Prof. Yuri Ivanovich Manin
Professor

Most important awards, prizes and academies

Awards: Moscow Mathematical Society (1963); Lenin Prize for work in Algebraic Geometry (1967); Brouwer Golden Medal for work in Number Theory, Royal Society and Mathematical Society of the Netherlands (1987); Frederic Esser Nemmers Prize in Mathematics, Northwestern University, Evanston, IL, USA (1994); Rolf Schock Prize in Mathematics, Swedish Royal Academy of Sciences (1999); Georg Cantor Medal, German Mathematical Society (2001); King Faisal Prize in Science, Saudi Arabia (2002); Order pour le Mérite, Germany (2007); Great Cross of Merit with Star, Germany (2008); Janos Bolyai International Mathematical Prize, Hungarian Academy of Sciences (2010). *Academies*: Academy of Sciences, Russia (1990); Royal Society of Sciences, Netherlands (1990); Academia Europaea (1993); Max-Planck-Gesellschaft (1993); Göttingen Academy of Sciences, Class of Physics and Mathematics (1996); Pontificia Academia Scientiarum (1996); Academia Leopoldina (2000); American Academy of Arts and Sciences (2004); Académie des sciences (2005). *Honorary Degrees*: Honorary Professor, Bonn University (1993); Université Pierre et Marie Curie, Paris (1999); University of Oslo (2002); Warwick University (2006); Honorary Member, London Mathematical Society (2011).

Summary of scientific research

The main contributions of Prof. Yuri Manin are in the domains of algebraic geometry, number

theory, differential equations, and mathematical physics. In algebraic geometry, he proved the Mordell conjecture for algebraic curves over functional fields: non-constant curves of genus more than 1 have only finitely many rational points. In the course of proof, he introduced an important tool which is now widely used under the name of Gauss-Manin connection in algebraic geometry, theory of singularities, theory of differential equations and mathematical physics. Another significant contribution is his counterexample to the classical Lüroth conjecture (joint work with V.A. Iskovskih) which revived the birational techniques of Italian algebraic geometry. In number theory, he constructed the so-called Manin-Brauer obstruction to the solvability of Diophantine equations. In many cases vanishing of this obstruction is the necessary and sufficient condition of the existence of solutions. His work on the arithmetic of modular forms led him to the construction of p-adic L-functions and the theory of modular symbols. In recent years he started a program of algebraic geometric investigation of Diophantine equations with many solutions complementing the circle method when it becomes inapplicable or leads to wrong heuristic conclusions. Among the main ingredients of this program is the general notion of point-accumulating subvarieties and their algebraic geometric characterization, depending on the so-called 'linear growth conjecture'. Recently he has started applying methods of noncommutative geometry to number theory and formulated an approach to the class field theory of real quadratic fields in which quantum tori replace elliptic curves. In the theory of differential equations, he developed a wide extension of the twistor methods using the cohomology theory of coherent sheaves. Building upon the earlier work of R. Penrose and E. Witten, he has shown that the twistor transform of Yang-Mills equations with current is encoded in the formalism of obstruction theory for infinitesimal extensions. His work with B. Kupershmidt and D. Lebedev on the equations of long waves and completely integrable systems led to the group theoretic explanation of their Hamiltonian structure. In mathematical physics, he made a contribution to the theory of quantum strings using algebraic geometric methods for the classification of instantons (jointly with M. Atiyah, N. Hitchin, V. Drinfeld) and the calculation of the Polyakov measure on the moduli spaces of curves. He introduced the technique of quantum spaces and universal coactions in the theory of quantum groups. His latest research is devoted to the quantum cohomology of algebraic varieties which physically is related to the study of partial compactification of the ten-dimensional Universe. From a mathematical viewpoint, this theory opens a new chapter of enumerative algebraic geometry giving a deep insight into the analytic properties of various generating functions. Yuri Manin has devoted a number of publications to the philosophy of science and the problems of the early stages of the development of language and mathematics. In computer science, Yuri Manin studied algebraic-geometric error-correcting codes, and was one of the first proponents of the project of quantum computing.

Main publications

Author and co-author of 11 monographs and about 225 papers in Algebraic Geometry, Number Theory, Mathematical Physics, History of Culture, Psycholinguistics. Manin, Yu.I., *Selected Papers*, World Scientific Series in 20th Century Mathematics, vol. 3, World Sci., Singapore, 1996, pp. xii + 600; Manin, Yu.I., *Cubic Forms: Algebra, Geometry, Arithmetic*, Russian: Nauka, Moscow,

pp. 307, 1972, English trans., North Holland, Amsterdam, pp. 292, 1974, and pp. 326, 1986; Manin, Yu.I., *Gauge Fields and Complex Geometry*, Russian trans., Nauka, Moscow, pp. 355, 1984, English trans., Springer Verlag, pp. 295, 1988; Kobzarev, I.Yu. and Manin, Yu.I., *Elementary Particles: Mathematics, Physics and Philosophy*, Reidel, Dordrecht, pp. 227, 1989; Manin, Yu.I., *Topics in Non-commutative Geometry*, Princeton University Press, pp. 163, 1991; Manin, Yu.I., *The mythological trickster in psychology and history of culture*, Russian trans., Priroda, 7, pp. 42-52 (1987); Manin, Yu.I., *Archetype of Empty City*, Russian trans., Arbor Mundi, 1, pp. 28-34 (1992), (E. Meletinsky, ed.); Kontsevich, M., Manin, Yu.I., Gromov-Witten classes, quantum cohomology and enumerative geometry, *Comm. Math. Phys.*, 164:3, pp. 525-62 (1994); Gelfand, S.I., Manin, Yu.I., *Methods of homological algebra*, Springer Verlag, pp. xv+372, 1996; Manin, Yu.I., Truth, rigor and common sense, *Truth in Mathematics*, (H.G. Dales and G. Oliveri, eds), Clarendon Press, Oxford, pp. 147-59 (1998); Manin, Yu.I., *Frobenius Manifolds, Quantum Cohomology, and Moduli Spaces*, AMS Colloquium Series, Providence, Rhode Island, pp. 365, 1999; Manin, Yu.I., *Classical computing, quantum computing, and Shor's factoring algorithm*, Séminaire Bourbaki, 862, vol. 266, pp. 375-404, Astérisque (June 1999); Manin, Yu.I. and Marcolli, M., Continued fractions, modular symbols, and noncommutative geometry, *Selecta math.*, new. ser., 8, pp. 475-521 (2002); Manin, Yu.I., Mathematics as Metaphor (Selected Essays), *American Math. Society*, 2007, xi+232 pp; Arend Bayer, Yu. I. Manin, *Stability conditions, wall-crossing and weighted Gromov-Witten invariants*, Mosc. Math. J., 9: (1): 3-32, backmatter (2009); Franz Luef, Yuri I. Manin, *Quantum theta functions and Gabor frames for modulation spaces*, Lett. Math. Phys., 88: (1-3): 131-161 (2009).