Gopal Prasad Named Collegiate Chair

Professor Gopal Prasd has been awarded a Collegiate Professorship. His Professorship will be named in honor of Raoul Bott, a member of the UM Mathematics faculty from 1951 to 1959. Bott was an admired pioneer in 20th century mathematics, particularly in the geometry and topology of Lie groups, and homogeneous spaces and representation theory.

Prasad received his Ph.D. from the University of Bombay. After visiting appointments at Yale and the Institute for Advanced Study, he joined the faculty at the Tata Institute of Fundamental Research in Mumbai. His 20 year career there culminated in a two year term as Dean of the School of Mathematics. He joined the UM faculty in 1992. Prasad has received significant recognition for his work. He is a member of the Indian National Science Academy and the Indian Academy of Sciences, and in 1989 received the Mathematical Sciences Prize from the Council of Scientific and Industrial Research in India. He was an invited speaker at the 1990 International Congress of Mathematicians. He received a Guggenheim Fellowship in 1998, and a Humboldt Senior Research Award in 2006.

Prasad is recognized as a leading expert in the theories of Lie groups and algebraic groups. The field has deep connections with problems and techniques in physics (classification of elementary particles); chemistry (crystallographic groups); and geometry, number theory, and numerous other branches of mathematics. The astounding breadth found in his past and current work is quite rare in the modern era of narrow specializations.

Prasad's most famous recent work solved a long-standing problem in algebraic geometry. In the beginning of the 20th century, the great Italian algebraic geometer Francesco Severi asked whether a smooth complex projective algebraic surface S whose underlying topology is "the same" as that of the complex projective plane P (the simplest such surface) must be that plane. It took more than fifty years before this question was answered in the affirmative by the Fields medalist S.-T. Yau. A refinement of this question is whether S is the same as P if the two

surfaces are merely assumed to have the same numerical topological invariants rather than the same underlying topology. It follows from a theorem of Yau that such an S that is different from P (a so-called "fake projective plane") must arise in a very special way, as the orbit space of a discrete subgroup Γ of the Lie group PU(2,1) acting on the two-dimensional complex ball. The existence of fake projective planes was established by the Fields medalist David Mumford in 1979. Since these fake planes are very intricate objects having the same numerical invariants as the simplest surface, they attracted a great deal of attention. However, Mumford's existence proof was quite indirect: it did not determine the group Γ, and it did not provide a concrete geometric description of the surface. After twenty-five years of unsuccessful efforts by many mathematicians, the challenge of giving a direct construction of these surfaces had become one of the major open problems in algebraic geometry.

In a breakthrough paper that appeared recently in *Inventiones Mathematicae*, one of the most distinguished journals in pure mathematics, Prasad and S. K. Yeung solved this problem by giving the first effective construction of a fake projective plane. In fact, they did something even more remarkable: they obtained an almost complete classification of the groups Γ that can occur. Their work involved an intricate and subtle blend of geometry, number theory, and the structure theory of algebraic groups. These results have attracted a great deal of attention from the mathematical community.

Prasad has also recently completed pathbreaking research in a very different direction, concerning whether a Riemannian manifold (generalizations of the kinds of geometric spaces that arise in Einstein's theory of general relativity) is determined by spectral data such as the spectrum of its Laplacian, or its length spectrum. Using deep results from number theory and algebraic groups, Prasad and Andrei Rapinchuk completely analyzed this question for arithmetic locally symmetric spaces of non-positive curvature. These classical objects form a large and extremely important class of Riemannian manifolds, and their work represents a quantum leap in our understanding of spectral theory.

In the mid-1990s, Prasad and former UM colleague Allen Moy wrote two papers on the representation theory of p-adic groups. These papers established a new invariant for representations of p-adic groups, affirmatively answered a very old and important conjecture relating the representation theory of p-adic groups with that of finite Lie groups, and re-introduced Bruhat-Tits theory to representation theory. Perhaps more importantly, the methods introduced in these papers have played a central role in the solution of at least two outstanding problems in the field, leading to explosive progress in several directions.

In a recent joint work with a former UM colleage Brian Conrad, and Ofer Gabber of IHES, France, Prasad has given a classification of nonabelian pseudo-reductive algebraic groups over all fields of odd characteristics. This work settles an outstanding problem in the area and has several important arithmetic applications.

His earlier results on strong rigidity, strong approximation, the congruence

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Associate Professor **Kristen Moore** has been awarded the Class of 1923 Memorial Teaching Award from the College of Literature, Science and the Arts. The award recognizes her outstanding teaching abilities and innovative classroom techniques.

Mircea Mustata was promoted to Professor of Mathematics.

Martin Strauss was promoted to Associate Professor of Mathematics.

Moore

New Faculty Members

Assistant Professor Juan Souto

Souto joined the Department in winter, 2008. He received his Ph.D. from the Rheinische Friedrich-Wilhelms-Universität in Bonn, Germany. From 2001 to 2004 he held the position of Wissenschaftlicher Assistent at that institution. In 2005 he held a Research position at the Université Paul Sabatier in Toulouse, France. He then joined the faculty at the University of Chicago for two years.

Souto's field of research is in geometry/topology, specifically in hyperbolic geometry and Kleinian groups, with broader interest in 3-dimensional topology and rigidity theory. His publications include a paper that solved a twenty year old conjecture and contributed to the proof of the Bers-Sullivan-Thurston Density Conjecture, and another which was influential in the solution of Marden's Tameness Conjecture.

Professor Roman Vershynin

Vershynin joined the Department in fall 2008. He received his Ph.D. from the University of Missouri-Columbia. After one year as a Research Postdoctoral Fellow at the Weizmann Institute in Israel and two years as a PIMS postdoctoral Fellow at the Pacific Institute for Mathematical Sciences and the University of Alberta, he came to the University of California, Davis as an Assistant Professor. He received a Sloan Research Fellowship in 2005, and was promoted to Associate Professor in 2006.

Vershynin's research interest is geometric functional analysis, exploring connections among functional analysis, convex geometry and probability theory. He has established himself as a leader in this area, and he has the ability to apply his expertise to a wide variety of problems, many of them drawn from applied mathematics. Several of Vershynin's papers contain solutions to long outstanding conjectures, and have been published in top journals.

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subgroup problem, determination of central extensions and the metaplectic kernel, and the computation of the covolume of arithmetic subgroups are well-known and widely used.

The enormous diversity of Prasad's work is evidenced by numerous important papers of his on algebraic and arithmetic groups, algebraic geometry, Bruhat-Tits theory, differential geometry, ergodic theory, number theory, and representation theory.

In the Department, Prasad is recognized as a devoted and effective teacher at all levels. He has directed four Ph.D. theses here, and developed a course on the theory of Lie groups. His colleagues in the Department have recognized him as an invaluable source of advice and insight on a wide panorama of mathematical subjects, always willing to share ideas and help with problems.

Since 1998, Prasad has been managing editor of the *Michigan Mathematical Journal*. Through his leadership, he has expanded the breadth of the editorial board to include highly regarded mathematicians from around the world. The Journal has risen in stature and importance in the mathematical community. Prasad is also an editor for the *Asian Journal of Mathematics* and an associate editor of the *Annals of Mathematics*, considered by many to be the most prestigious mathematics journal. He has served on the Department's Executive Committee several times.

Math Problem

A jar contains 600 jelly beans: 100 red, 200 green, and 300 blue. These are drawn randomly from the jar, one at a time, without replacement. What is the probability that the first color to be exhausted is red?

Answer elsewhere in the newsletter