Strategic Plan for Mathematics Department, Stony Brook University

Stony Brook Department of Mathematics is universally considered as one of the best mathematics departments in the country. Since the time when James H. Simons was its Chairman, the Stony Brook Mathematics Department has been one of the world's great centers for geometry and topology. Established in 1958, the Department now plays a leading role in mathematics research and graduate education in the country, having awarded about 300 Ph.D. degrees. The Department's world-renowned faculty, past and present, have received such highly prestigious awards as the Fields Medal, the National Medal of Science, the Wolf Prize, and the Leroy P. Steele and Veblen Prizes of the American Mathematical Society (AMS), among others. Five of our faculty are currently members of the National Academy of Sciences, and the Department includes a past President and Vice-Presidents of the AMS. Almost all our faculty has been invited speakers at the International Congresses of Mathematicians, the highest forum for achievements in mathematics.

The Department's leadership role in geometry and topology is exemplified by its strength in Riemannian and symplectic geometry, algebraic geometry, algebraic topology, complex analysis, dynamical systems, mathematical physics, nonlinear partial differential equations, representation theory, Riemann surfaces and their moduli spaces, and applications of these disciplines to quantum field theory and string theory. The Department is closely affiliated with the Institute for Mathematical Sciences (IMS), which was founded in 1989, with John W. Milnor, one of the greatest mathematicians of the 20th century, as its first director. Currently the IMS is one of the world centers in the field of dynamical systems. The Department also has close ties with the new Simons Center for Geometry and Physics (SCGP), established in 2007 by a gift from the James and Marilyn Simons Foundation. Its first director is our faculty member John W. Morgan, who was previously Chairman of the Mathematics Department of Columbia University. The Department also has a very close connection with C.N. Yang Institute for Theoretical Physics (YITP), which goes back to the legendary math-physics dialogs between James H. Simons and Chen Ning Yang in the late sixties.

Mathematics is the universal language of natural sciences and technology, and today has sophisticated applications to social sciences as well. It evolves and develops according to the fundamental problems raised by Geometry, Number Theory and Physics. The 20th century has witnessed dramatic progress in these areas, in particular in our understanding of the different geometric forms and shapes in the spaces of various dimensions. These types of problems are at the cutting edge of current knowledge, and they constitute the core of Department's research. Working closely with the SCGP and YITP, our faculty study geometric forms and shapes from analytic, algebraic, topological and arithmetic points of view. With this they aim for new breakthroughs in understanding both numbers the mysteries of the universe. Our faculty also work on various applications of fundamental mathematics, including dynamics of fluids, quantum computation and wavelets. Progress in these fields may lead to dramatic advancement in many areas of human experience.

Together with the IMS, SCGP and YITP, the department plan is to expand and consolidate its leading role in mathematics research, graduate and undergraduate education, interdisciplinary activities and outreach. Specifically, we aimed at the following objectives.

Research

1. To become No. 1 mathematics department in the area of Geometry and Topology by hiring world-class mathematicians associated with the SCGP.
2. To become a national leading force in broad areas of mathematics, including mathematical physics, global analysis and dynamical systems, and number theory – the areas which promise the rapid growth in the coming years, and which concern the most fundamental mysteries of the mathematical and physical sciences.
3. Strategic hiring of the key personnel affiliated with the SCGP, both at junior and senior levels, to achieve the above objectives.

Graduate Education

1. To increase the number graduate students and TA lines to harness effectively outstanding research opportunities provided by the Department and the mathematics faculty at the SCGP. To this end, we are also proposing an extensive RTG program in the interface of Geometry and Physics to attract more talented domestic students.
2. To establish a new free standing Master of Arts program in Mathematics for the students who need to expand their knowledge of the field without pursuing the Ph.D.
3. The Department plans to expand its role in the education of the mathematics teachers in the country. There is a well-documented need for radical improvement in this area and we believe that it is our duty to use our resources and expertise to become a leader in this field. We plan, in collaboration with the PEP and CESAME at the University and with the aid of the private donors, to create a Center of Mathematics for Teachers to serve this purpose. This Center will be also used for providing courses for existing teachers and improving their qualifications.
4. Under the auspices of the Center of Mathematics for Teachers and with collaboration with CESAME, we plan to establish new Ph.D. degree in Mathematics Education.

Undergraduate Education

1. We aim to provide the highest quality mathematics education for the University's students. This makes it particularly urgent that we decrease our currently high student-to-faculty to ratio by hiring new faculty.

2. We plan to strengthen our existing majors in mathematics by providing close mentoring and participation in research. For this purpose we will be using the RTG grants, the Math Club, Undergraduate Seminars, Summer Student Workshops and other creative initiatives. The goal is to significantly improve the level of our majors so that more of them will become active in mathematics.

Infrastructure

1. We need a significant expansion of our office space in order to accommodate our growing faculty and graduate students. It is absolutely vital to have more office space, which can be achieved by moving the Applied Mathematics and Statistics Department, which currently occupies first and second floors and the P level of the Math Tower, to a new building.

Outreach and Interdisciplinary Activities

1. We plan to use the facilities of the Simons Center to hold lectures on mathematics for different groups, including the general public.
2. We plan to forge close collaboration with YITP, the Department of Physics and other departments on various projects, including Quantum Computation and other exciting new applications.