Sergey Petrovich Novikov

Date of Birth 20 March 1938

Place Gorky (Russia)

Nomination 25 June 1996

Field Mathematics

Title Professor

Professional address

University of Maryland at College Park

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Most important awards, prizes and academies

Awards: Fields Medal (1970); Lenin Prize (1967); Lobachevski International Prize (1981); Wolf Prize (2005). *Academies*: USSR/Russian Academy of Sciences (1981); Honorary Member, London Math. Society (1987); US National Academy (1994); Accademia Nazionale dei Lincei (1993); Pontifical Academy of Sciences (1996); European Academy of Sciences, Brussels.

Summary of scientific research

Classical Topology of 60s: 1. Method of classification of manifolds developed 1961-4 [1]. Proof of topological invariance of rational Pontryagin classes [2]. Novikov Conjecture describing all homotopy invariant expressions from the Riemann Curvature Tensor [3]. 2. Calculation of stable homotopy groups of spheres and cobordism rings [4]; new methods of algebraic topology based on the complex cobordisms [5, 6]. 3. Topology of 2-foliations on 3-manifolds (1963-5): proof of the existence of compact leaf on a 3-sphere, braids and classification of analytical 2-foliations in the solid torus, homotopy obstructions for the Anosov systems [7]. *Topological Phenomena in Physics*: 1. Chern numbers of the dispersion relations for the generic 2D Schrodinger operators in magnetic field and lattice found in 1980 before the discovery of the Integral Quantum Hall Effect [8]. 2. Topology of multivalued functions and functionals (closed 1-forms) gas constructed in 1981-2 [9]. Morse theory and fundamental group, representations and von Neumann factors, Novikov-Shubin invariants [10]. 3. Qualitative theory of the Einstein equation for Homogeneous Cosmological Models as a dynamical system near singularity constructed in 1971-3 [23]. 4. Galvanomagnetic phenomena: universal generic asymptotics for the conductivity tensor of the 3D normal metal with complicated Fermi surface in the strong magnetic field (of the order of magnitude about 10-100t) was found [11]. *Solitons and Algebraic Geometry*: 1. Periodic Problem for the KdV equation: large family of the exact 'finite-gap' solutions found based on the discovery of finite-gap (algebro-geometrical) 1D periodic potentials. Riemann surface, #-functions [12, 13]. KP hierarchy and Krichever solutions found in 1976 as a basis for the Novikov Conjecture on the solution of Riemann-Schottki Problem for #-functions. Inverse spectral problem for the 2D Schrodinger operators on a single energy level [13]. Higher rank solutions for the KP hierarchy. Explicit calculation of the commuting higher rank linear OD operators, Krichever-Novikov equation [14]. 2. Special Poisson brackets for the finite-dimensional integrable systems [15]. Dubrovin-Novikov Hydrodynamic Type Poisson brackets based on the Riemannian Geometry discovered in 1983. Numerical and analytical integration of the Whitham systems with singularities, dispersive analog of shock wave [15]. 3. Analog of the Laurent-Fourier decompositions on Riemann surface as a tool for the operator quantization of the bosonic strings for any number of loops [16]. 4. Laplace Chains of the 2D Schrodinger operators, new exactly solvable cases in the magnetic field and lattice, discrete systems [16, 17]. Scattering theory on graphs developed on the basis of Symplectic Geometry 1997-8 [18].

Main publications

[1] Homotopically equivalent smooth manifolds, I., *Izv. Akad. Nauk SSSR*, 28 (2), pp. 365-474 (1964); [2] On manifolds with free Abelian fundamental group and their application, *Izv. Akad. Nauk SSSR*, 30 (1), pp. 207-46 (1966); [3] Analogues hermitiens de la K-theorie, *Actes Congr. Intern. Math* (Nice, 1970), Gauthier-Villars, Paris, vol. 2, pp. 39-45 (1971); [4] Homotopy properties of Thom complexes, *Mat. Sb.*, 57 (4), pp. 406-42 (1962);

[5] Methods of algebraic topology from the point of view of cobordism theory, *Izv. Akad. Nauk SSSR*, 31 (4), pp. 885-951 (1967); [6] Formal groups and their role in the apparatus of algebraic topology (*et al.*), *Uspekhi Mat. Nauk*, 26 (2), pp. 131-54 (1971); [7] The topology of foliations, *Trudy Moskov. Mat. Obshch*, 14, pp. 248-78 (1965); [8] Bloch functions in a magnetic field and vector bundles. Typical dispersion relations and their quantum numbers, *Dokl. Akad. Nauk SSSR*, 257 (3), pp. 538-43 (1981); [9] The Hamiltonian formalism and a many-valued analogue of Morse theory, *Uspekhi Mat. Nauk*, 37 (5), pp. 3-49 (1982); [10] Morse inequalities and von Neumann 1-factors, *Dokl. Akad. Nauk SSSR*, 289 (2), pp. 289-92 (1986); [11] Topological Phenomena in Metals (with Maltsev, A.), *Uspekhi Phys Nauk*, 168 (3), pp. 249-58 (1998); [12] A periodic problem for the Korteweg-de Vries equations, I., *Funktsional Anal. i Prilozhen*., 8 (3), pp. 54-66 (1974); [13] Non-linear equations of Korteweg-de Vries type, finite zone linear operators, and Abelian varieties (*et al.*), *Uspekhi Mat. Nauk*, 31 (1), pp. 55-136 (1976); [14] Two-dimensional Schrödinger operators: Inverse scattering transform and evolutional equations (with Veselov, A.P.), *Phys.*, D18, pp. 267-73 (1986); [15] Holomorphic bundles over algebraic curves and nonlinear equations (with Krichever, I.M.), *Uspekhi Mat. Nauk*, 35 (6), pp. 47-68 (1980); [16] Poisson brackets and complex tori, *Trudy Mat. Inst. Steklov*, 165, pp. 49-61 (1984); [17] Hydrodynamics of the soliton lattices. Differential geometry and Hamiltonian formalism (with Dubrovin, B.A.), *Uspekhi Mat. Nauk*, 44 (6), pp. 29-98 (1989); [18] Riemann surfaces, operator fields, strings. Analogues of the Fourier-Laurent bases (with Krichever, I.M.), *Physics and Mathematics of Strings* (L. Brink *et al*., eds), World Scientific, Singapore, pp. 356-88 (1990); [19] Spectral Symmetries of the Low-dimensional Schrödinger Operators and La place Transformations (with Dynnikov, I.A.), *Russia Math Surveys*, 52 (5), pp. 175-234 (1997); [20] Schrödinger Operators on Graphs and Symplectic Geometry, to appear in the Additional Volume of *Arnoldfest*, Toronto, Fields Institute; [21] Topology. *1. Encyclopedia of Mathematical Sciences*, Springer Verlag, vol. 12, pp. 320 (1996); [22] *Solitons and Geometry. Fermi lectures 1992*, Scuola Norm. Sup. di Pisa, (1994); [23] Singularities of the cosmological model of the Bianchi IX type according to the qualitative theory of differential equations (with Bogoyavlenskii, O.I.), *Zh. Eksper. Teoret. Fiz.*, 64 (5), pp. 1475-94 (1973). *Latest articles*: Dynamical Systems, Topology and Conductivity in Normal Metals, *Journal of Statistical Physics*, 2004, vol 115, iss 1-2, pp. 31-46 (16), (with A. Maltsev); Integable Systems. *1. Encyclopedia Math. Sciences*, Dynamical Systems, v 4 (edited by V. Arnold and S. Novikov), 2nd exp. and rev. edition, pp. 177-332, Springer, 2001 (with B. Dubrovin and I. Krichever); *Algebraic Topology. Modern Problems of Mathematics. Steklov Math Institute Series*, pp. 1-46 (in Russian) A revised version of this article is published: Topology in the 20th Century: A view from inside, *Uspekhi Math. Nauk=Russian Math Surveys*, vol 59 (2004) n. 5; On the metric independent exotic homology, preprint. *Proceedings (Trudy) of the Steklov Math Institute*, vol 251 (2005), pp. 202-12; Topology of the quasiperiodic functions on the plane and dynamical systems, *Uspekhi Math. Nauk*, 2005, v. 60 n. 1 (with I. Dynnikov); *Topology of foliations given by the real parts of holomorphic 1-forms* (v. 1, 21 Jan 2005, rev. February 2005 and March 2005); Topology of the Generic Hamiltonian Foliations on the Riemann Surface. Math. GT/0505342, New version, *Moscow Math. Journal* (*MMJ*), vol 5 (2005), n. 3, pp. 633-67.