

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 actively 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 direction and be specific in content, and not to cover all areas.

In general, Key Program project has only one research unit. If necessary, two units are allowed as collaborators at maximum. The length of a Key Program project usually lasts for 4 years.

In 2009, NSFC funded 391 Key Program projects, with a total funding of 724.08 million yuan and an average funding of 1.8519 million yuan per project (please see the table below for detailed information). In the year 2010, 360 Key Program projects are planned to be supported, with a total funding of about 900 million yuan.

Funding of Key Program Projects in 2009

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	163	48	9,438	13.03	196.63	29.45
Chemical Sciences	203	48	9,000	12.43	187.5	23.65
Life Sciences	813	114	20,000	27.62	175.44	14.02
Earth Sciences	324	56	9,900	13.67	176.79	17.28
Engineering and Materials Sciences	339	65	13,000	17.95	200	19.17
Information Sciences	154	46	9,400	12.98	204.35	29.87
Management Sciences	73	14	1,670	2.31	119.29	19.18
total	2,069	391	72,408	100	185.19	18.90

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

Department of Mathematical and Physical Sciences

In order to encourage competition and promote the generation of projects with innovative ideas during the Eleventh Five-Year Plan period, NSFC will announce more project areas and research directions for application in the *Guide* than the number of projects to be actually funded, so as to let the research directions guide applicants to choose research topics. Applicants may choose freely the research title, research content, research scheme and fund request in the following specified areas. Key Program projects are determined mainly on the basis of priority funding areas proposed in the “Study report of disciplinary strategic development for the Eleventh Five-Year Plan period”. The reason for doing so is to conduct an overall planning for the development of research disciplines.

In 2010, the Department plans to fund more than 40 Key Program projects. Please give the title of the area of proposed research in the Note section of the application form.

In 2010, the Division of Mathematics plans to fund 6-8 Key Program projects, with an average funding of 1.4 million yuan per project. Main research directions are listed as follows:

1. Automorphic form and Galois representation theory (A0101)
2. Harmonic mapping and sub manifold geometry and topology (A0103)
3. Multi-complex analysis and complex geometry (A0105)
4. Nonlinear functional analysis and infinite dimensional dynamical systems (A0106)
5. Delay differential equation and difference equation (A0107)
6. Nonlinear elliptic and parabolic equations (A0108)
7. Nonlinear hyperbolic and mixed partial differential equations (A0108)
8. Mathematical and physical problems in quantum field theory and string theory (A0109)
9. Graph value Markov process (A0110)
10. Complex data statistical inference (A0111)
11. Problems driven applied mathematical research (A0114)
12. Self adaptive high precision computational methods (A0117)
13. Geometric modeling of complex bodies, theory and application (A0117)

In 2010, the Division of Mechanics plans to fund 8-10 Key Program projects, and the average funding will be 2 million yuan per project. Main research directions are listed as follows:

1. Nonlinear dynamics and control of high dimensional system (A0202)
2. Dynamical, vibration and control problems in aerospace (A0202)
3. Basic mechanical problems in advanced materials and structures (A0203)
4. Studies on the completeness and endurance of structure (A0203)
5. Multi field coupling mechanical problems (A0203)
6. Studies on complex flow mechanisms (A0204)
7. Fluid mechanical problems in major projects (A0204)
8. Biomechanical studies related to human health and medical sciences (A0205)
9. Key mechanical problems in extreme conditions (A02)
10. Key basic mechanical problems in new energy field (A02)
11. Key mechanical problems in major equipment (A02)
12. Theory, methods and software in computational mechanics (A02)
13. New methods and technology in experimental mechanics (A02)

In 2010, the Division of Astronomy plans to fund 6-9 Key Program projects, and the average funding will be 1.8 to 2.4 million yuan per project. Main research directions are listed as follows:

1. Galactic cosmology (A0301 and A0302)

- (1) Cosmological parameters, dark matters and dark energy, and observable phenomenon of residuals from early cosmic evolution;
- (2) Formation of various celestial bodies and structures in the universe, and key physical process of formation of structures;

- (3) Formation and evolution of galaxies;
- (4) Radiation, structure and evolution of active nucleus of galaxy.

2. Formation, evolution and eruption of stars (A0303)

- (1) Formation and early evolution of stars, especially the observation and theoretical studies on the formation of large mass stars and large scale formation of stars in the galaxy;
- (2) Star structure and evolution and star atmosphere, late evolution of stars and compact celestial bodies and relevant eruption phenomenon and radiation mechanisms, and the observation and theory of formation, evolution of outer planets in the solar system;
- (3) Structure and evolution of the Galaxy.

3. Solar physics (A0304)

- (1) Precise structure and evolution of solar magnetic field and velocity field, and the process of interaction between solar magnetic field and plasma;
- (2) Solar eruption events, especially the solar flare and characteristics of the source and physical mechanism and high-energy radiation, and dynamic process of solar corona mass ejection;
- (3) Effect of solar eruption activity on the weather in solar earth space, and the physical basis and methods for solar activity forecast;
- (4) Solar quake, solar power generator and solar weekly activity mechanism;
- (5) Heating mechanism of solar corona and cause of high-speed solar wind.

4. Astrometry and celestial mechanics (A0306 and A0307)

- (1) Methods of astrometry and development of astronomical reference frame;
- (2) Theory and methods of celestial mechanics;
- (3) Planet and star system dynamics;
- (4) Natural and artificial celestial dynamics of the solar system;
- (5) Astrodynamics;
- (6) Applied astronomical research to address national key needs.

5. Astronomical techniques and methods (A0308)

- (1) Radio astronomical techniques (including millimeter wave and sub millimeter wave);
- (2) Optical and infrared astronomical techniques;
- (3) High energy astronomical technology;
- (4) Space astronomical techniques and other astronomical techniques and methods.

In 2010, the Division I of Physics plans to fund 6-8 Key Program projects, and the average funding will be 2 million yuan per project. Main research directions are listed as follows:

1. Physical problems in solar energy, hydrogen energy and other new forms of energy (A0402 and A0404)

2. Physics of new functional materials (A0402 and A0404)

- (1) Physical properties of new functional materials such as ferro electric, thermoelectric and semiconductors;

- (2) Physical properties of new types of 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 transfer materials.

3. New phenomena in relevant electronic systems (A0402)

- (1) Superconducting mechanism of non standard superconductors and normal state abnormal physical properties;
- (2) Special physical properties of strongly related electronic systems, metal-insulator transformation and quantum phase change;
- (3) Low dimensional system quantum magnetism and other physical problems.

4. Physical properties of soft matter systems (A0402)

- (1) Physical properties of particle matter;
- (2) Physical issues of meso-scale water systems;
- (3) Explorations on nonlinear physical phenomena and laws in complex systems.

5. Quantum transport phenomena in confined quantum systems (A0402)

6. Micro-nano scale photonics (A0404 and A0402)

- (1) Micro structure photo functional material physics;
- (2) Surface plasma excimer physics;
- (3) Cavity quantum electrodynamics solid micro cavities.

7. Cold atomic and molecular physics and basis of applications (A0403 and A0404)

- (1) Interactions of light and cold atom and molecules;
- (2) Cavity quantum electrodynamics.

8. Complex interactions in atomic and molecular systems (A0403 and A0404)

- (1) Atomic and molecular properties and impact dynamics under special environments;
- (2) Correlation, excited state dynamics and quantum multi body process in molecules;
- (3) Interactions between light and atoms and molecules.

9. Quantum information physics (A0404 and A0402)

- (1) Physical problems such as quantum information storage, transmission, cloning, identification and measurement;
- (2) Physical realization of quantum bit, generation and measurement of quantum entanglement;
- (3) New principles and new methods of quantum computation.

10. New types of acoustic energy converter and its matrix (A0405)

- (1) New types of acoustic energy conversion materials and wide band and high power acoustic energy converter;
- (2) New types of acoustic energy converter such as acoustic MEMS and optical fiber;
- (3) Transducers of acoustic surface waves measuring physical, chemical and biological quantities.

11. Spatial temporal properties of marine acoustic field and its applications (A0405)

- (1) Properties of sound propagation, variation and scattering in 3-D uneven marine

environment;

(2) Laws and properties of low frequency, ultra low frequency sound propagation.

12. High precision measurement physics and technology (A04)

In 2010, the Division II of Physics plans to fund 5-7 Key Program projects, and the average funding will be 2 million yuan per project. Main research directions are listed as follows:

1. High dimensional gravitational theory, application and experimental verifications (A0501)

2. TeV energy zone physics and experimental methods (A0502)

3. Hadron structure and new hadron state (A0502, A0503)

4. Relativistic heavy ion collision and QCD phase change (A0503)

5. Radioactive nuclear beam physics, ultra heavy nuclear synthesis and nuclear decay properties (A0503)

6. Neutron physics and applied research (A0504)

7. Basic research on applications of nuclear technology in energy, environment and health related areas (A0504)

8. Advanced technology in accelerator and detectors (A0505)

9. Key physical problems and technology in low temperature plasmas (A0506)

10. Advanced technologies and experimental methods of synchrotron (A0507)

Department of Chemical Sciences

During the Eleventh Five-Year Plan period, there is a large increase in the number and funding intensity of Key Program projects supported by the Department of Chemical Sciences, which plans to grant around 215 Key Program projects. In the period of 2006-2009, the Department funded 180 Key Program projects. In 2010, The Department will publish guides and accept proposals in 41 research areas and the average funding intensity will be from 1.5 to 2.5 million yuan for each project. Proposals from those groups and teams with excellent research resources are welcome, and proposals for interdisciplinary research suggested by strong cooperative teams are encouraged. By the way, the number of projects actually funded by the Department will be less than the number of those research areas and the number of projects planned to be funded, as published in the *Guide to Programs*.

In 2010, the research areas of Key Program projects funded by the Department are listed as follows:

1. Preparation and function of clusters and their compounds (B01)

2. Multi-functional molecular materials (B01)

3. Compounds with multi-hole structure and their properties (B01)
4. Inorganic solid functional materials (B01)
5. Basis of bio-inorganic chemistry (B01)
6. Synthesis, structure and function of new large-ring host-molecule with multi-dimension and multi-hollow (B02)
7. Study of synthesis, reaction rule and application of element organic compounds (B02)
8. Research on the high effective asymmetric catalytic reaction (B02)
9. New reaction and new method in the synthesis of heterocyclic compounds (B02)
10. Study of active small molecule with regulating and controlling erroneous conformation of protein (B02)
11. Design and research based on controlling the selectivity of reaction (B02)
12. Synthesis of complex natural products with important bioactivity (B02)
13. Structure of self-assembly and characterizing way of assembly process (B03)
14. New methods on theoretical and computational chemistry (B03)
15. Application of theoretical and computational chemistry in the energy/materials/life fields (B03)
16. Study of the nature of catalytic action of catalyst (B03)
17. Key physicochemical issues related to the conversion process of energy (B03)
18. New method for studying electrochemistry (B03)
19. New method of molecular photochemistry and spectrum (B03)
20. Basic research of bio-physical chemistry (B03)
21. Synthetic chemistry of polymers (B04)
22. Polymers used in the field of bio-medicine (B04)
23. Structure and properties of polymers (B04)
24. Methodology of structural characterization of polymers (B04)
25. Polymer with optic/electric/magnetic function (B04)
26. New analytical method of complex samples (including handling sample, separation and determination, etc.) (B05)
27. Determination of mono-molecular and unicellular, and image formation analysis (including *in-situ* analysis) (B05)
28. Analytical chemistry basis of the bio-sensors (B05)
29. New techniques and new methods for pre-warning and diagnosis of major diseases (B05)
30. New techniques and new methods for high-output, multi-scale and multi-parameter analysis and determination (B05)
31. Key scientific issues in the area of bio-chemical engineering (B06)
32. Chemical engineering basis in the area of food and medicines (B06)
33. Chemical engineering foundation for the high effective clean utilization of fossil energies and exploitation of new energy (B06)
34. Basic research on chemical reaction engineering and separation engineering

(B06)

- 35. Scientific foundation of environmental chemical engineering and safety (B06)**
- 36. Key scientific issues related to the design of new materials for chemical engineering and chemical product engineering (B06)**
- 37. Basic problems of chemical engineering related to the high effective utilization of resources and the cyclic economy (B06)**
- 38. Bio-marker for early pre-warning of environmental pollution and its healthy risk (B07)**
- 39. Forming mechanism and controlling principle of typical pollutants in the industrial producing process (B07)**
- 40. Diagnosis, micro-interface process and regulating principle of soil polluted (B07)**
- 41. Discernment and metabolism of environmental pollutants as well as their toxicological mechanism (B07)**

Department of Life Sciences

In 2010, the Department of Life Sciences will support over 50 Key Program projects. The average funding will be around 2.0 million yuan per project. Applicants should carefully read the application requirement, things to be noted and funding plan of the Department in 2010 listed in this chapter, put forward reasonable budget clearly according to real research necessity. In general, the duration of Key Program projects is 4 years.

In 2010, the Department will accept applications entirely according to the designated areas published, so applicants should propose research topics, and compose application texts in accordance with the designated areas of Key Program guidelines issued by the Department in 2010. In the column of “Annotations” on the basic information table of the application form, applicants should write down the applied research areas. And applicants should correctly fill in the corresponding application codes lined out in each division’s designated areas. Please note that the designating of application codes of Key Program is just 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.

Note: The Department of Life Sciences will not accept proposals of free application to non-designated areas in 2010.

The designated areas of each division in the Department of Life Sciences in 2010 are as follows:

1. Molecular mechanisms and regulation study of microbe important physiological process (Microbiology, C010201)
2. Molecular mechanisms of mutual action between plants and microbes (Botany, C020402)
3. Sustainable mechanism and conservation of biodiversity (Ecology, C031201)
4. Research of new laboratory animals and new model animals (Zoology, C040601)
5. Modification, regulation and structural function research of biomacromolecules (Biophysics, biochemistry and molecular biology, C050102)
6. Identification and functional research of non coding RNA genes (Genetics and bioinformatics, C060604)
7. Molecular mechanisms of cell metabolism (Cell biology, C0711)
8. Cellular and molecular mechanisms of immune response (Immunology, C080103)
9. Cellular and molecular mechanisms of nerve development (Neuroscience, cognitive science and psychology, C090203)
10. Magnitude basis study of tissue regeneration and construction (Biomechanics and tissue engineering, C100308)
11. Regulating mechanism of metabolic homeostasis (Physiology, C110304)
12. Molecular basis of directional differentiation of stem cells (Developmental biology and reproduction biology, C120114)
13. Excavation of excellent genes of disease and adversities resistance of crop germplasm (Plant protection, C130106)
14. Biological basis of the improving of characters of forests and woods, and the increasing of production (Forests science, C161002)
15. Pathogen and pathogenesis of Food-borne zoonosis (Veterinary science, C180501)
16. Biochemistry basis of food storage (Food science, C200301)

Moreover, in view of the problems existing in the past, the Department particularly reminds applicants in 2010 to avoid any cases listed below. Otherwise, their proposals may be declined during the preliminary checking:

- (1) Applications which do not specify the title of designated research areas in the column of “Annotations” of the basic information table in the application text;
- (2) Applications without appointed application code;
- (3) Similarity or overlapping with projects already funded by the National “973” Plan, “863” Plan or NSFC Fund for Distinguished Young Scholars;
- (4) Applications that indicate the designated areas in the “Annotation” column but actual research contents do not match the scope of funding.

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

Department of Earth Sciences

The Department announces guidelines of Key Program projects 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 are: 1) to foster the development of earth sciences, boast beneficial accumulation, represent the advantage and characteristics of China, and effectively contribute to the promotion of international impact of Chinese earth sciences; 2) 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 funds needed 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 number 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 of the research with related projects funded by other national agencies.

As one branch of basic science, 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 gone 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 submit applications for Key Program projects. The application code for interdisciplinary study shall be filled in the application form.

In 2009, the Department received 324 proposals for Key Program projects, and 56 were funded with 990 million yuan allocated. In 2010, at least 57 projects will be supported,

with 1.7 to 2.5 million yuan to be allocated to each project on average. The research period of a Key Program project is 4 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 be declined during the process of preliminary review. 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, to explain the cause of formation of global change, current situation and future prediction and 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 in this field are:

- (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 for global change processes;
- (5) Impact and consequences of major global change events;
- (6) Mitigation, evasion and adaptation strategies for global change.

Research directions to be emphatically granted in 2010 include:

- (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 the global change;
- (3) Capturing, monitoring and forewarning for early signal of global 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 5 to 7 projects are to 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 biogeology, 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 produce a group of creative results and retain the world leadership of China in the field.

Key scientific issues to be studied in this area include:

- (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 directions to be emphatically supported in 2010 include:

- (1) Origin, evolution and environmental constrains 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 and planetary biology;
- (7) Evolution of key characters of creatures and environmental background -- biomarkers, molecular paleontology and developmental biology.

About 5 to 7 projects are to 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 forming and dispersion of the continent in various geological eras, the orogenic processes and uplift of the plateau and forming 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 for this area include:

- (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 directions to be emphatically supported in 2010 include:

- (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) Accretion of orogenic belt, basin-range system evolution and later modification;
- (5) Early evolution of the solid Earth and correlation and reconstruction of the ancient continents;
- (6) Precise record, tracing, simulation and experimental research of the physical-chemical process of the geodynamics;
- (7) Structural-geomorphologic-hydrologic evolution and their significance for geodynamics and environment;
- (8) Deep mechanism and surficial appearance of major earthquake belts and volcanic activities in China and related geohazards;
- (9) Evolution and geodynamics of the present western Pacific continental margins;
- (10) Monitoring technology, data assimilation and interpretation for the modern continental activities.

About 5 to 7 projects are to 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 structures 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 questions in the field include:

- (1) Metallogenic mechanism and temporal and spatial evolution of important and unique deposits in China;
- (2) Formation of large scale metallogenic domains;
- (3) Comparison between metallogenic 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 directions to be emphatically supported in 2010 include:

- (1) Mechanisms of the enrichment of large amount of ore-forming materials in sedimentary basins;
- (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) Subduction of western Pacific plate and its effect on the large scale Mesozoic mineralization in eastern China;
- (7) Evolution of palaeo-Asian Ocean and its effect on the large scale metallogenesis in North China;
- (8) Regional dynamic system of the evolution of large congruent basins and their accumulating regularities of oil and gas;
- (9) Systematic evolution of the Earth and sedimentary conditions of hydrocarbon-generating materials;
- (10) Analogy between the modern ocean floor hydrothermal systems and the palaeo metallogenic systems;
- (11) New theories and methods for prospecting unconventional energy and mineral resources.

About 5 to 7 projects are to 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 on the interactions among natural processes on different spatial scales, and the coupling of natural and human systems, reveal the mechanism and evolution of key components and processes of the terrestrial surface systems, find the relationship between the roles of human actions and environmental conditions in regional sustainable development in China, and explore the strategies for achieving regional sustainable development.

Key scientific issues in this field are:

Processes and mechanisms of key components, mechanisms of mass transportation/transformation and the interfacial processes, interaction of key components and its modeling, and the integrated assessment of disaster damage mechanisms and risks.

Research directions to be emphatically supported in 2010 include:

- (1) Geomorphologic processes and evolution mechanism;
- (2) Interface process and mechanism for lakes;
- (3) Habitat changes of lakes and their impacts and mechanism on the aquatic ecosystem;
- (4) Succession of wetland and its ecological impacts;
- (5) Mechanisms of mass transport and transformation in soil evolution;
- (6) Processes of C, N and P transformation in soils and the roles of microbe;
- (7) Root-soil interface processes;
- (8) Hydrothermal processes and biogeochemical cycling of glaciation and permafrost (the terrestrial surface ecosystem);
- (9) Eco-geographical processes in the cold region and their responses to climate change;
- (10) Functions of regional ecosystem and eco-geographical zoning;
- (11) Risk management and scenario analyses of physical disasters.

The recent revolution in aerospace and information technology is rapidly transforming the landscape of geosciences. The application of new principles, methodologies and technologies of earth system observation and information processing will inevitably become the core of future geo-scientific research and development. Therefore, in the Eleventh Five-Year Plan period, research efforts in these areas will be strengthened and research on some specific disciplines or fields encouraged.

Geographical 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 directions to be emphatically supported in 2010 include:

- (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) Geographical information synthesis and expression;
- (6) Spatial data mining and analysis methodologies;
- (7) Simulation of spatial heterogeneity and evolution.

About 5 to 7 projects are to 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 macroscopical control and utilization of water resources for supporting the sustainable regional social-economic development.

Key scientific issues in this field are:

Watershed hydrological cycle under changing environment, 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 directions to be emphatically supported in 2010 include:

- (1) Integrated observation and measurement 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 of surface and underground water and the renewal capability of underground water resources;
- (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 water resource security.

About 5 to 7 projects are to 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 in this field are:

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 directions to be emphatically supported in 2010 include:

- (1) Coupling relations between the mode of regional development and its environmental effects;
- (2) Variety of land use and its ecological effects;
- (3) Migration process of pollutants under drainage measure and its dynamic mechanism;
- (4) Risk evaluation of persistent toxic pollutants in the environment and related controlling principles;
- (5) Process of groundwater pollution and its interfacial effects;
- (6) Environmental and hazardous effects of major infrastructure construction;
- (7) Environmental effects of natural disasters and the mechanism of human response;
- (8) Mechanism of geological hazards due to the exploitation of mineral resources and energy.

About 5 to 7 projects are to 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 directions to be supported in 2010 include:

- (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) Sedimentation process, dynamics and geomorphic evolution over estuaries and offshore;
- (5) Dynamics of continental margin in the Mesozoic-Cenozoic eras and oil/gas resource in China's costal seas;
- (6) Hydrothermal system of mid-ocean ridge and its resource-environmental effects;
- (7) Oceanic process of terrigenous trace metals and their isotopes;
- (8) Response of typical marine ecosystem to long-term changes of marine environment;
- (9) Effect of human activities on the offshore marine ecosystem;
- (10) Mechanism of offshore compound pollution and its effects on the ecosystem;
- (11) Record of climate and environmental changes of the Antarctic ice sheet.

About 5 to 7 projects are to 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 Eleventh 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 in this field are:

- (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 proceed with the analysis and assimilation applications of massive survey data;

(4) To investigate new theories, methods and technologies for weather and climate element detection;

(5) To study physical and chemical processes of cloud and mist, and to investigate the weather modification.

Research directions to be emphatically supported in 2010 include:

(1) Impact of the high-latitude atmospheric circulation on the East Asian climate interannual anomalies;

(2) Interactions among ocean, land and atmosphere and their impacts on the East Asian climate;

(3) Research, development and improvement of models of the climate system;

(4) Formation mechanism and projection 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) Physical processes of cloud and mist, and approaches and methods of weather modification;

(9) Interaction among atmospheric chemical components, aerosols, clouds and radiation.

About 5 to 7 projects are to be supported.

10. Solar-terrestrial space environment and space weather

The scientific objectives are to form a complete theoretical framework of the space weather coupling process based on the study of space weather processes in different regions of solar-terrestrial system so as to achieve some important and creative progresses, to establish space weather cause-effect chain models and develop physics-based integrated models of space weather forecast, making contributions to the safety of space activities and other applications, to open the frontiers in the study of the mechanism of space weather effects on human activities by intercrossing with physics, mathematics, informatics, materials and life sciences so as to provide a reliable scientific basis for the administrative departments as reference in policy making, and to develop new concepts and methods of space exploration and put forward new designs of missions of satellite series so as to open up new prospects in space weather research. Basic research on space weather related to national key projects is encouraged, and analysis, theoretical study and numerical simulation of data obtained by current international and domestic space-borne and ground based observations are also welcome.

Key scientific issues in this field are:

(1) Triggering mechanism and releasing process of coronal mass ejection (CME), releasing

and physical processes in the source region;

(2) Source region of the solar wind, surface structure of the solar source and 3-D structures of the solar wind, effects of various discontinuities on the propagation of interplanetary disturbances;

(3) Interactions between interplanetary disturbances and the magnetosphere, and physical processes of space storms in the magnetosphere with multi temporal and spatial scales;

(4) Magnetosphere-ionosphere middle and upper atmosphere coupling, responses and physical processes of the Earth's mesosphere, thermosphere and ionosphere during storm time, and the ionospheric and upper atmospheric modeling;

(5) Physical processes of the magnetic reconnection in space plasma, mechanism of the heating and acceleration of charged particles, and the triggering mechanism of plasma waves and instabilities;

(6) Mechanisms of catastrophic space weather effects on information transferring, damages of materials and microelectronic devices in space, and the influence on space life and human health;

(7) Study on the prediction requirement, methods and models in different space regions of solar-terrestrial system and integrated prediction models for space weather;

(8) Measurements of the Sun with multi-waveband methods and techniques, imaging and remote sensing techniques of interplanetary disturbances, magnetosphere, ionosphere, middle and upper atmosphere, techniques of mini-satellite constellation, and new methods and techniques in space explorations;

(9) Solar activities and their influence on weather, and climate of the whole solar system.

Research directions that will be funded in 2010 include:

(1) Solar driving forces of space weather;

(2) Basic physical processes of space weather;

(3) Multi temporal and spatial scale structures in the solar wind, magnetosphere, ionosphere, middle and upper atmosphere and their evolutions and couplings;

(4) Modeling, forecast and effects of space weather;

(5) New concepts, theories and methods for the exploration of space weather.

About 3 to 5 projects are to be supported.

Department of Engineering and Materials Sciences

Two categories of Key Program projects are to be supported 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 2009, 65 research proposals were granted after the evaluation by the Department, with a total

funding of 130 million yuan, which means an average funding of 2 million yuan per project and an approval rate of 19.17%. According to the overall arrangement of the Department in priority funding areas in the Eleventh Five-Year Plan period, 58 projects are to be supported in the following areas or directions in 2010, with an average funding of 2 million to 2.5 million yuan per project.

- 1. Phase transition and new materials tailored by atomic magnetism (E010501)**
- 2. Interface and size-effect in bulk metal matrix nano-composites (E010202)**
- 3. Penetration mechanism of hydrogen isotope in surface coatings of structural materials for nuclear fusion applications (E011002)**
- 4. Micro-mechanism of transformation induced plasticity during deformation (E010701)**
- 5. Magneto-Optical Couplings of photonic crystal-metallic thin film structure (E010503)**
- 6. Structural evolution and adjustment in alloys by liquid Spinodal decomposition (E010601)**
- 7. Design and controlled fabrication of energy-saving glass coating materials (E0202)**
- 8. Research on crucial materials for semiconductor solar cells (E0209)**
- 9. Free sintering techniques and property studies of non-oxide composite refractory materials (E0212)**
- 10. Material design on electro-optical crystals and fabrication on novel crystals (E0201)**
- 11. Research on intrinsic optical frequency metamaterials (E0204)**
- 12. Design, fabrication and property characterization of novel functional materials for transition-metal compounds in unusual conditions (E0204)**
- 13. Fundamental research on ceramic based composite materials for protective coatings of high temperature environments (E0203)**
- 14. Basic issues on the implementation of high performance and functional properties, and the surface/interface of general polymer materials (E0301, E0302 and E0303)**
- 15. Basic issues on the construction, regulation and application of hierarchy congregation structure of functional polymer materials (E0314)**
- 16. Key issues on organic polymer materials and devices for white light-emitting and organic transistor (E0309)**
- 17. Basic research on polymer materials for drug delivery (E0310)**
- 18. Basic research on polymer materials related to energy, environment and resource utilization (E0313)**
- 19. Mine water prevention theory (E041002)**
- 20. Stability of mining high and steep slope (E0405)**
- 21. Oil gas exploitation basis of the complex reserve (E0403)**

22. Fundamental research on the utilization of mineral materials (E041105)
23. Ferroalloy metallurgical theories (E0414)
24. Nonferrous metal fabrication and processing (E041604)
25. New theories and technologies of malfunction prediction and safe operation assurance for key equipment (E0503, E0504)
26. Integrated optimization design theory and method for complex equipment (E0506)
27. Multi-physics coupling theory and design method for electronic equipment (E0506)
28. Fundamental theory on the welding design of light weight structures and key manufacturing technology (E0508)
29. Theoretical basis on forming manufacturing of composite materials and key technology of the forming dies (E0508)
30. Optimization theories and key technologies of manufacturing system operation (E0510)
31. Key science and technologies of multiscale manufacturing of flexible electronics (E0510, E0512)
32. Fundamentals and key technologies of optical component manufacturing with micro/nano precision (E0512)
33. Research on energy saving and optimistic control of thermal systems (E0601)
34. Research on aerodynamics and flow control of high performance turbo-machinery (E0602)
35. Advanced mechanism and theory of heat enhancement (E0603)
36. Thermo-physical fundamentals in high efficiency and clean combustion and fire (E0604)
37. Research on basic thermo-physical issues in thermo-chemical transformation and utilization of biomass energy (E0607)
38. Research on key thermo-physical issues in building environment control (E0608)
39. Ecological research methodology for optimization of the environment of historic towns in China (E0802)
40. Theories and technologies of the thermal environment and energy efficiency on the rural buildings (E0803)
41. Control technology for regional heavy air pollution (E0804)
42. Principles of manipulation and resource recovery for energy-saving and waste-reducing wastewater treatment processes (E0804)
43. Key basic theory and design method for modern steel structures (E0805)
44. Seismic response mechanism and seismic resistance for long tunnel at great depth (E0805)
45. Key scientific problems in urban underground engineering safety (E0805)
46. Fundamental theory and design methods of asphalt pavement (E0807)
47. Non point source pollution and its environmental effect and control method

(E0902, E0903)

48. Pollution of rivers and lakes and the repair methods (E0903)

49. Foundational theory of non-homogeneous sediment transport (E0904)

50. Foundational theory and diagnostic method of machinery transient flowing (E0906)

51. Disaster process and prevention method of unqualified dams of non-cohesive soils (E0905, E0907)

52. Multidisciplinary optimization of ship performance (E0910)

53. Fundamental research on the UHV discharge theory and UHV electromagnetic effects (E0705, E0708, E0709, E070301)

54. Key issues on the safety and high efficiency operation of large power system (E0704)

55. Key issues of the electromechanical energy conversion and the storage of energy under extreme conditions (E0703, E0712)

56. Key issues on power electronics and its system (E0706)

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

Department of Information Sciences

In 2009, the Department of Information Sciences announced 50 areas and one group for the application of Key Program projects, received 154 applications, and funded 46 projects, with a total funding of 94 million yuan, and an average funding intensity of 2.04 million yuan per project.

The Department announces 47 areas for application in 2010, of which 4 areas are priority funding areas. The Department plans to fund 48-55 Key Program projects, with an average funding of about 2.5 million yuan per project.

Key priority funding areas of the Department

1. Analysis and identification, machine translation and application of multi ethnic documents (F010205, 2-3 projects)

It is to study the theory and methods for printing of ethnic Chinese nationals' languages and identification of handwritten documents and machine translation, explore theoretical methods and key technologies for syntax based acquisition and presentation of multi language knowledge, so as to improve the ability of digital processing and application of information technology for ethnic languages. Research contents may include identification, document and image analysis and translation of Mongolian, Tibetan and Uyghur languages.

2. Data based system control, dispatching, diagnosis and dynamic perception (F0301, 2-3 projects)

Various economic and engineering systems in modern social and economic development become more and more complex, it is more and more difficult to build precise mathematical models to analyze, control, dispatch and diagnose based on various mechanisms. It is therefore an urgent problem in the national economic and social development and disciplinary development to make an effective use of large amount online and offline data and other knowledge to make analysis, control dispatching and diagnosis in complex systems under difficult conditions of building mechanism models. This project group aims at real complex system to formulate general basic scientific problems, develop new theory and new methods of system analysis, control, dispatching and diagnosis that are based on data and different from traditional framework. This project group includes the following three directions:

- (1) System analysis and control based on data (F0301);
- (2) Prediction of trouble and health management of complex engineering system based on data (F0301);
- (3) Optimal dispatching theory and methods for complex production system based on data (F0302).

3. New functional devices and integration technology based on SPP (F050805, 2-4 projects)

Integrated with traditional media material with metals, using the unique physical properties of micro nano structures, through research on new mechanism, new structure, and new technology of SPP, it is to make photoelectric regulation at nanometer scale, and try to make breakthroughs in new photoelectric functional devices and integration technology. This project group relates to 4 directions, and research content focuses on functional devices and chip integration technology:

- (1) Electrically induced luminescent devices by locally enhanced light conditions of metal/media nano structure SPP;
- (2) SPP based nano light source integrated chips;
- (3) SPP integrated closed circuit based on metal/media nano structures;
- (4) SPP based integrated bio sensor chips.

4. Acquisition and processing of long distance non-coordinated object information (F010805, 2-3 projects)

Key areas funded by divisions

- 1. Basic theory and key technology of new type of oscillator angular rate gyros (F0109)**
- 2. Basic theory and key technology for the interpretation and interactions of embedded brain machine interface information (F0108)**
- 3. New methods and application of sound imaging by ultrasonic stimulated**

vibrations (F0104)

4. Basic theory and key technology of artificially triggered lightning (F0106)
5. Key problems of ground mobile wideband wireless communications at ultra high altitude (F0102)
6. Basic theory and key technology for communications in deep space exploration (F0101)
7. All-optical generation of any waveform and its optical fiber transmission (F0102)
8. Integrated coding of signal source and channel for secured information (F0101)
9. Theoretical studies on error matching and data correlation of multi information integration system (F0103)
10. Studies on the interference signal processing method of complex mixed solvent (F0103)
11. Complexity theory of quantum computation and communication (F0201)
12. New problems, new methods and application of computability and computational complexity (F0201)
13. Computational model and algorithm based on bio principles (F0201)
14. Theory and methods of compressed perception multi media coding (F0201)
15. Theory, methods and application of service software (F0202)
16. Data management methods and key technology for data intensive computation (F0202)
17. Highly efficient computational theory and technology for major areas of application (F0203)
18. Key theory and technology of verification of on-chip multi-core processors (F0204)
19. Models and methods of web information integration and knowledge service (F0205)
20. Key technology of simulation of robot and man interaction and cooperation (F0205)
21. Theory and key technology of image invariant properties based on cognition models (F0205)
22. New method of information security protocol analysis (F0207)
23. Mechanism and key technology of CPS (Cyber-Physical System) (F0208)
24. Optimal control and key technology of electric automobile energy and driving systems (F0301)
25. Optical control of urban waste water treatment process (F0301)
26. Modeling and control of high incident flight (F0301)
27. Theory and method of advanced navigation system for major engineering projects (F0303)
28. Moving object measurement and tracking and the analysis of abnormal behavior based on multi coordinated cameras (F0304)
29. Data based multi source media dynamic perception and understanding (F0305)

30. Mass data mining based on cloud computation (F0305)
31. Real time modeling and autonomous behavior optimization of mobile robot in complex environment (F0306)
32. Theory and methods of multi state brain functional information integration (F0307)
33. Wide spectrum absorption silicon based high efficient solar cells based on semiconductor nano materials and structure (F040306)
34. Basic scientific problems of silicon based photon integration for optical interconnections (F040304)
35. Research on the extension and relevant devices of silicon based germanium materials (F040104)
36. Key technologies of high performance CMOS image transducers under 90 nanometer (F040205)
37. High speed high sensitivity room temperature probe at 8-12 micrometer band (F050404)
38. Printing techniques of polymer display devices (F050204)
39. Theory and key technology of 3-D video display (F050106)
40. Ultra high speed microwave photoelectric devices and its measurement and presentation techniques (F050302)
41. Quantity effect relation and monitor of good micro vascular targeted photodynamic effect (F051203)
42. Basic research on large diameter off-axis high order aspheric surface manufacturing and measurement (F050804)
43. New principle and technology of high precision measurement of refractive index of optical devices (F050804)

Department of Management Sciences

In accordance with the overall funding scheme for Key Program projects during the 11th Five-Year Plan period, the Department of Management Sciences will increase the average funding intensity to 1.1 million yuan per Key Program project. The number of priority areas planned for funding also increased from 37 during the 10th Five-Year Plan period to 66 during the 11th Five-Year Plan period. Twenty-two priority areas are planned for each scientific division of the Department of Management Sciences during the 11th Five-Year Plan period. Therefore, each division plans 4-5 priority areas per year.

A total of 12 priority areas are proposed by the Department in 2010, namely, 5 in the Division of Management Science and Engineering, 4 in the Division of Business Administration, and 3 in the Division of Macro-Management and Policy. In total, around 12 Key Program projects are planned for funding in 2010, with an average funding

intensity of 1.5 million yuan per project. The duration for each Key Program project will be 4 years.

Key Program projects aim at frontier scientific issues which promote disciplinary development, bring innovative achievements with international impact and focus on the economic and social development and opening up to enhance China's comprehensive national competitiveness by resolving major issues of theoretical and application values. The research shall be oriented towards 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.

Requirement for the application of General Program projects also applies to the application of Key Program projects and is thus worth applicants' due attention.

Key Priority Areas of the Department of Management Sciences:

1. Strategy-oriented investment decision-making and risk management (G0114)

Research focuses on strategy-oriented investment decision-making and risk management theory and methods. Main research contents include the relationship between strategic orientation and business and industry evolution, the relationship between strategic orientation and enterprise performance, the internal mechanism of impact of strategic orientation and its dimensions on enterprise performance, modeling the relationship between strategic orientation and investment value, modeling the relationship between enterprise performance and investment decision-making, strategic choice and the implementation of risk assessment and management, and enterprise performance based investment decision-making risk management.

2. Behavior-based supply chain management theory and methods (G0103)

Research mainly focuses on the main characteristics and governing law of supply chain

decision-making behavior in line with the status quo in China, supply chain group decision-making behavior and simulation studies, design of behavior-based supply chain coordination mechanisms, subject behavior and risk management of abnormal events in supply chain, and limited rational behavior based supply chain management theory and application issues (such as inventory, procurement, distribution, etc.).

3. High-dimensional complex data analysis theory and applications in the field of economic management (G0107, G0113)

Based on the comparison and induction of basic principles on the analysis of complex data such as symbol data, the function data and composition data, the establishment of a high-level basic theoretical system is to be achieved. It is to solve the curse of dimensionality problems of complex data in high-dimensional analysis, to study the methods for multivariate analysis of complex data, and to carry out related empirical research on management science issues.

4. Modeling and organizational management of large-scale complex man-machine system (G0109, G0116)

Research focuses on modeling and analysis of large-scale complex man-machine system structure/process, integrated organization modeling and analysis of man-machine computing, organization optimization of large-scale complex man-machine system and resource allocation methods, organization management and operational mechanism of large-scale complex man-machine system, and related research on concrete typical systems.

5. Product life-cycle oriented knowledge management theories and methods (G0117)

Research mainly focuses on the knowledge characteristics, variations and transmission mechanism and laws in different stages of product life cycle, various types of collaborative mechanisms and methods of knowledge during various stages of product life cycle, the super-network and its characteristics effective tacit knowledge communication at all stages, knowledge delivery model during the full life cycle, and related new methods and ideas for modeling, interaction between "system of systems" (SoS) concept based knowledge management system, personnel system and organizational system, and underlining laws, comprehensive integration methods, etc.

6. Research on Chinese business leaders' behavior (G0205)

Research is required to focus on CEOs of Chinese enterprises (both successful and unsuccessful) as the research objects. Through theoretical research and empirical studies, interviews, observation, experiments and other methods, the impact of business leaders' behavioral patterns, decision-making mechanisms and models, and leadership on enterprise innovation, strategic decision-making as well as business growth and development are studied under China's cultural backgrounds and institutional

environment, with a view to explore the leadership theory with Chinese characteristics, to enrich the organization and leadership theories through comparative studies (e.g. comparison between Chinese CEOs and CEOs from multinational companies or international companies) and theoretical innovation, and to sum up the institutional background and stages of the development of Chinese management science with unique characteristics.

7. Research on organizational culture and organizational creativity (G0204)

Main research topics include the content and interaction mechanisms of organizational creativity from the multi-scale perspectives of individuals, teams and organizations in the context of economic transition, the coupling relationship between creative behaviors of subjects at different scales and the possibility of "emergence" (positive and negative), the relationship between organizational culture and organizational creativity, the impact of organizational culture and institutional environment on the organizational creativity, and theories and methods for promoting organizational creativity and innovation of enterprises with reference to the actual management practices of Chinese enterprises.

8. Batch decision-making based production scheduling optimization theory and methods (G0209)

Research mainly focuses on issues concerning batch decision-making based novel production scheduling theory and modeling, mathematical programming methods and intelligent optimization methods, new batch decision-making for production process optimization and operational mode of batch production, batch production decision-making and scheduling optimization, scheduling of logistics coordination, the modeling and optimization of batch decision-making based production scheduling, and applied research on batch decision-making based production scheduling.

9. Accounting theories and methods for Chinese enterprise management (G0207)

Research may focus on the latest accounting theories and methods in the context of economic transition, cost behavior of high-ranking executives in decision-making with reference to China's institutional background, the choice of management accounting and its economic consequences, costing and control, value chain management and control, the effectiveness of internal transfer pricing, salary system design and performance evaluation, and empirical research on new budget management and control theories.

10. Research on industrial ecosystem management (G0312)

Mechanisms of structural coupling and functional integration in industry ecosystem, ecological regulation and control methods for industrial restructuring and circular economy construction, macro-management system and trade integration policies, industrial ecosystem management mode for the transition from a product economy to a service economy, from a chain economy to a network economy, from a competitive

economy to a symbiotic economy, and from a resource economy to a knowledge-based economy, and policy advice and scientific support for the change in the pattern of economic growth and the management energy-saving emission reduction.

11. Coordinated urban-rural development based rural public goods management (G0305)

Research on the status quo and trends of rural public goods and services supply on the basis of the historical evolution of urban-rural dual structure and the integrated management of urban and rural areas, the effect of present and past investment in rural public goods and services, the demands for rural public goods and services (especially education, health and technology), the corresponding inputs of public goods in order of priority and institutional arrangements of efficient services, and national public finance system, policy measures and management system in keeping with coordinated development of urban and rural areas.

12. Theories and policies on the internationalization of national independent innovation system (G0307)

Research on the basic theories and mechanisms of the internationalization of national independent innovation system, strategic management and model of the internationalization of national independent innovation system, mechanisms for the flow of knowledge and the allocation of S&T resources during the internationalization of national independent innovation system, and policy tools for the management of national independent innovation system and the international evaluation system, etc., that provide advices and support for the national policy-making and management.

Department of Health Sciences

The Department of Health Sciences mainly supports basic and applied basic researches on the morphological, structural, functional, developmental, genetic and immune abnormalities in the cells, tissues, organs and systems of human beings or animal models, and on the occurrence, progression, regression, diagnosis, treatment and prevention of diseases. As it is the first year to receive applications for Key Program projects in 2010, the Department welcomes applications on disease-related basic and applied basic researches from individuals with good existing bases, and applicants for this type of projects should refer to the instructions in the Department's guide for General Program projects section as well as the general information about the Key Program projects at the beginning of this section.

By proposing thematic areas on the basis of priority funding areas for the 11th Five-Year Plan period, the Department mainly intends to support in-depth, systematic innovative

studies by medical investigators in areas that will either greatly enhance the progress of health sciences or are new emerging areas with good existing bases and accumulation in China.

Applicants for the Key Program projects of the Department are expected to provide detailed information about their relevant previous working bases, awards, research results and publications, the background information of the principal investigators and participants in both working experiences and education in the biographical sketch section. A list of relevant publications with the names of all authors, the article and journal title, volume number, page number and year of publication, and a copy of the first pages of up to 5 representative publications as appendix materials. In addition, applicants are expected to make their own decisions on their specific project titles, research contents and research designs in response to the thematic areas below, and the name of the responded areas should be specified on both the cover sheet and on the note box in the basic information form section of the applications.

The funding for the Key Program projects in 2010 will be 1.7-2.5 million yuan each, for which a reasonable budget justification is required, and the duration of each project is 4 years.

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

- 1. Basic research on hypertension and hypertension-related severe complication (H02, Circulatory system)**
- 2. Basic research on hepatic injury, repair and regeneration (H03, Digestive system)**
- 3. Energy metabolism regulation and obesity development (H07, Endocrine system/metabolism and nutrition support)**
- 4. Pathogenesis of genetic diseases of cranio-maxillofacial and sense organ system (H12, Ophthalmology or H13, Otorhinolaryngology, head and neck science or H14, Oral cranio-maxillofacial science)**
- 5. Mechanisms of injury and repair of the central nervous system (H09, Nervous system)**
- 6. Algorithms for multimodality medical imaging and massive data processing (H18, Medical imaging and biomedical Engineering)**
- 7. Interaction between pathogens and host (H19, Pathogen and infection)**
- 8. Key scientific problems of regenerative medicine in traumatic reconstruction (H15, Emergency medicine, trauma, burns and plastic surgery)**
- 9. Inflammation and tumorigenesis (H16, Oncology)**
- 10. Non-coding RNA and tumor occurrence, development and prognosis (H16, Oncology)**

- 11. Roles of microenvironment on tumor metastasis and recurrence (H16, Oncology)**
- 12. Screening and basic studies of harmful factors in food and possible damage to human health (H26, Preventive medicine)**
- 13. Mechanisms underlying the effects of inflammation on immune responses (H10, Medical immunology)**
- 14. Research on neuroprotection mechanism and new drug target of neurodegenerative diseases (H31, pharmacology)**
- 15. Research on TCM etiology and pathogenesis (H27, Traditional Chinese medicine)**
- 16. Basic research on the composition regularity of couplet medicines of traditional Chinese medicine (H28, TCM materia medica/TCM pharmacology).**