15. Molecular mechanisms of the development and differentiation of immune cells (C0801)
16. Cell and molecular mechanisms of response of innate and adoptive immunity (C080103)
17. Mechanisms of inter connection between nerve cells (C090202)
18. Neural mechanisms of learning and memory (C090303)
19. Biomechanics between the interaction of large biomolecular cells and tissues (C100101)
20. Interaction between biomaterials and organisms (C1002)
21. The discovery of new Endogenous small active molecules and its important physiological function (C110301)
22. Functional regulation and its mechanisms of ion channel and its receptor under the physiological environment (C1101)
23. The origin and differentiation mechanisms of primary tissue and organ rudiment (C120106)
24. Molecular regulating mechanisms of the occurrence, maturation of gametes (C120101)
25. The formation mechanisms of crop heterosis (C1305)
26. The physiological basis of high crop yield, excellent and high efficient cultivation (C130301)
27. Mechanism and regulation of regional agricultural disease and pest disasters (C1404)
28. Molecular mechanisms of insecticides resistance of crop pests and Pathogen (C1405)
29. The appraisal and utilization of germplasm resources of gardening crops (C150102)
30. Quality formation mechanism and its regulation of gardening crops (C1507)
31. Basic theory and method of forest hereditary breeding (C161003)
32. The constitution, structure and function of artificial forests (C161102)
33. The physiological, biochemical and genetic basis of quality formation of chief domestic animal products (meat) (C170102)
34. Genetic analysis of the fine characteristics of China's typical species resources of livestock and poultry (C170101)
35. The infectious and immune mechanisms of important pathogens of domestic animals (C1803)

- 36. Pharmacy, metabolism and dynamics of new, important veterinary drugs (C1807)**
- 37. Functional analysis of related genes of important traits of aquatic economic organisms (C190103)**
- 38. The pathogenesis of chief diseases in aquatic organisms (C190603)**
- 39. Analysis and function of food nutrition component (C200102)**
- 40. The constitutional change rule and mechanisms during the processing and production of food (C02002)**

Moreover, in view of the problems existing in the past, the Department particularly reminds applicants of avoiding any of the cases listed below in 2011. Otherwise, their proposals may be refused during the preliminary checking:

- (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, or do not fill in the corresponding application code;
- (2) Applications for ANA do not specify “ANA” in the column of “annotations” of the basic information table in the application text, or applications without 800 Chinese characters description about the important innovative progresses already achieved;
- (3) Applicants for Key Program projects (including both ADA and CFA) do not attach the requested first pages of five representative papers to the application;
- (4) 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) and NSFC Research Fund for Distinguished Young Scholars;
- (5) Applications indicate the designated areas in the “Annotation” column, but the actual research contents do not match the scope of funding;
- (6) 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 the writing of applications, please refer to the guide to General Program projects of the Department of Life Sciences.

Department of Earth Sciences

The Department of Earth Sciences announces the guideline for Key Program according to the major issues in the *Priority Funding Areas in Earth Sciences for the Eleventh Five-Year Plan Period*. The criteria to identify priority areas is as follows: (i) to foster the development of earth sciences, boost beneficial accumulation, represent the advantage and characteristics of the country, and effectively contribute to the promotion of international reputation of Chinese earth sciences; (ii) to solve certain critical scientific issues concerning the major problems which constrain the development of economic and

social sustainable development, and strive to bring far-reaching impact on the social and economic development. 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.

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 Key Program in the Department of Earth Sciences. The application codes for interdisciplinary study should be filled in the application form.

In 2010, the Department received 352 proposals for Key Program, and 66 were funded with a total of 142.5 million yuan. In 2011, about 70 projects will be funded, and 3 million yuan will be allocated to each project on average. The required research period of a Key Program project is 5 years.

Applicants should bear in mind that they need to fill in “Annotations” in the proposal sheet with the following title of the themes, such as, “Global change and its regional response”, “Environmental evolution and life processes on the Earth”, “Deep earth processes and continental dynamics”, “Process, mechanism and distribution of

metallogenesis and accumulation”, “Processes and mechanisms of the changes in terrestrial surface system”, “Water cycling and water resources”, “The effect of human activities on environmental change and its control principles”, “Marine resources, environment and ecosystem”, “Process and mechanism of weather and climate system change” and “Solar-terrestrial space environment and space weather”. Proposals with incorrect “Annotations” will not be accepted. Application codes will be chosen by applicants on their own discretion.

1.Global change and its regional response

The scientific objectives are to improve the understanding of global change regulations and future change trends, explain the cause of formation of global change and its current situation and future prediction, as well as to provide scientific and technical support for addressing the enormous environment problems and challenges which human society is facing, by focusing on key scientific issues in the Asian monsoon and arid regions.

Key scientific issues

- (1) Regulations and characteristics of decadal-to-centennial-scale global change events
- (2) Causes of global change, mechanisms induced by human activities, and interactive physical, chemical and biological processes dominating global change
- (3) Capturing, monitoring and forewarning for early signal of global change
- (4) Modeling, simulation and prediction of global change processes
- (5) Impact and consequences of major global change events
- (6) Mitigation, evasion and adaptation strategies for global change

Research orientations in 2011

- (1) Regulations and characteristics of decadal-to-centennial-scale Asian monsoon and arid climate system, and the interaction among different spheres
- (2) Uncertainties in estimating carbon cycle and carbon budget for the typical ecosystems of the Tibetan Plateau etc
- (3) The linkage of characteristics and dynamical processes of land-air-sea interaction in Asia-Indian Ocean-Pacific Ocean monsoon regions to climate change
- (4) Major regional environmental change events, characteristics and the main driving factors (with global significance since the Cenozoic)
- (5) Issues in earth sciences in the impact, adaptation and mitigation of global change
- (6) Important scientific issues in earth system sciences (e.g. linkages and uncertainties of each component)

About 6 to 8 projects will be supported.

2. Environmental evolution and life processes on the Earth

The targets are to exploit China's advantages of the abundant records for the Earth's history and reinforce the intercrossing between geochemistry, mineralogy, tectonics, paleontology and geobiology, to make full use and digest the up-to-date results of modern biology, and to re-speculate the relationship between the earth environment and life process so as to develop a group of creative results and retain China's global leadership in the field.

Key scientific issues

- (1) Concerted evolution of the life and environment in the early Earth history
- (2) Environmental response and evolution of key species during major historical era of global change
- (3) Fossil records and environment constraints to construct the "tree of life"
- (4) Present biogeochemical processes and earth surface environmental changes
- (5) Species, characteristics and specific life processes in extreme environments

Research orientations in 2010

- (1) Origin, evolution and environmental constraints of critical species
- (2) High-precise and high-resolution geological and geochemical records of the environmental evolution history of the Earth
- (3) Life-environment processes and ecosystem changes in major geological periods
- (4) Geochemical and environmental evolution in the Earth history
- (5) Geobiology, low temperature geochemistry and their environmental effects on biogeochemical processes
- (6) Forms and processes of life in extreme environments

About 6 to 8 projects will be supported.

3. Deep earth processes and continental dynamics

The scientific objectives are to take major tectonic units of the China continent as typical examples and key scientific issues as sketch lines and apply new approaches and new technologies in order to disclose the formation and dispersion of the continent in various geological eras, the orogenic processes and uplift of the plateau and formation of basins, and the mechanism of large scale magmatic activities, to detect the physical and chemical 3-D structure and mechanical state of present continent, as well as to probe into the pattern of the accretion and elimination of the continents, to set up a new theoretical framework of the tectonic pattern and continental evolution, and to discover how deep dynamic processes control the resource formation, environment evolution and natural hazard. In the meanwhile, by comparison with the neighboring or similar regions, the

dynamics and deep processes of the continent of China could be better understood from the global perspective.

Critical scientific issues

- (1) Heterogeneity of the structure and composition of the continental lithosphere
- (2) Processes and dynamics of the Mesozoic-Cenozoic continental deformation
- (3) Mechanism of the origin and evolution of the continent
- (4) State of the materials in the deep earth and rheology

Research orientations in 2011

- (1) 3-D structure and geodynamics of the deep earth with their controls to the lithospheric process
- (2) Inter-layer exchange of material and energy with the mechanism of large scale magmatic activities
- (3) Chemical differentiation and recycling of the subducted materials with the effects to continental evolution
- (4) Basin-range system evolution and basin dynamics
- (5) Early evolution of the solid Earth and converging and dispersion of super-continent
- (6) Structural-geomorphologic-hydrologic evolution and their significance for geodynamics and environment
- (7) Deep mechanism and surficial appearance of major earthquake belts and volcanic activities in China and related geohazards
- (8) Evolution and geodynamics of the typical orogenic belts and continental margins
- (9) Precise record, tracing, simulation and experimental research of the geological processes
- (10) Monitoring technology, data assimilation and interpretation for the modern continental activities
- (11) Correlation and interaction between the earth and other planets

About 6 to 8 projects will be supported.

4. Process, mechanism and distribution of metallogenesis and accumulation

The scientific objectives are to make breakthroughs in the metallogenic theories and mineral exploration through studying the relationship between the structure of shallow crust and metallogenesis, tracing the regional ore-forming fluids, investigating the orefield structure and metallogenic process, and studying the special metallogenic system and metallogenic geodynamics; to improve the theoretical systems for oil and gas generation in complex geological setting in China, to expand the remaining resources in the matured basins, and to extend the prospect of petroleum exploration by launching

integrated studies on the relationship between the dynamic process of large compound basins and the accumulation of oil and gas, especially in the oceanic carbonates and deep water sediments, the accumulation dynamics of coalbed methane, the continental sequence stratigraphy, the palaeo-environment of hydrocarbon generation and the systematic evolution of the Earth, the methods for prospecting oil and gas; and to strengthen theoretical researches on some strategic and unconventional energy and mineral resources such as natural gaseous hydrates in ocean, marine polymetallic nodules and accretions, and the hydrothermal sulfides on the ocean floor locally.

Key scientific issues

- (1) Metallogenetic mechanism and temporal and spatial evolution of important and unique deposits in China
- (2) Formation of large scale metallogenetic domains
- (3) Comparison between metallogenetic systems at regional scale and those at global scale
- (4) Theories and methods for exploring mineral deposits, and oil and gas resources in depth
- (5) Dynamics and accumulation of oil and gas-bearing basins
- (6) Theories of large scale metallogenesis and accumulation beneath the sea floor

Research orientations in 2011

- (1) Mechanisms of the enrichment of large amount of ore-forming materials in sedimentary basins and magmatic systems
- (2) Metallogenesis and metallogenic regularities of some specific metallogenic systems
- (3) Background and process of continental intra-plate metallogenesis
- (4) Tracing of regional fluid systems and evolution of metallogenic systems of large metallogenic concentration areas
- (5) Forming mechanism of mineral deposits and oil and gas resources in depth, and their system responding to geophysics
- (6) Metallogenesis in continental convergence
- (7) Regional dynamic system of the evolution of large congruent basins and their accumulating regularities of oil and gas
- (8) Systematic evolution of the Earth and sedimentary conditions of hydrocarbon-generating materials
- (9) Analogy between the modern ocean floor hydrothermal systems and the palaeo metallogenic systems
- (10) New theories and methods for prospecting unconventional energy and mineral resources

About 6 to 8 projects will be supported.

5. Processes and mechanisms of the changes in terrestrial surface system

Guided by the earth system theory, aiming at the terrestrial surface systems, concentrated on the interactions between human society and natural systems, and based on the modeling studies of various fundamental processes, researches in this field should emphasize the interactions among natural processes at different spatial scales, and the coupling of natural and human systems, to reveal the mechanism and evolution of key components and processes of the terrestrial surface systems, to find the relationship between human activities and environmental conditions in regional sustainable development in China, and to explore the strategies for achieving sustainable regional development.

Key scientific issues

- (1) The changing processes and mechanisms of key components
- (2) Interface processes and mechanisms of mass transportation/transformation
- (3) Interaction of key components and its modeling
- (4) Mechanism of integrated disaster formation and risk assessment

Research orientations in 2011

- (1) Geomorphologic processes and evolution mechanism
- (2) Interface processes of lakes and their mechanism
- (3) Habitat changes and their impacts on aquatic ecosystems in lakes
- (4) Succession of wetland and its ecological impacts
- (5) Evolution of soil quality under intensive use
- (6) Mechanisms of mass transport and transformation in soil evolution
- (7) Processes of C, N and P transformation in soils and the microbiology mechanism
- (8) Root-soil interface processes
- (9) Hydrothermal processes and biogeochemical cycling of laciations and permafrost (the terrestrial surface ecosystem)
- (10) Eco-geographical processes in the cold region and their responses to climate change
- (11) Services of ecosystems and their regional integration
- (12) Comprehensive risk assessment and management of physical disasters

The comprehensive development of the earth system sciences have been dramatically driven by the rapid development of high-techs led by aerospace and information technology. The new principles, methodologies and technologies applied in the earth system observation and information processing will inevitably become the critical issues for future development and competition in the research on the earth system sciences. Therefore, research efforts in these areas will be strengthened in the 12th Five-Year Plan period, and studies on some specific disciplines and areas will be encouraged.

Geographic information science is a new branch of geography, focusing on the study of

the mechanisms of geographical information generation and evolution, and technologies for information acquisition and analysis. It aims at improving our comprehensive understanding of integrated geographical objects and systems. In recent years, the rapid progress in geographic science, information science, computing and network technology, aerospace engineering and sensor technology has brought unprecedented capabilities and opportunities for GIS research.

Research orientations in 2011

- (1) Remote sensing radiation, scattering, transfer mechanism, and quantitative retrieval
- (2) Multi-sources data fusion, assimilation, synergism and information extraction
- (3) Surface parameters retrieval of remote sensing data
- (4) GIS data model and organization
- (5) Scale conversion and expression of geographical information
- (6) Spatial data mining and analysis methodologies
- (7) Simulation of spatial heterogeneity and evolution

About 6 to 8 projects will be supported.

6. Water cycle and water resources

The scientific objectives are to study the regional water cycling processes, to build water cycle models, to explore the temporal and spatial features of the evolution of water resources, to investigate the impacts of water utilization on the ecological system and environment, and to propose optimal schemes of macroscopic control and utilization of water resources for supporting the sustainable regional social-economic development.

Key scientific issues

Interactions of water cycle with climate, ecosystem, environment and society, temporal and spatial variation and the cycling of water in the atmosphere-surface water-soil water-groundwater system, regional water resource formation and transformation, impact of anthropological activities on water cycle, and mechanism of social forces on water cycle.

Research orientations in 2011

- (1) Observation experiment of hydrologic process and its scaling effect
- (2) Coupling mechanism of soil water salt dynamics and ecological process
- (3) Quantitative description, simulation and uncertainty analysis of hydrologic process
- (4) Transformation mechanism between surface and underground water
- (5) Impacts of the hydro-geological structure change and media heterogeneity on water cycle
- (6) Impacts of human activities on the regional water cycle and their ecological effects
- (7) Water cycle process and its extreme hydrological events

About 6 to 8 projects will be supported.

7. The effect of human activities on environmental change and its control principles

The scientific objectives are to study regional, typical and key environment issues and illustrate the effect of human activities on environmental changes and its control principles under the guidance of systematic science of the Earth and the concept of sustainable development.

Key scientific issues

Impact of the exploitation and utilization of resources on the earth environment, impact on ecosystem and environment due to major infrastructure construction and natural hazard, spatial and temporal distribution of persistent toxic pollutants and its environmental risks, and identification and control of the environmental abnormality caused by natural processes and human activities.

Research orientations in 2011

- (1) Correlation between the modes of the human adaptation to the environmental changes in different regions
- (2) Development of cities and other regions and environmental changes
- (3) Revitalization of cultivated land, change of land use and their environmental effects
- Migration process of pollutants under drainage measure and its dynamic mechanism
- (4) Identification of the source, tracing of the process and quantitative resolution of environmental pollutants
- (5) Environment and health risks of toxic pollutants
- (6) Process of groundwater pollution and theory for restoration
- (7) Environmental and hazardous effects of major infrastructure construction
- (8) Mechanism of geological hazards due to the exploitation of mineral resources and energy
- (9) Origin of major geological hazards, their monitoring and precaution

About 6 to 8 projects will be supported.

8. Marine resources, environment and ecosystem

Centered on international frontiers and key issues closely related to major national demands and oriented towards deep-sea and polar ocean, the scientific objectives in this field are to try to make great progress on the offshore process, ecosystem variation and the environmental evolution of deep-sea and polar areas, with emphasis on the evolutionary rules of marine resources, interaction between marine environment and ecosystem and its function on climate change.

Key scientific issues: Marine dynamic process and environmental change, marine ecosystem and biogeochemical process, service function and biodiversity of marine ecosystem, land-sea interaction and its environmental effects, deep-sea environment and ecosystem, and environmental change and the interaction of ocean-land-atmosphere-ice in the polar regions.

Research orientations in 2011

- (1) Dynamics of ocean internal wave and mixing process
- (2) Ocean material transport, process of shelf circulation and the response of ecosystem
- (3) Formation mechanism of coastal-continental shelf sedimentary system and record of climate and environment evolution
- (4) Dynamics of continental margin in the Mesozoic-Cenozoic eras and oil/gas resource in China's costal seas
- (5) Deep-sea extreme environment system and its effects of resource and environment
- (6) Oceanic process of terrigenous trace metals and their isotopes
- (7) Marine ecosystem and its response to changes of environment
- (8) Ocean drilling and its relationship with deep biosphere and environmental evolution
- (9) Mechanism of offshore compound pollution and its effects on the ecosystem
- (10) Biogeochemistry process of biogenic elements in Polar Regions

About 6 to 8 projects will be supported.

9. Process and mechanism of weather and climate system change

The scientific objectives 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 Twelfth 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) To further improve the accuracy of disastrous weather forecast, to extend the forecast valid time, and to expand prediction objectives
- (2) To study the climate change and climate prediction theory and experiment on the monthly, quarterly, interannual and interdecadal time scales

- (3) To develop weather and climate system models
- (4) To proceed with the analysis and assimilation applications of massive survey data
- (5) To investigate new theories, methods and technologies for weather and climate element detection
- (6) To study physical and chemical processes of cloud and mist, and to investigate the weather modification

Research orientations in 2011

- (1) The impact of atmospheric general circulation anomaly on East Asian weather and climate
- (2) Interactions among ocean, land and atmosphere and their impacts on weather and climate
- (3) Research, development and improvement of models of the climate system
- (4) Formation mechanism and predictability of extreme climate events
- (5) Occurrence, development and prediction of heavy influence weather
- (6) Research on the parameterization of physical processes in numerical models
- (7) Research on atmospheric remote sensing, retrieval method and data assimilation
- (8) Theories and methods of weather modification
- (9) The linkage of weather and climate to atmospheric environment
- (10) Aerosols, clouds and radiation and their interactions
- (11) Researches on land surface processes and atmospheric boundary layer physics

About 6 to 8 projects will be supported.

10. Sun-earth space environment and space weather

The scientific objectives are to form a theoretical frame of the global cause-effect chain of space weather processes so 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 to serve 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 120° E Meridian Project observations and to encourage studies on hazardous space weather events during the solar cycle 24.

The key research issues

Triggering mechanism of coronal mass ejection (CME), physical process in the source region and how the mass ejected; the source region of solar wind, its surface structure and three dimensional structure of the solar wind, the influence of various discontinuities on interplanetary propagation of solar wind; interactions of interplanetary perturbations with earth's magnetosphere, physical processes of multi-scaled magnetospheric storms; coupling processes of magnetosphere-ionosphere-upper atmosphere, responses and fundamental physics of earth's mesosphere, ionosphere and thermosphere to storms and their modeling; magnetic reconnection in space plasma, heating and acceleration of charged particles, triggering mechanism of plasma waves and instabilities; impacts of space disasters to information transfer, space materials and micro electronic devices, influence to humans health and possible mechanisms; prediction indicator for different space regions of the solar terrestrial system, models and methodologies for prediction and integrated modeling study of space weather; methods and techniques in solar multi-bands measuring, techniques in imaging and remote sensing of disturbances in interplanetary medium, earth's magnetosphere, ionosphere and upper atmosphere; technology and new methods in small satellite constellation and space exploration; effects of solar activity on weather and climate of the solar system.

Key study orientations

- (1) Solar driving source of space weather and related physical mechanisms
- (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 geodesy and earth detection, process and mechanism of earth's mass transferring

About 4 to 6 projects will be supported.

Department of Engineering and Materials Sciences

Two categories of Key Program projects are to be funded by the Department of Engineering and Materials Sciences, namely, Key Program projects in the priority areas of the Department and Key Program projects of the respective divisions. In 2010, 63 research proposals were funded after the evaluation by the Department with a total funding of 147.5 million yuan, an average funding of 2.34 million yuan per project and an approval rate of 24.9%.

According to the overall arrangement of the Department in priorities, 10 to 12 projects will be supported in the following three directions with an average funding of 3 million yuan per project for 5 years in 2011.

1. Corrosion mechanism and related fundamentals of metal corrosion in environments (E011101)

- (1) Basic theory of electrochemistry of thin liquid film of material corrosion in the atmosphere
- (2) Influencing factors and rust evolution mechanism of metals in typical atmospheres
- (3) Formation and failure mechanisms of corrosion product film on typical metallic materials in water environments
- (4) Key influencing factors and related mechanisms of soil corrosion of high-strength pipeline steels

2. Research on the growth of nonlinear optical crystals with important application background and related scientific basis (E0201)

Focused on the exploration, growth and characterization of novel nonlinear optical crystals with important application background, the following three topics will be financed preferentially:

- (1) The growth and characterization of novel UV and DUV nonlinear optical crystal
- (2) The growth and characterization of novel middle and far-infrared nonlinear optical crystal with high power and high efficiency
- (3) Fundamental research and technological keys for the growth of large-size nonlinear optical crystal with important application background

3. Studies on aging failure basic rules and novel protection methods of organic polymer materials under complex weather conditions (E031304)

In view of complex natural environments in various types of typical regions of our country, the aging failure behavior and mechanism of typical polymer materials will be studied. Through comparison of aging behavior of polymer materials under natural

outdoor environment and indoor simulation environment, the corresponding relationship of aging failure will be achieved, and the service life of polymer materials will be predicted theoretically. The new mechanism and novel methods of ageing resistance and high efficient stabilization of polymer materials under complex weather conditions will be developed.

About 10 to 12 projects in following priority areas will be funded by respective divisions in 2011.

- 1. Bionic functionalization of metallic materials and its fabrication foundation (E010503)**
- 2. New strengthening and toughening mechanism of magnesium alloys and new magnesium alloy design (E010803)**
- 3. Phase transformation and deformation of metallic materials at high strain rate and the related scientific foundation (E010801)**
- 4. Fabrication foundation of aluminum based amorphous bulk materials (E010301)**
- 5. Nano phase structure and magnetic properties of new high-temperature permanent magnet (E010501)**
- 6. Micro-mechanism in the interfacial synergy deformation of composite sheet during rolling (E010801)**
- 7. Physical metallurgical foundation of toughening of intermetallic materials by metallic phase (E010803)**
- 8. Calculation and simulation of alloy phase, phase transformation and relative properties in a ternary metallic system (E010603)**
- 9. Cluster structure and relative properties of complex alloy phase (E010701)**
- 10. Penetration and anti-irradiation mechanism and design of nuclear coatings (E011002)**
- 11. Structure assembly, controlled release drug delivery and targeting vectors for inorganic micro/nano carriers (E0204)**
- 12. Study on the mechanism of hardening and hydration of silicate (Portland) cement under the influence of exogenous and native sulfate (E0205)**
- 13. Key scientific problems in the high-temperature microwave response of microwave absorbing materials (E0204)**
- 14. Fundamental application research on the multi-field coupling of composite materials and related novel devices (E0204)**
- 15. Fundamental research on LTCC materials (E0204)**
- 16. Research on low-dimensional materials and structures with special functions (E02)**
- 17. Novel quantum-dot manipulation and some related fundamental problems in applications of bio-detection (E0207)**
- 18. The mechanisms and applications in transparent functional microstructure induced by femtosecond Laser (E02)**

19. Basic research on the low temperature fluidity of polymer molecular chains and its application in polymer materials preparation (E0315)
20. Basic research on the preparation of polymer materials: from molecular design to regulation of aggregation structures (E03)
21. Fundamental research on opto-electronic organic polymer materials and devices with high efficiency and stability (E0309)
22. Basic issues on the implementation of high performance and low cost for general polymer materials (E0301, E0302 and E0303)
23. Basic issues on biomedical polymer materials (E0310)
24. Basic research on polymer materials related to energy, environment and resource utilization (E0313)
25. Construction and regulation of hierarchy structures of functional polymer materials (E0314)
26. New theories and new methods for polymer material processing (E0315)
27. Fundamental research on Gas Drilling Technology (E0407)
28. Storage and transportation of fluid fossil energy (E0404)
29. Basis on the wall rock destroy and control of the submarine tunnel (E0409)
30. Stability and safety monitor of the tailings dam (E0405)
31. Mechanism of the HEAT-HARM prevention and control in deep well (E0410)
32. Efficient utilization of Complicated and Refractory iron minerals (E0411)
33. Novel method of metallurgical physical chemistry (E0412)
34. Ferroalloy electrothermal theories (E0414)
35. Manufacturing Process basis of the Porous or fibre metal materials (E0416)
36. Mechanisms innovation and system integration design of mechanical systems (E0501, E0506)
37. Fundamentals of key technologies of novel precision driving/transmission systems (E0502)
38. Dynamic behaviors and control methods of complex electromechanical systems (E0503, E0505)
39. Fundamentals of full life-cycle and reliability design on key parts/components (E0504, E0506)
40. Biomanufacturing and Bionic Manufacturing (E0507)
41. Novel process and equipment principles of precision forming (E0508)
42. New principles and processes on the manufacturing of key components/devices (E0509)
43. Fundamentals of low-carbon manufacturing (E0510)
44. Fundamentals of high energy density beam and nontraditional energy field manufacturing (E0509)
45. New principles of the design and manufacturing of precision mechanical sensors (E0511)
46. Mechanism research on flow, drag and noise reduction in fluid machinery

(E0602)

47. Research on heat and mass transfer based on time, space micro/nano, trans-dimensional and phase interface enhancement (E0603)

48. Combustion reaction dynamics and fundamental theory of combustion (E0604)

49. New-pattern combustion and pollutant emission mechanism study for solid fuels (E0604)

50. Research on multiphase flow and interfacial effect (E0605)

51. Fundamental issues of engineering thermo-physics in application of solar energy and biomass energy (E0607)

52. Fundamental issues of engineering thermo-physics in environmental pollution protection (E0608)

53. Fundamental research on high efficient conversion and large scale storage of electric power (E070303/E0712)

54. Key issues on the Smart Grid and its facilities (E0704, E0705)

55. Fundamental research on electromagnetic-biological effects (E0711, E0701)

56. Fundamental research on the UHV apparatus and related electric materials (E0705, E0702)

57. Key issues on the efficiency and reliability of power electronic devices and its system (E0706)

58. Key issues on the pulse power and discharge plasma (generation and application) (E0707)

59. Key issues on the power transmission and system integration of large scale sustainable energy (E0704)

60. The theories and methods of the protection and regeneration of historic towns and architectural heritages (E0801)

61. The theories and methods of the public building design based on sustainability (E0801)

62. Thermodynamic analysis on building thermal built environment (E0803)

63. The theories and methods of industrial building environments control and energy-saving design (E0803)

64. New process principles for high efficiency and security drinking water purification (E0804)

65. Fundamental research on novel advanced treatment technologies for urban wastewater reclamation (E0804)

66. Water quality degradation mechanism and control principle of reclaimed water during surface storage (E0804)

67. High-performance civil engineering structural system (E0805)

68. Structural safety and protection of nuclear power plants (E0805)

69. Deformation control and dynamic damage analysis for high-speed rail system (E0807)

70. Scientific solutions for transportation problems during urban development (1):

Modern urban transportation network system and control (E0807)

71. Scientific solutions for transportation problems during urban development (2): Fundamental theory and methodology for integration design of modern urban transportation systems (E0807)

72. Extreme hydrological processes and disaster prevention and reduction methods (E0901)

73. High efficient water use in paddy field and its environmental impact (E0902, E0903)

74. Hydro-environmental effects of estuarine and coastal works (E0903, E0909)

75. Pressure fluctuation and hydraulic vibration in hydraulic machinery system (E0906).

76. Stability of large-scale underground caverns under influence of problematic terrane (E0907)

77. Forecast and treatment of unfavorable geological conditions in the construction of hydraulic tunnels (E0907)

78. Theory and methodology for real-time control in the construction of high dams (E0908)

79. Dynamic characteristic and safety of floating structures in complex environment (E0909, E0910)

80. Navigation performance and Energy efficiency advancement of large ship (E0910)

81. Theory and methodology for long-term service of major hydraulic structures or ocean works (E0908, E0910)

Department of Information Sciences

In 2010, the Department of Information Sciences announced 47 areas and 4 priority funding areas for the application of Key Program, received 240 applications, and funded 59 projects with a total funding of 137.50 million yuan and an average funding intensity of 2.33 million yuan per project.

The Department announces 61 areas and 4 priority funding areas for application in 2011. The Department plans to fund 65 to 70 Key Program projects with an average funding of about 3 million yuan per project for 5 years.

Please provide proper application code in the application form.

Key priority funding areas of the Department

1. Basic theory and key technology for the operation safety of high speed trains (F03, 2-4 projects)

The operation safety of high speed trains is fundamentally important for the development of high speed train system in China. It involves a series of important scientific issues such as the safe operation of a large, complex and fast changing system in unknown environment. This key funding area stresses on the development of new theory, new methods, and new technology, as well as the verification using experimental platform of high speed train for promoting the integration of theoretical studies and engineering applications. Main research areas are as follows:

- (1) Theory and method of mobile communication for operation safety of high speed trains
- (2) Sensing and overall monitoring of high speed trains and its operating environment
- (3) Safety warning and maintenance of high speed trains
- (4) Theory and methods of active safety control of high speed trains

2. THz information theory and technology (F01, 2-4 projects)

Main research areas

- (1) New types of THz source
- (2) Wide band high speed regulation technology of THz waves
- (3) THz detection system and target diction
- (4) Theory and characteristics of new THz transmission line

3. Studies on all solid state laser technology based on nonlinear functional crystals (F0506, 1-2 projects)

Main research areas

- (1) Studies on high power, short wavelength, narrow line deep ultraviolet all solid state laser
- (2) Studies on watt level all solid self double frequency green light laser

4. Studies on high power laser technology for new applications (F0506, 2-3 projects)

Main research areas

- (1) Studies on SBS hundred picoseconds laser technology with high peak power and high energy
- (2) Studies on basic problems of high average power 2 micrometer ultra short pulse laser technology
- (3) Studies on basic theory and key technology of generation, amplification and synthesis of high power all optic fiber lasers

Key areas will be funded by Divisions as follows:

- 1. Theory and key technology of intelligent and active service for mobile network users (F010104)**
- 2. Theory and technology for high speed data transmission in space network**

(F010203)

3. Theory and method for wireless communication channels for underground rail transportation (F010202)

4. Theory and key technology of OFDM-PON (F010205)

5. Key technology of multi user quantum communication (F010205)

6. Basis of on board high frequency ground wave over the horizon radar marine detection (F010303)

7. Integrated SAR information processing and environmental parameter inversion (F010304)

8. Basic theory and key technology of ground target tracing and positioning by unmanned plane (F010404)

9. Near space SAR information processing and imaging (F010404)

10. Multi strategy minority language machine translation based on semantics (F010406)

11. Theory and key technology of low consumption IP core design based on double logic (F010501)

12. Active and micro nano structure meta-material (F010612)

13. Temporal information characteristics of neural image and it clinical drug effectiveness relevance prediction (F010810)

14. Basic research on silicon integrated nano multi level composite structure micro nano air-sensitive sensor (F010905)

15. Basic theory and key technology of open software system (F020201)

16. Basic theory and key technology of data quality management (F020204)

17. Analysis and mining of group behavior in multi source heterogeneous data merging (F020204)

18. Method and technology of parallel programming for many-core processor (F020206)

19. Theory and method of management for large hetero parallel systems (F020304)

20. Video coding, transmission and intelligent processing adapted for cloud computing environment (F020502)

21. Complex scenario modeling and super high resolution rendering technology (F020503)

22. Studies on machine learning method for protein data (including protein interaction) (F020504)

23. Theory and method of exploratory video analysis (F020505)

24. Basic theory and method for space-time type processing of knowledge (F020512)

25. Basic theory and method of semantic analysis for chapters in Chinese language (F020603)

26. New types of encryption algorithm and security analysis (F020701)

27. Security and privacy protection in new computing environment (F020702)

28. Post IP architecture and exploration of mechanism (F020801)

29. Theory and key technology of sensing computation for mobile social network (F020808)
30. Theory and key technology of low energy consumption scalability for large data center (F020403)
31. Theory and key technology for on-chip many-core processor verification (F020401)
32. Mineral selection process monitoring and optimal control based on machine visual sense (F0301)
33. Quantum system control theory and experimental verification system (F0301)
34. Dynamic evolution modeling and coordinated control of carbon fiber forming process (F0301)
35. Modeling and control of reproduction of coordinated target movement in space (F0301)
36. Dynamics and control of vertical or short distance take off aircraft (F0301)
37. Real time monitor, evaluation and optimization of multi level structure process system performance (F0301)
38. Dynamic behavior and regulation mechanism of bimolecular network of complex metabolic disease (F0302)
39. Method and technology for fast acquisition of crop environmental information (F0303)
40. Theory and technology of information acquisition and storage based on retarded memory (F0303)
41. High performance air sensor for automobile environment protection (F0303)
42. Non-coordinated target information processing based on joint decision making and estimation (F0304)
43. Computational modeling of voice generation and application in language barrier rehabilitation (F0304)
44. Visual computation theory and principle verification system based on non Euclidean space (F0304)
45. Theory and technology of environmental observation using deep water robot (F0306)
46. Mechanism of local muscle and neural function re-construction and method of information decoding (F0307)
47. Studies on key technology of AIN single crystal cushion material preparation (F0401)
48. Key scientific issues in oxidant membrane transistor used in OLD active display (F0404)
49. Research on integrated passive sensor for applications in IOT (F0407)
50. Studies on Graphene filed effect transistor and its integrated technology (F0404)
51. Studies on excited transmission of electric pump organic transistor (F0403)
52. Studies on femto second ultra fine processing and application of

reflection/refraction mixed imaging devices (F0501)

53. Studies on key technology of high sensitivity bio chemical optic fiber sensors (F0503)

54. Studies on high performance micro structured transistor laser (F0502)

55. Basic research on ultra high density photo information storage and devices (F0501)

56. Basic research on high speed photo electric devices based on new electro photo materials (F0502)

57. Studies on new types of full-spectrum efficient compound transistor solar cells (F0403)

58. Studies on key technology of graph processor chips (F0402)

59. Studies on new theory and new materials for light wave length/THz 3-D stealth technology (F0509)

60. Studies on maskless parallel nano direct writing technology based on surface plasma eximer (F0508)

61. Generation, characterization of vector light beams and applications in optical micro control (F0505)

Department of Management Sciences

In accordance with the development planning and priority area of the 12th Five-Year Plan period, the Department of Management Sciences will release areas of the key programs year by year and duly issue areas of key programs group and data infrastructure. The number of key program and the average funding intensity will be increased to some extent compared with the 11th Five-Year Plan period. Key Program focus on the economic and social development and opening up policy of the country, aims at 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 possible resolved in the improvement of the comprehensive competitiveness. The research shall be oriented toward scientific issues exploring management theories and laws with Chinese characteristics, and shall be systematically carried out in the fields with sound research basis 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.

Applicants 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

A total of 21 priority areas are proposed by the Department in 2011, around 21 Key Program projects are planned for funding in 2011 with an average funding intensity of 1.8-2.5 million yuan per project. The duration for each Key Program project will be 5 years.

1. Modeling on complex evolution of financial system, assets Evaluation and risk anagement (G0115, G0116)

Research on the microscopic behavior and mechanism in the system of complex financial system (Individual's adaptive behavior and interactions, evolution behavior of organizations and groups etc.), various modeling techniques of the complex evolution of the financial system, analysis of dynamic properties of complex evolution of the financial system, factors in asset prices of the complex evolution of the financial system and formation process (Market system, investor behavior and the impact of external information etc.), risk management method and financial design in the context of the complex evolution of the financial system.

2. Operation management and modeling of the integrated transport system (G0103)

Research on the mechanism of choice behavior in the regional integrated transport system, the modeling of the variety of transportation options, theories and methods of the regional integrated transport network, and structure optimization. Research on factors of the efficiency of regional integrated transport network, and evaluation methodology. Study on organization theories and optimization methods focusing the integrated operation of overall transport hubs, and the harmonious modeling of the synthesized transport system integration. The development of the management theory and methods which can improve the overall transportation system efficiency based on the empirical study.

3. Research on multi-source information service systems in the environment of cloud computing (G0112)

Research on the discovery mechanism, management method, the integration method of multi-source information, the characteristics of multi-source information services and

multi-source information service model, the service process optimization and coordination mechanism in the environment of cloud computing, architecture and key technologies of multi-source information service system, and the reliability protection mechanism of multi-source information service system and management method of multi-source information service system application process in the environment of cloud computing.

4. Optimal Management and control of the compact Storage Systems (G0103)

Research on strategy optimization problems of the compact cargo storage center access, cost optimization and control problems of the compact cargo storage center, simulation modeling problems of the compact cargo storage system, compact storage systems coordination optimization problems under distribution information, compact storage system optimization decision problems based on the company behavior, and the construction and development problems of the compact cargo storage system etc.

5. Innovation mode and method research on our country's supply chain management (G0103)

Research on the operational theory and method in a innovation mode of supply chain management in line with the status quo in China, including formation mechanism of the new cooperation model, operational theory and method of supply chain optimization, profit sharing mechanism and method of supply chain coalition and the stability of coalition, the product cooperation and innovation model in supply chain and its operational mechanism, the operational theory and method in supply chain based on multi-channel distribution, and the operational theory and method based on innovation mode of supply chain finance.

6. Theories and methods of the panel data modeling (G0113)

Research on the panel data, which is a data type of pooling of cross-section and time-series data, including the analysis and characterization of the internal dependency structure of panel data, mixed effect or marginal regression models based on panel data, the asymptotic behavior and theoretic property of panel data model, the variable selection of the high dimensional panel data model, and the mutations behavior of long term observed panel data and statistical inference.

The empirical study is carried out on practical problems from the social system and economy system.

7. Resource scheduling and optimization in medical service (G0103, G0110)

Research on the optimization problem of key resources involved in hospitals' operation and management, including the ranking and optimization of the key resources in hospitals, the operational management of key resources in hospital, the predictive maintenance of medical equipment, theories and methods of the optimization and

allocation of the major medical resources, the related collaborative optimization model of the key resources, algorithm and theories and methods of the system implementation, as well as theories and method of the hospital emergency planning management, the resource scheduling and the system simulation.

8. Research on foreign direct investments and international merging strategies of Chinese enterprises (G0201)

Systematic researches on the theory and practice of Chinese enterprises' outward external direct investment (OFDI) and international merging, and the international strategy and theoretical innovation of state enterprises in emerging markets countries. The main study topics include: the influences of native markets on Chinese enterprises OFDI motive, process and the results; the transnational management and control mode of enterprises and the adaptation, learning and ability improvement of overseas subsidiaries; the integration of transnational merging and knowledge transfer mechanisms; impacts of technical ability, industrial development, culture, institutions and the geographic distance on the foreign direct investments by Chinese enterprises. Comparative study on the foreign direct investments and merging between Chinese enterprise and other emerging markets enterprise.

9. Research on transnational governance and evaluation of Chinese conglomerates (G0202)

Research on the theory and mechanism of transnational (transcultural) and networking governance of the multinational operation, conglomerates and listed companies, as well as the governance mechanism and theory and method of evaluation on governance, which could provide theoretical basis of governance system design for internationalization and business growth and development of Chinese enterprises. The main research contents include: the research on networking governance structure and features of conglomerates; the networking operating model and management mechanisms design of the enterprises group under the uncertain environment; the transnational governance structure and mechanism of international enterprises or overseas listed companies; the transition of Chinese corporate governance regime and the dynamic optimization and application of corporate governance evaluation system, etc.

10. Cenozoic employees and diversity management of human resources (G0205)

Research on the theory and method of the human resource management strategy from the multiple perspectives in consideration with the diversity of the human resources and the current situation, where Cenozoic employees are the major force for enterprise. The main contents include: the pluralism structure of human resources and the improvement of the labour quality; group characteristics of Cenozoic employees and 'generation gap' in the workplace; the organizational structure and incentives mechanism in enterprises; wages

and salaries of the employees and labour supplying; corporate culture, psychological contract and employee performance management; onthejob training and employee enhance program, etc.

11. Research on accounting information and resource allocation efficiency (G0207)

In consideration of the reality of the accounting information quality and disclosure of Chinese listed companies, research on the influence mechanisms of the accounting information quality of Chinese listed companies on the resource allocation efficiency for internal and external capital markets. The main contents include: the accounting information quality and its impacts on resource allocation efficiency of the capital market; the accounting information risk and business valuation; accounting information, companies internal governance and internal resource allocation efficiency in the group; accounting information and credit resource allocation efficiency; the influence of split share structure reform on the relations of accounting information and resource allocation efficiency, etc.

12. Customer relationship and marketing channels management under Network environment (G0208)

Under the Internet environment for enriching the scientific theory of marketing, research on theories and methods of the new customer relationship management and channel relationship management. The main contents include: new features of customer relationship under the Internet environment; the impact of online community information dissemination on business customer relationship; online and offline marketing channels matching and physical logistics, products and service assurance systems; customer relationship revenue management, and channel optimization management, etc.

13. Research on networking of Research & Development and technological innovation of enterprises (G0210)

Under the networking of R&D, the globalization and transformation of Chinese economic structure, research on the formation mechanism of technological innovation capability of enterprise which will provide theoretical support for strengthening technological innovation capability of enterprise. The main contents include: the networking of R&D, global knowledge innovation, sharing and transfer mechanisms; the law of the technology and organizational integration, matching and interact; the mechanism and model of technology introduction, digestion, absorption and re-innovation; the formation mechanism and evolution of the technological innovation network between organizations and within the organizations; the formation mechanism and dynamics evolution of indigenous innovation ability, and the formation mechanism of technological innovation system and innovation culture, etc.

14. Research on the integration of logistics resource and scheduling optimization (G0212)

Under the new IT technology environment, research on the integration of resources and the mechanism of value creating process of the logistics system, synergy of network structure logistics, the theory and method of scheduling optimization. The main contents include: the logistics resources and its characteristics based on the new IT technology; the dynamic analysis of resource integration of the logistics system; the process and principles of logistics resource value creation and the model of maximizing the benefits, and the optimization scheduling methods of logistics resource. Study on the coordination mechanisms among the participants whose decision-making is decentralized in the logistics network, the model of synergy benefits and cost.

15. The economic security management of important strategic resources of the nation (G0301)

Analysis of the relationship of the alternative resources between the potential growth of resource extraction, the changes of demand structures and important resources based on investigation on the current situation and development trend of the sources of the important strategic resources, price formation mechanism, and transportation. Research on the macro-economic management tools and countermeasures concerned for realizing optimal domestic resources exploitation and import channel selection based on the comparison of the costs, benefits and risks between the import of foreign resources and the exploitation of domestic resources, which should be carried out combining with empirical study on a certain type of resources.

16. Research on construction and management of the rural financial system (G0305)

Research on the rural financial theory and model, and market structure system which are rationally integrated between rural and finance, as well as its characteristics based on the transition economy; the credit demands behavior and the extent of credit constraints of farmers and agriculture-related business; models, operating systems, efficiency and impact of the formal and informal rural financial organizations and their relationship of integration; patterns of the rural financial risk management and innovative financing mechanisms; the function and role of government in the rural financial market, and the institutional arrangement, policy and suggestion for reforming the rural financial market.

17. Research on the national public policy decision-making pattern and evolution (G0306)

Research on the formation, evolution and development trends of public decision-making pattern in China, and the differences from that of the Western countries, as well as the establishment of the public policy-making pattern and its path for Chinese circumstances based on the analysis of the decision-making pattern and evolution of the foreign public policy, the Chinese practice and experience of public decision-making.

18. Research on theories of the public hospital govern, regular methods and policies under the background of the new health care reform (G0308)

Research on the expectations model of the hospital for its new social role, the content, the evaluation criteria and system, as well as the implementation mechanism of the public welfare of hospital; analysis of the game process of stakeholders related to the public hospital and the establishment of a diversified and progressive management and supervisory pattern for public hospital with Chinese circumstances based on the institutional innovation theory; study on governance pattern with the positive interaction between the government and public hospital, in particular the coordinate relationships between the internal management and external supervision of government for public hospital for providing a theoretical support to policy making in the reforms of the public health system .

19. Research on China's education resources allocation mechanism (G0309)

Research on the relationships between the education and the economic & social development, the amount of education resources and its spatial distribution in China; the rational configuration and implementation mechanisms of education resources among different levels of educations and within different levels of administration areas; the key factors affecting the education resources allocation, such as school layout structure adjustment, the balanced configuration of compulsory education resources, the financial resources for school condition, the inter-regional and intra-area distribution of education opportunity, etc. An empirical research with a particular education type or region is required.

20. Research on the management of national urbanization (G0313)

Research on the objective of Chinese urbanization, the coordination of urban and rural development, and the role of the government in the process of the urbanization, and study on the development rate, dynamic mechanism, influencing factors and spatial distribution of Chinese urbanization in the new period, and the proposal for the reform policy, the pattern for city management and the future direction of rural development based on the experience and lessons of foreign experience in the process of the urbanization, and Chinese experience in the process of the urbanization and its impact on the social and economic development since the reform and opening-up policy was implemented.

21. Research on the Policy and Management of Information Resources Industry Development (G0314)

Research on the strategic value of the information resources industry's development on the economic developing mode changes of the country, and the optimizing and upgrading of traditional industries, as well as the expanding of employment; analysis of the policy environment required by the information resource industry; study on objectives, functions, basic framework, the core value, and primary coverage of the information

resource industry, as well as policy tools and their application, implementation, evaluation, etc.; the strategy proposal for priority development and management measure of information resources industry. An empirical study focusing on a specific information resource is required.

Basic Data Construction

Principles for selecting the basic data construction area are as follows: a good working basis, the fully incarnation of the advantages and characteristics of the country, and in favor of the enhancement of the international status of the management science in China; the sharing data provided should be necessary to the scientific research and scholars working in different area, and hardly obtain through other channels; the host institution should have the permanent data hardware platform and guarantee to matching necessary financial support; the funding for the project will be used for the data acquisition, data processing and data sharing only.

Data acquisition platform

It is aiming at the establishment of the platform for the comprehensive, systematic, standardized, regular data investigation in a specific area, which should share all results and data with scientific community and provide open service. 1-2 projects will be funded with a funding intensity of 400-500 million yuan per project. The duration of the project will be 5 years.

Data sharing platform

It is aiming at the collection of the existing cruising data accepted by the scientific community, and the establishment of a data sharing platform to simplify the process of data sharing and maximize the utilization of the data. 1-2 projects will be funded with a funding intensity of 100- 150 million yuan per project. The duration of the project will be 5 years.

Department of Health Sciences

Two types of Key Program projects are offered by the Department of Health Sciences in 2011: solicited key program according to certain thematic areas that are set by the panel scientists on the basis of the Department's priority areas, and unsolicited key program according to the extensive areas of medical scientific frontiers, which are not covered in listed areas for Key Program, proposed by applicants themselves.

About 80 Key Program projects will be awarded by the Department of Health Sciences in 2011, of which 80% are for solicited Key Program projects, and 20% for unsolicited Key

Program projects. The funding intensity is expected to be 2 to 4 million yuan per project (A specification is required when more fund are requested, with a maximum of 5 million yuan per project and the average award size around 3 million yuan), and the duration for each Key Program project is 5 years. Applicants are also expected to fill in the budget and justification form.

The thematic areas for solicited Key Program projects and their corresponding application codes in the Department of Health sciences in 2011 are listed as follows:

- 1. The molecular mechanism involved in the chronic airway inflammatory disease (H01 Respiratory System)**
- 2. The mechanism and intervention in the abnormalities of bleeding and blood coagulation regulation and thrombosis (H08 Haematological System)**
- 3. Basic research on the mechanism and intervention of vascular injury and repair (H02 Circulatory System)**
- 4. The mechanism involved in the disease related to the gastrointestinal mucosae injury (H03 Digestive System)**
- 5. Pathogenesis of renal persistent fibrosis (H05 Urinary system)**
- 6. The relationship between important diseases of filial generation and uterus microenvironment (H04 Reproductive system)**
- 7. Islet β cell and development of diabetes mellitus (H07 Endocrine System)**
- 8. Pathogenesis of important blind related eye diseases and basic research on injure of eye area and vision function reconstruction (H12 Ophthalmology)**
- 9. Genetic susceptibility to psychiatric disorders and pathogenesis research (H09 Neurological and Psychiatric Diseases)**
- 10. Abnormalities of electroneurographic activity and pathogenesis of Seizure Disorder (H09 Neurological and Psychiatric Diseases)**
- 11. The basic research on multifunctional contrast agents and molecular probes (H18 Medical Imaging and Biomedical Engineering)**
- 12. The theory, methods and the basic research on small animal imaging in vivo (H18 Medical Imaging and Biomedical Engineering)**
- 13. Research on the etiology and pathogenesis of important human parasites (H19 Medical Pathogenic Microorganisms and Infections)**
- 14. Research on the etiology and pathogenesis of Inflammatory and immune skin diseases (H11 Skin and Skin Appendages)**
- 15. Research on the molecular mechanisms of initiation and development of the bone and joint degenerative diseases (H06 Orthopedics and Sports Medicine)**
- 16. Research on the pathophysiological mechanisms and therapeutics interventions in sepsis and subsequently multiple organ damages (H15 Emergency Medicine, Trauma, Burns and Plastic surgery)**
- 17. Effect of protein modification on occurrence and development of cancer (H16 Oncology)**

18. Cell autophagy and cancer occurrence and development (H16 Oncology)
19. Mechanism of resistance to molecular targeted cancer therapy (H16 Oncology)
20. Gonadal hormones and cancer occurrence and development (H16 Oncology)
21. The intake of nutrient and food bio-activated substances on the prevention and treatment of chronic disease (H26 Preventive Medicine)
22. The Prevention and treatment of early health impact in population exposed to environmental and occupational hazards (H26 Preventive Medicine)
23. The molecular and cellular mechanism underlying immune therapy (H10 Medical Immunology)
24. Basic research on immune rejection and immune tolerance in allograft (H10 Medical Immunology)
25. Basic research on high efficient drug delivery systems (H30 Materia Medica)
26. Research on new drug targets for insulin resistance and drug intervention (H31 Pharmacology)
27. Basic research on the therapeutic principles and treatments of Traditional Chinese Medicine in vital important diseases (H27 Traditional Chinese Medicine)
28. The biological basis of the effect and compatibility of accupoints (H27 Traditional Chinese Medicine)
29. The research on the correlation between genuine traditional Chinese medicines and ecological environment (H28 Traditional Chinese Materia Medica)
30. The basic research on the contemporary traditional Chinese medicine in compound based on Holism (H28 Traditional Chinese Materia Medica)