

Department of Mathematical and Physical Sciences

Mathematical and physical sciences are basic disciplines of natural science, and the precursor and basis for the development of contemporary science. The development of mathematics and physical sciences also supplies theories, methods and means to the development of other disciplines. Research findings in mathematics and physics play a key role in promoting the progress of both basic and applied scientific disciplines. Therefore, the Department has always paid great attention to basic research, and will continue to increase its support to basic research that takes advancing the disciplinary development, promoting originality and training talented researchers as its primary goals. The Department will give sustained funding so as to stabilize a keen-witted and high standard research team for every discipline covered by the Department, and to boost the development of mathematics and physics in a persistent, stable and harmonious way so that they can gradually reach the internationally advanced level. The Department will also give timely funding to applied basic research projects that have clear prospects of application and meet the needs of national long-term development.

Mathematical and physical sciences have extensive interactions with other sciences, e.g., mathematics with information science, life science and management science, physics with materials science, life science, information science and chemistry, astronomy with earth science, and mechanics with engineering science and earth science. As a result, a series of interdisciplinary and cross-boundary disciplines and new research areas have emerged, and at the same time research objects and areas in mathematical and physical sciences are also expanding. In 2007, the Department will continue to support interdisciplinary projects both within the Department and jointly with other departments of NSFC.

International cooperation and exchange play an important role in promoting the development of mathematical and physical sciences. To promote international cooperation and exchange in mathematical and physical sciences and to encourage researchers to participate in international competition, the Department will, in accordance with the plan of the Bureau of International Cooperation, continue to support a number of high level international cooperative projects in 2007, including some major joint research projects. Interested scientists with cooperation background and qualification may submit proposals according to the requirements in time. The Department will hold panel meetings to review and interview the qualified applicants according to the results of peer review in the second half of the year.

In accordance with the strategic position of NSFC, namely, “supporting basic science,

sticking to free exploration and play the guiding role”, the strategic needs of the development of mathematical and physical sciences and the overall plan of project funding, the Department has taken some measures in project funding and has strengthened macro guidance in recent years. In 2007, the Department will continue to pay attention to the following aspects:

1. To increase the support on fostering outstanding young talents. In 2006, the percentage of principal investigators under the age of 45 in General Program projects reached 47.31%. In 2007, the scope of Young Scientists Fund projects will continue to expand, so as to allow more young scientists get funding to conduct independent research. In the Free Application projects, more emphasis lies on innovative research and balanced development of disciplines.
2. To increase both the funding intensity per project and the success rate in the Fund for Less Developed Regions. In order to support the national strategy of developing the western part of China, the Department has, since 2001, adopted special policies in favor of applications for General Program projects from scientists in the west, and at the same time started increasing gradually the budget for the Fund for Less Developed Regions.
3. For General Program projects, the Department will adopt various means of funding to meet the research requirements. For the studies on developing experimental methods and techniques that promote original innovation and have innovative ideas, the Department will give priority in funding according to the actual needs, which can be up to 500,000 to 600,000 yuan. Applicants should pay attention to this policy.

Funding for Free Application Projects in the Recent Two Years

Unit: 10, 000 yuan

Scientific division		FY 2005			FY 2006		
		Projects granted		Success rate ⁺⁺ (%)	Projects granted		Success rate ⁺⁺ (%)
		Number	Funds		Number	Funds	
Division of Mathematics	Basic mathematics	131+11*	2,952	34.55	147+11*	3,124	33.47
	Applied mathematics and computational mathematics	102+4*	2,214	31.85	130+9*	2,794	29.76
Division of Mechanics	General mechanics	27+2*	800	25.22	35+3*	1,076	25.33
	Solid mechanics	103+8*	3,406	24.56	118+8*	3,832	24.56
	Fluid mechanics	44+4*	1,340	26.97	55+3*	1,699	26.48
	Interdisciplinary mechanics	31+1*	1,016	27.12	39+6*	1,376	26.47

Division of Astronomy	Astrophysics	40+4*	1,340	34.11	34+3*	1,357	30.83
	Astronomical measurements and celestial mechanics	10+1*	321	26.83	15	514	39.47
Division I of Physics	Condensed matter physics I	30+3*	918	26.19	21+3*	739	19.83
	Condensed matter physics II	73+3*	2,291	26.86	102+2*	3,243	28.42
	Atomic and molecular physics	28+4*	908	30.77	38+3*	1,177	30.83
	Optics	46+3*	1,431	26.78	58+3*	1,912	27.23
	Acoustics	23+3*	782	29.21	27+2*	891	28.16
Division II of Physics	Basic physics	21+1*	578	24.72	29+1*	764	24.79
	Particle physics and field theory	22+2*	638	45.28	28+3*	824	42.47
	Nuclear physics and nuclear technology and application	70+4*	2,327	31.62	79+10*	2,744	33.58
	Particle physics And experimental facilities for nuclear physics	25+3*	858	30.11	29+2*	1,021	26.50
	Plasma physics	27+2*	867	31.87	35+4*	1,220	31.71
Total		853+63*	24,987	29.31	1019+76*	30,307	28.85
Average funding per project			27.28 (28.29**)			27.67 (28.48**)	

Notes: * Projects of Small Fund for Exploratory Studies.

** Not including projects of Small Fund for Exploratory Studies.

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4. To strengthen the macro planning and adjustment and give preferential support to special areas. In 2007, the areas enjoying preferential support are:

- 1) Basis of precision measurement technology;
- 2) Applications of mathematics in other disciplines and interdisciplinary problems related to information sciences;
- 3) Research and development of experimental methods and techniques with novel research ideas;
- 4) Pre-research on scientific goals of large-scale national engineering projects;
- 5) Synchronized radiation methods and technology;
- 6) Radiation protection and radiation chemistry;

- 7) Projects needed by disciplinary development or layout, mainly to support important research areas where research basis is still weak in China or that have prospect of development but the research basis is weak in China, or those disciplines or areas that are nearly disappeared but are still needed due to the national needs in the long run;
- 8) Non-consensus projects.

The above areas will be given preferential support in 2007 so as to promote the sustained development of these areas. Meanwhile, according to the results of investigation and the requirement of NSFC, support will be increased in some areas.

In order to strengthen the role of basic research in promoting the development of new research directions and new areas for new concepts and new methods for national security and high-tech research, NSFC and the Chinese Academy of Engineering Physics established a joint fund in 2000. In 2006, the Joint Fund supported 41 projects with a total funding of 15 million yuan in the fields of mathematics, physics, information, materials, chemistry, etc. The Department is responsible for proposal evaluation. In 2007, proposals will still be accepted and more information can be found in the section of “NSAF Joint Fund”.

NSFC and the Chinese Academy of Sciences (CAS) decided in 2006 to set up NSFC-CAS Joint Fund on Astronomy (Joint Fund of Astronomy for short) in order to make full use of the evaluation and management system of NSFC, bring into play the role of existing national research platforms in the field of astronomy, promote researchers in universities and other research institutes to conduct research on these facilities, foster basic research talents in astronomy and related disciplines, raise the innovative capability of Chinese astronomical research, and promote the development of Chinese astronomical research. In 2007, proposals for this joint fund will be accepted continuously and more information can be found in the section of “ Joint Fund of Astronomy”.

Division of Mathematics

Modern mathematics tends to develop towards internal unity among its various branches, and has more and more important potentials of application in various other research areas. According to the characteristics and trend of development of modern mathematics, the Division encourages original research in important issues and open problems in mathematics, and the development of new mathematical methods, models and theories. Interdisciplinary research among different branches of mathematics and application of mathematics in other disciplines are encouraged. This requires that applicants and their research teams have sound basis and capability of research. Research plan should be based on deep understanding of the status in research, main problems and relevant research methods and available means. Through funding of projects, outstanding talents are to be fostered and research adjusted to the international trend, so as to lay a solid foundation for reaching the international level in mathematical research.

The following fields will be supported: mathematical and physical logic and mathematical bases, number theory, algebra, geometry, topology, theory of functions, functional analysis, ordinary differential equations and dynamical systems, partial differential equations, mathematical physics, probability theory and mathematical and physical statistics, control theory, discrete mathematics, computational mathematics, large scale computation of scientific and engineering problems, mathematical theory and methods in operations research, other disciplinary studies with mathematics, and new mathematical models and algorithms for practical problems.

Free Application projects support research teams having strong research capabilities and aiming at hot spots and important issues in international mathematical research. Young Scientists Fund is to support young applicants to conduct independent studies on topics of their own interests and having theoretical significance and application values, and, through funding of projects, foster talented mathematicians. The Fund for Less Developed Regions is aimed at helping those regions where mathematical research is relatively weak, creating a good environment for mathematical research and building a research team of reasonable scale, so as to improve gradually the research level and cultivate talented mathematicians for the development of local science and technology. Application by a single individual or separate applications of the same research direction from the same research unit are not encouraged, and, in order to attain a reasonable distribution of projects and appropriate funding scope, support will be strictly controlled for proposals from applicants having on-going projects.

For basic mathematics, the funding is aimed at maintaining research directions where China is advanced and research areas where China has comparatively large-scale research, promoting the development of research areas that are within the mainstream of international mathematical research but are still relatively weak in China, and encouraging interdisciplinary research among branches of mathematics.

The funding for applied mathematics and computational mathematics encourages topics having strong practical background and application. Applicants should pay attention to the development in life science, information science, environmental science, energy science and other disciplines closely related to the economic and social development, have a good understanding of important scientific issues in these areas, and actively find the cutting points intercrossing with these areas so as to promote the development of applied mathematics.

Together with the Department of Information Sciences, the Department will continue to support interdisciplinary projects proposed from mathematics and information science areas in 2007. These include mathematical methods in modern computer science, mathematical methods in information security, information system and advanced control theories, etc. In the application, please choose the category of “interdisciplinary project between information and mathematics”. Please refer to relevant sections in the

Department of Information Sciences of this guide.

The Tianyuan Fund for Mathematics mainly emphasizes on the fostering of talents and academic exchange activities in mathematics. Please refer to relevant sections in this guide for details.

Division of Mechanics

The Division mainly supports research in the areas of dynamics and control (general mechanics), solid mechanics, fluid mechanics and interdisciplinary mechanics. The Division supports, on the one hand, basic research projects that are on the frontiers of international research and have creative academic ideas, and on the other hand, those applied basic research projects that are closely related to national economic development and national security and that promote the development of engineering and technology. The Division encourages experimental research using experimental facilities and key labs in China and advocates interdisciplinary research conducted by scientists from relevant disciplines.

Research in dynamics and control (general mechanics) should address issues of complex dynamical systems and control, pay attention to breakthroughs in the theory and methods of nonlinear dynamics and dynamical modeling of problems involving the coupling of solid, flexible, fluid and control problems, and problems in micro and nano scale dynamic problems. The Division encourages studies on key issues of dynamics in China's major engineering projects, such as aeronautics, space exploration, ships and vehicles, etc.

Applications in the area of solid mechanics should give more considerations on intercrossing with physics and materials science, and should be able to propose research topics in areas such as aeronautics, astronautics, mechanical engineering, marine engineering, etc., strengthen research on constitutive theory of materials at macro, meso and micro scales, damage evolution process and failure mechanism, mechanical behavior of new materials and performance control, optimal design, structural optimization, stability analysis and safety evaluations, damage of rock and soil materials, prevention of geological disasters, etc.

Applications in fluid mechanics should strive for breakthroughs in understanding the mechanism and governing principles of turbulence formation. Whereas fluid mechanical problems in aerospace, navigation, weaponry, hydrology and chemical engineering are studied, further efforts should be made on strengthening research on fluid mechanical issues in energy, environment, and other high-tech and advanced technology areas.

In interdisciplinary mechanics, research in environmental fluid mechanics should pay attention to problems in real environment, especially the environment in western regions

of China. Research on explosive mechanics should focus on relevant engineering and safety issues. Studies on biomechanics should pay attention to mechanical problems in human health issue, and the integration with life science, especially clinical medicine. Biomechanics and environmental science will receive preferential support continuously

Special attention should be paid to applications in mechanical science to strengthen basic research that has national needs. Research topics of foresight and exploratory nature and brought up from real problems in economic development and national security are encouraged. Research topics on the development and re-fabrication of instruments and equipment with creative ideas, and novel experimental methods and technology will be encouraged, and will be given preferential support both in terms of project number and funding.

In 2007, in order to strengthen the role of Key Program projects in the overall planning of disciplinary development of mechanics and to increase the competitiveness of project application, the Division will continue to identify Key Program areas according to its priority areas and the latest world development under the principle of supporting basic research, paying attention to international frontiers, promoting the disciplinary intercrossing and intensifying demand-orientated research.

Division of Astronomy

The Division of Astronomy mainly supports research in astrophysics, basic astronomy and astronomical instruments and technology. In accordance with the trend of astronomical development in the world and the present situation in China, the Division supports research proposals with emphasis on the development of technology and instrumentation. Studies based on existing observation apparatus or facilities to be built soon in China will be encouraged. The Division promotes the combination of innovative ideas, observation and theories, and studies on new technologies and methodologies used in astronomy, especially studies which are closely related to the large sky area multi-objects fiber spectrographic telescope (LAMOST), a mega-science project under construction in China. Interdisciplinary research is strongly encouraged so that research groups having special features and influence in international scientific communities can be gradually established. International cooperation and exchange, particularly those using large and advanced facilities abroad for observation and research, will be given great attention and financial support.

Of the General Program projects funded in recent years, studies in astrophysics become the mainstream. In 2006, projects for galaxies and cosmology, stellar physics, solar physics, astrometry and celestial mechanics and astronomical technology and methods (including the history of astronomy) represented 13.5%, 42.3%, 11.5% and 32.7% of the total projects, respectively. Projects funded in astrophysics accounted for 71% of the total. Young researchers have become the main force in astronomical research and about

60.5% of the total researchers are young people under the age of 40. The discretionary fund of the Department supported one project related to scientific goals of LAMOST, one project related to astronomical technology and one project related to disciplinary development.

In 2007, in addition to continuously strengthening support on projects integrating theory and observation and young scientists, emphasis will be given to interdisciplinary research with physics, space science, etc. Compared with the development in the world, research on planetary physics is rather weak in China, and should therefore be enhanced immediately. On the basis of funding the best, the Division encourages research on particle cosmology, celestial bodies in the solar system, structure and dynamics of ordinary galaxies, infrared astronomy, space astronomical measurement, and astronomical research that addresses the national needs. Priority support will be given continuously to research in astrometry, celestial mechanics, astronomical technology and methods and small astronomical research units.

In the next few years, the Division plans to give special support to pre-research around the scientific objectives of LAMOST, and conceptual studies on new technologies that are urgently needed for large-scale telescope and space exploration. In addition to research on dark matter, dark energy, formation and evolution of galaxies, structure and evolution of the Galaxy, etc., preferentially supported research areas related to the scientific goals of LAMOST also include the pre-research on the scientific goals of LAMOST using SDSS observation data. Meanwhile, research on the evolution of stars using large samples obtained during the adjusting and pre-observation period of LAMOST, supernova observations, and low and middle resolution spectrum observation of the structure or various special celestial bodies in the Galaxy will be supported. The funding intensity per project is from 400,000 to 600,000 yuan. Research on manufacturing and refurbishing instruments and facilities having clear physical ideas will be funded for 400,000 to 600,000 yuan per project.

Division I of Physics

The Division I of Physics supports research on condensed matter physics, optics, atomic and molecular physics and acoustics, and new research areas formed by the intercrossing between these four disciplines and other disciplines. Support on new interdisciplinary areas emphasizes more on exploratory and basic studies in physics.

In order to change the long time dependence on importing advanced research instruments and special software in physics studies, the Division will give priorities to support research projects on the preparation of advanced materials, new technology and methods for experimental measurements in physics research, and the development of new computational methods and software. Starting from this year, in reviewing some of the relevant applications, whether they have such contents in their research will be

considered as a factor for support.

In condensed matter physics, the Division pays attention to singular quantum phenomenon in electron related systems, quantum phenomena and quantum effects in various low dimensional and small-scale systems or devices that break the classical physical limit, and physical theory and experimental methods related to life science. Encouraged areas of research include basic physical problems in soft matters, structural and physical properties of surface, interface and membrane, physical properties of nano systems, advanced technologies and methods of device physics and nano structures, physical problems in the formation and preparation of new functional materials, and interdisciplinary problems related to condensed matter physics. Emphasis is given to fundamental physical problems urgently needed to be solved in the development of technologies serving major national needs.

Following the development of cold atom, cold molecule and ion catching technology, and the generation of ultra-short pulse light source, atomic physics is now facing challenges of many newly formed research topics. While continuously selecting the best to support in the areas of atomic, molecular and cluster structures and dynamical process, the Division encourages research in cold atomic and molecular physics and application, complex interactions of atomic and molecular systems, principles and key technologies of atomic and molecular precision spectrum and precision measurement, and computer simulation of atomic and molecular plasma in materials, energy, life, environment and space sciences. In order to promote atomic and molecular research, the discretionary budget will be used first on atomic and molecular physics and nuclear physics, optical physics, condensed matter physics and interdisciplinary projects with chemistry and life science, so as to expand gradually the research fields of atomic and molecular physics, and to meet the needs of the development of modern disciplines.

Studies on optical physics are focused on basic properties of optical radiation, basic laws of light propagation, interaction of light and matter, etc. The Division encourages studies on physical problems in ultra fast and extremely strong light conditions, micro and nano optics, new quantum frequency markers, optical frequency markers and quantum information, propagation process of light in new media and its characteristics, high resolution, high sensitivity and high precision laser spectrum and its application, and optical process in energy, information, life and space sciences. In addition, optical electronics as well as physical issues in optical electronics are also important research areas. It is hoped that proposals will closely combine optics with atomic and molecular physics so as to learn from each other.

Much of the research in China is in application field, so the basic aspect should be strengthened. Therefore, the Division encourages fundamental acoustic research related to major needs of the national development. It is hoped that more projects with innovative ideas will appear in areas of hydro-acoustics and marine acoustics, ultrasonic and acoustic effect, structural acoustics and vibrations, acoustic materials, acoustic

information processing, noise and control, acoustic problems in information technology, etc.

Division II of Physics

The Division II of Physics mainly supports research in fundamental physics, particle physics, nuclear physics, nuclear technology and application, accelerator physics and detectors, plasma physics and synchronized radiation methods.

The focus of support in fundamental physics is on original studies in theoretical physics and interdisciplinary research between theoretical physics and other disciplines. Stress should be given to current research frontiers, especially important theoretical physical problems that are closely related to experimental studies and raised from scientific experiments and from interdisciplinary considerations.

In particle physics and nuclear physics, the Division will focus its support on the research of physics issues related to large-scale experimental facilities that are in operation or those to be completed soon, and in particular, the combination of theoretical and experimental studies. In the next few years, a number of large-scale experimental facilities of international cooperation will be in operation successively. In conjunction with international cooperative projects centered on large-scale equipment, the Division will select some proposals of physics in relation to this and give preferential support. The funding will be used to guide research towards the understanding of important physical rules related to the latest experimental results, such as the theory and experiments of phenomenology in particle physics and interdisciplinary research of nuclear physics under extreme conditions with nuclear astrophysics and other disciplines.

In nuclear technology, accelerator and detector, low-temperature plasma and synchronized radiation, it is hoped that fundamental problems can be drawn from the disciplinary development, national demands and through intercrossing with other disciplines, which can facilitate a deeper understanding of the physical laws underlying the development of the discipline and at the same time have important prospects of application. Special emphasis is laid on key technologies and innovative ideas in methodology and intercrossing with other disciplines. In addition, the exploration of mechanisms and rules governing the interaction of matter with instantaneous, high energy, high power and strong field radiation (ion, neutron and electromagnetic fields) may become hotspots in this area. In accordance with this, in accelerator and detector and plasma research, nanometer micro-beam, high power ion beam, strong current accelerators, plasma radiation source and all other advanced radiation sources of nuclear technology will receive more attention.

Concerning applications in nuclear fusion and plasma physics, more attention should be paid to the exploration of new diagnostic means related to large facilities, which are in

operation at present or will be built soon. In particular, basic research on advanced magnetic confinement fusion and new approaches to inertial confinement fusion and related fundamental physical problems, and key physical problems in fusion studies and computer simulation of various kinds of plasma will be stressed.

In order to ensure a more efficient use of limited funds and research in each field in a benign cycle of sustainable development, the Division encourages researchers all over China using large national facilities to do research, encourages studies of independent innovative methods of high resolution diagnosis and detection and important experimental studies for the development of accelerators and detectors, including the development of experimental facilities, and detection and diagnosis devices. The amount of funding for this will be increased according to the actual needs. Funding priority will be given to projects having more young scientists in the research team. Attention will be given to projects that have national needs and basic nature and have good record in previous studies. Meanwhile, the development of interdisciplinary research will also be noted.