Curriculum Vitae
Serge Tabachnikov

Department of Mathematics
Pennsylvania State University,
University Park, PA, 16802, USA;
tabachni@math.psu.edu

Education

Ph.D.: Moscow State University, 1987. Advisors: D. Fuchs and A. Fomenko.

Dissertation title: Geometrical applications of the cohomology of infinite-dimensional Lie algebras

M.S.: Moscow State Pedagogical University, 1978, with Honors

Positions held

Permanent positions

Mathematics Teacher, Special High School for Mathematics No 2, Moscow, 1978–80

Assistant Professor and Program Coordinator, School of Mathematics by Correspondence ("Gelfand's School"), Moscow State University, 1979–88

Head of Mathematics Department, "Kvant" magazine, USSR Academy of Sciences, Moscow, 1988–90

Assistant Professor, Associate Professor and Professor of Mathematics, University of Arkansas, 1990–2000

Associate Professor of Mathematics and MASS Director, Pennsylvania State University, 2000–2002

Professor of Mathematics and MASS Director, Pennsylvania State University, 2002–

Visiting positions

Centre de Physique Theorique, Luminy: May, September 1992; April 1995; June 2000

ENS de Lyon: June–July 1992

Université Louis Pasteur, Strasbourg: October 1992

IHES, Bur-sur-Yvette: November 1992

ETH, Zurich: December 1992–January 1993, May–July 2003

University of Cambridge and I. Newton Institute: 1994-95

MSRI, Berkeley: May–June 1995; May–July 1997

Max-Planck-Institut, Bonn: 1995–96; July-September 1998; May-August 1999; June-July 2001; January-June 2006

Tel Aviv University: December 1996–January 1997; May 2000; December 2001; January 2004

Université de Rennes: January, 1998

Université Catholique de Louvain: June 1998

Oberwolwach, RiP program: August 1999; July-August 2003; May 2004; June-July 2005; July 2006, June-July 2007

Fields Institute, Toronto: May 2001
Institut de Mathématiques de Luminy: May–June 2002
Haifa Institute of Technology (Technion), January 2004
Université Claude Bernard, Lyon, June–July 2006

Grants and awards

UARK Research Incentive Grants, 1992–93, 1993–94, 1997–98, 1998–99
NSF Grants, 1992, 97, 98, 99: organizing an annual mathematical conference at UARK
Arkansas Science and Technology Authority Research Grant, 1993–94
Wolfson College, University of Cambridge fellowship, 1994–95
NSF Research Grants, 1994–97, 1998–01, 2003–05, 2006–09 (sole investigator)
SILO Grant (undergraduate research, with J. Reed), 1998-99
Volkswagen-Stiftung RiP-program at Oberwolfach: summer 1999, summer 2003 (with V. Ovsienko); spring 2004 (with E. Gutkin); summer 2005, summer 2006, summer 2007 (with D. Fuchs)
BIRS Research in Teams, spring 2008 (with V. Ovsienko)
BSF Research Grant, 2001–2004 (with M. Farber and S. Weinberger)
NSF Grants, 2004–05, 2005–10, MCTP: MASS Program at Penn State (co-PI)

Books

Books and parts of books authored

1. Billiards. Société Mathématique de France, "Panoramas et Syntheses", No 1, 1995
2. Polynomials. Phasis, Moscow, 1996 (second edition 2000, third edition 2004) (in Russian)
3. Rational billiards and flat structures (with H. Masur). Handbook of Dynamical Systems, v. 1A, North-Holland, 2002, 1015–1089
4. Projective differential geometry, old and new: from Schwarzian derivative to cohomology of diffeomorphism groups (with V. Ovsienko). Cambridge Univ. Press, 2005
   Russian translation, MCCME, Moscow 2008
5. Geometry and billiards. Amer. Math. Soc., 2005
6. Mathematical omnibus (with D. Fuchs), Amer. Math. Soc., 2007 (translations into Russian and into German, to appear)
7. Billiards and Poncelet theorem, in L. Flatto. Poncelet's theorem. Amer. Math. Soc., in print

Books edited

1. Mathematical Olympiads by Correspondence, Nauka, Moscow, 1987 (in Russian)
2. Differential and symplectic topology of knots and curves, AMS Transl., ser.2, v. 190, 1999
3. Differential topology, infinite-dimensional Lie algebras and their applications (with A. Astashkevich), AMS Transl., ser.2, v. 194, 1999
4. Kvant Selecta: Algebra and Analysis I, AMS Math. World, v. 14, 1999
5. Kvant Selecta: Algebra and Analysis II, AMS Math. World, v. 15, 1999
6. Kvant Selecta: Discrete mathematics I, AMS Math. World, v. 17, 2002
7. MASS Selecta: teaching and learning advanced undergraduate mathematics (with S. Katok, A. Sossinsky), AMS, 2003

Research Papers

1. On invariant differential operators in general position. Func. Anal. Appl., 16, No 3 (1982), 86–87
2. On characteristic classes of homogeneous foliations. Russ. Math. Surv., 39, No 2 (1984), 189–190
3. On homology in general position of the Lie algebra of vector fields on the line. Soviet Math. Dokl., 275, No 2 (1984), 310–314
4. Characteristic classes of Grassman foliations. Func. Anal. Appl., 19, No 1 (1985), 83–84
5. Characteristic classes of parabolic foliations and symmetric functions. Serdica, 11 (1985), 86–95
6. Characteristic classes of parabolic foliations of series B, C, D and degrees of isotropic Grassman manifolds. Func. Anal. Appl., 20, No 2 (1986), 84–85
7. Geometrical applications of cohomology of infinite-dimensional Lie algebras. Dissertation, Moscow, 1987 (translation to French: University of Lyon, 1994)
8. An invariant of submanifolds transversal to a distribution. Russ. Math. Surv., 43, No 3 (1988), 193–194
9. Calculation of the Bennequin invariant of a Legendrian curve by the geometry of its front. Func. Anal. Appl., 22, No 3 (1988), 89–90
10. Characteristic classes of Lagrangian foliations. Func. Anal. Appl., 23, No 2 (1989), 90–91
11. Two remarks on the asymptotic Hopf invariant. Func. Anal. Appl., 24, No 1 (1990), 84–85
12. Around four vertices. Russ. Math. Surv., 45, No 1 (1990), 191–192
13. Numerical study of dual billiards: the case of a semicircle (with I. Monroe). UARK Technical Report, 1992
14. Geometry of Lagrangian and Legendrian 2-webs. Diff. Geom. Appl., 3 (1993) 265–284
15. Poncelet's theorem and dual billiards. L'Enseign. Math., 39 (1993), 189–194
16. Outer billiards. Russ. Math. Surv., 48, No 6 (1993), 75–102
17. Commuting dual billiard maps. Geom. Dedicata, 53 (1994), 57–68
18. A cone eversion. Amer. Math. Monthly, 102 (1995), 52–56
19. On the dual billiard problem. Advances in Math., 115 (1995), 221–249
20. The four vertex theorem revisited – two variations on the old theme. Amer. Math. Monthly, 102 (1995), 912–916
21. Asymptotic dynamics of the dual billiard transformation. J. Stat. Phys., 83 (1996), 27–38
22. Invariants of smooth triple point free plane curves. Knot Theory and Ramifications, 5 (1996), 531–552
23. Sturm theory, Ghys theorem on zeroes of the Schwarzian derivative and flattening of Legendrian curves (with V. Ovsienko). Selecta Math. (NS), 2 (1996), 297–307
24. Projective connections, group Vey cocycle and deformation quantization. Int. Math. Res. Notes. 1996, No 14, 705–722
25. Introducing projective billiards. Ergod. Theory and Dynam. Syst., 17 (1997), 957–976
26. Invariants of Legendrian and transverse knots in the standard contact space (with D. Fuchs). Topology, 36 (1997), 1025–1053
27. On zeroes of the Schwarzian derivative. Topics in singularity theory, 229–239, AMS Transl., ser. 2, v. 180, 1997

28. Parameterized curves, Minkowski caustics, Minkowski vertices and conservative line fields. L'Enseign. Math., 43 (1997), 3–26
29. On functions with zero mean over a finite group. Func. Anal. Appl., 31, No 1 (1997), 93–94
30. Estimates for the Bennequin number of Legendrian links from state models for knot polynomials. Math. Research Lett., 4 (1997), 143–156
31. Exact transverse line fields and projective billiards in a ball. Geom. and Funct. Anal., 7 (1997), 594–608
32. More on paperfolding (with D. Fuchs). Amer. Math. Monthly, 106 (1999), 27–35
33. Geometry of exact transverse line fields and projective billiards. Differential and symplectic topology of knots and curves, 131–152, AMS Transl., ser. 2, v. 190, 1999
34. Projectively equivalent metrics, exact transverse line fields and the geodesic flow on the ellipsoid. Comm. Math. Helv., 74 (1999), 306–321
35. Fagnano orbits of polygonal dual billiards. Geom. Dedicata, 77 (1999), 279–286
36. Remarks on the geometry of exact transverse line fields. Differential topology, infinite-dimensional Lie algebras and applications, 247–260, AMS Transl., ser. 2, v. 194, 1999
37. Going in circles: variations on the Money-Coutts theorem. Geom. Dedicata, 80 (2000), 201–209
38. A four vertex theorem for polygons. Amer. Math. Monthly, 107 (2000), 830–833
39. Projective geometry of polygons and discrete 4-vertex and 6-vertex theorems (with V. Ovsienko). L'Enseign. Math., 47 (2001), 3–19
40. Billiards in Finsler and Minkowski geometries (with E. Gutkin). J. Geom. and Phys., 40 (2002), 277–301
41. Ellipsoids, complete integrability and hyperbolic geometry. Moscow Math. J., 2 (2002), 185–198
42. Topology of cyclic configuration spaces and periodic orbits of multi-dimensional billiards (with M. Farber). Topology, 41 (2002), 553–589
43. Periodic trajectories in 3-dimensional convex billiards (with M. Farber). Manuscripta Mat., 108 (2002), 431–437
44. Dual billiards in the hyperbolic plane. Nonlinearity, 15 (2002), 1051–1072
45. On polygonal dual billiard in the hyperbolic plane (with F. Dogru). Reg. Chaotic Dynamics, 8 (2003), 67–82
46. Topological robotics: motion planning in projective spaces (with M. Farber and S. Yuzvinsky). Int. Math. Res. Notes, 2003, No 34, 1853–1870
47. On skew loops, skew branes and quadratic hypersurfaces. Moscow Math. J., 3 (2003), 681–690
48. On three-periodic trajectories of multi-dimensional dual billiards. Alg. Geom. Topology, 3 (2003), 993–1004
49. Remarks on magnetic flows and magnetic billiards, Finsler metrics and a magnetic analog of Hilbert's fourth problem. Dynamical systems and related topics, Cambridge Univ. Press, 2004, 233–252
50. Tire track geometry: variations on a theme. Israel J. Math., 151 (2006), 1–28
51. Non-existence of n-dimensional T-embedded discs in $\mathbf{R}^{2n}$ (with G. Stojanovic). Comm. Math. Helv., 81 (2006), 877–882

52. Complexity of piecewise convex transformations in two dimensions, with applications to polygonal billiards (with E. Gutkin). Moscow Math. J., 6 (2006), 673–701
53. On configuration space of plane polygons, sub-Riemannian geometry and periodic orbits of outer billiards (with D. Genin). J. Modern Dynamics, 1 (2007), 155–173
54. The Poncelet grid and the billiard in an ellipse (with M. Levi). Amer. Math. Monthly, 114 (2007), 895–908
55. Hyperbolic Carathéodory conjecture (with V. Ovsienko). Proc. of Steklov Inst., 258 (2007), 178–193
56. A proof of Culter's theorem on the existence of periodic orbits in polygonal outer billiards. Geom. Dedicata, 129 (2007), 83–87
57. Geodesics on an ellipsoid in Minkowski space (with D. Genin and B. Khesin). L'Enseign. Math., 53 (2007), 307–331
58. Totally skew embeddings of manifolds (with M. Ghomi). Math. Zeitschrift, 258 (2008), 499–512
59. On algebraically integrable outer billiards. Pacific J. Math., 235 (2008), 89–92
60. Birkhoff billiards are insecure. Discr. Cont. Dyn. Syst., in print
61. Converse Sturm-Hurwitz-Kellogg theorem and related results. J. Fixed Point Theory Appl., 3 (2008), 121–130
62. Self-dual polygons and self-dual curves (with D. Fuchs). Funct. Anal. and Other Math., in print
63. Spaces of pseudo-Riemannian geodesics and pseudo-Euclidean billiards (with B. Khesin). Preprint
64. Existence and non-existence of skew branes (with Yu. Tyurina). Preprint
65. Variations on the Tait-Kneser theorem (with V. Timorin). Preprint
66. On bicycle tire tracks geometry, hatchet planimeter, Menzin's conjecture and oscillation of unicycle tracks (with M. Levi). Preprint

Expository articles

Articles in "Kvant" magazine (in Russian)

1. Mathematical radio club. 1983, No 3
2. Mistakes in geometrical proofs. 1984, No 3 (in English: Quantum, 1998, No 6)
3. Considerations of continuity. 1987, No 9. (in English : Quantum, 1990, No 2)
4. Geometry of equations. 1988, No 10
5. On plane curves. 1988, No 11-12
6. On curvature. 1989, No 5
7. On self-referential sentences. 1989, No 6
8. Archimedes' law from the viewpoint of a mathematician. 1989, No 10 (in English: in "Geometry, Analysis and Mechanics", World Sci. Publ., 1995, 215–218)
9. Differential geometry around us. 1989, No 11
10. How many roots does a polynomial have? 1989, No 12
11. Polynomials least different from zero. 1990, No 6 (in English: Quantum, 1994, No 1 and Kvant Selecta: algebra and analysis, II, 161–165)
12. Web geometry. 1990, No 7
13. Chebyshev's nets (with Yu. Kotov). 1990, No 7

14. Segments of constant areas (with D. Fuchs). 1990, No 8. (in English: Quantum, 1992, No 2)
15. Which is larger? 1990, No 10
16. Nazism and mathematics. 1990, No 11. (in Japanese: Basic Sugaku, 1991)
17. Variations on Escher's theme. 1990, No 12

Other

1. Monthly mathematical radio show. All-Union Radio Station, Moscow, 1981-83 (10 scripts)
2. Instructive games (with A. To'om). Moscow State Univ. Math. School by Correspondence, 1987
3. Encyclopedia of mathematical physics, Nauka, Moscow, 1997. 17 articles on contact geometry
4. Solution to a problem by Coxeter. Summer Geometry Institute Problem Book, Smith College, 1993
5. A problem. Math. Intelligencer, 13 (1991), No 2
6. Problem No 10724, Amer. Math. Monthly, 106 (1999); solution: 108 (2001), 472–473
7. Preface to Kvant Selecta, AMS Math. World, v. 14 (1999)
8. Personal reflections on D. Fuchs, Differential topology, infinite-dimensional Lie algebras and applications, 309–311, AMS Transl., ser. 2, v. 194, 1999
9. Outer billiards (in Russian). Mat. Prosv., ser. 3, No 5 (2001), 125–135
10. MASS Program at Penn State (with A. Katok and S. Katok). Math. Intelligencer, 24 (2002), No 4, 50–56
11. A tale of a geometric inequality. MASS Selecta, AMS, 2003, 257–262
12. Bringing Eastern European traditions to North American students (with P. Humke and Yu. Ilyashenko). Notices of AMS, 50 (2003), 1250–1254
13. Dual billiards (with F. Dogru). Math. Intelligencer, 27, No 4 (2005), 18–25
14. Comments to problems 1976-4, 1976-5, 1976-12, 1979-19, 1981-10, 1983-4, 1987-3, 1994-2, 1994-8, 1994-17. Arnold's Problems, Springer-Verlag, & Phasis, 2005
15. Billiards in bounded convex domains. Encyclopedia of mathematical physics, Elsevier, 2006, v. 1, p. 296–299
16. Polygonal billiards. Encyclopedia of mathematical physics, Elsevier, 2006, v. 4, pp. 84–87
17. "Arnold's Problems" book review. Math. Intelligencer, 29, No 1 (2007), 49–51
18. 27 lines (in Russian). Mat. Prosv., ser. 3, No 12 (2008), 145–160

Curriculum development

Transformational geometry, lecture notes, UARK, 1993
Differential topology, lecture notes, UARK, 1999
Mathematical methods of mechanics, lecture notes, UARK, 2000
Introduction to symplectic topology, lecture notes, Penn State, 2002
Intuitive topology, MASS course, Penn State, 2002
Geometry and billiards, REU and MASS course, Penn State, 2004 and 2005

Editor

Kvant, 1989–1990
American Mathematical Monthly, 2001–

Journal of Fixed Point Theory and Applications, 2007–

Conference organizing

Symplectic topology, Fayetteville, AR, 1992
Dehn surgery (with Ch. Goodman-Strauss), Fayetteville, AR, 1997
Combinatorial methods in algebra (with M. Johnson and V. Retakh), Fayetteville, AR, 1998
Complex dynamics (with L. Lanzani and V. Retakh), Fayetteville, AR, 1999
Nonholonomic dynamics and integrability (with B. Khesin), Banff, 2007
Billiards and related topics (with R. Schwartz), AMS Southeast Meeting, Murfreesboro, 2007
Legendrian knots and related topics, AIM 2008

Doctoral students

F. Dogru, Ph.D. 2003, D. Genin, Ph.D. 2005, Yu. Tyurina, Ph.D. 2005, G. Stojanovic, Ph.D. 2007, J. Chen

Conference, colloquium and seminar talks (since 1991)

1. Annual AMS/MAA Meeting (Geometry), San Francisco, January 1991
2. Midwest Topology Conference, Lawrence, May 1991
3. Centre de Physique Theorique, Luminy, June 1991
4. University of Texas at Austin, October 1991
5. UC at Davis, December 1991
6. Annual AMS/MAA Meeting (Symplectic topology), Baltimore, January 1992
7. Rencontres Franco-Russe de geometrie, CIRM, Luminy, May 1992
8. Ecole Normale Superieur de Lyon, June 1992
9. Université Louis Pasteur, Strasbourg, October 1992
10. Conference on polygonal billiards, ENS de Lyon, October 1992
11. Université de Rennes, November 1992
12. IHES, Bures-sur-Yvette, November 1992
13. ETH-Zentrum, Zurich, December 1992
14. Penn State University, March 1993
15. UC at Davis, May 1993
16. Stanford University, May 1993
17. Smith College, July 1993
18. Wichita St. University, September 1993
19. UC at Riverside, March 1994
20. SUNY at Stony Brook, March 1994
21. Yale University, March 1994
22. Symposium on classical and quantum billiards, Ascona, July 1994
23. Université Louis Pasteur, Strasbourg, April 1995
24. Ecole Normale Superieur, Paris, April 1995
25. Centre de Physique Theorique, Luminy, April 1995
26. Stanford University, May 1995
27. University of Southern California, May 1995
28. UC at Santa Cruz, May 1995

29. Geometry conference, Oberwolfach, October 1995
30. MPIM (Oberseminar), Bonn, November 1995
31. Koeln University, February 1996
32. Tel Aviv University, January 1997
33. Combinatorics and knot theory workshop, MSRI, January 1997
34. AMS Meeting (Chaotic dynamics), Memphis, March 1997
35. UC at Santa Cruz, June 1997
36. Université de Rennes, January 1998
37. University of Wisconsin, Madison, February 1998
38. AMS Meeting (Geometry and topology of 3-Manifolds), Davis, April 1998
39. Université Catholique de Louvain, June 1998
40. University of Toronto, November 1998
41. Columbia University, December 1998
42. University of Alabama, Birmingham, February 1999
43. Dynamics conference, Oberwolfach, July 1999
44. University of Arizona, Tucson, September 1999
45. Tulane University, October 1999
46. Penn State University, November 1999
47. New Mexico State University, Las Cruces, December 1999
48. AMS Meeting (Finsler and Minkowski geometry), Lowell, April 2000
49. Tel Aviv University, May 2000
50. Centre de Physique Theorique, Luminy, June 2000
51. Ecole Normale Superieur, Paris, June 2000
52. Georgia Topology Conference, Athens, July 2000
53. Geometry conference, Oberwolfach, October 2000; mini-course of 2 lectures
54. AMS Meeting (Dynamics), San Francisco, October 2000
55. Indiana University, Bloomington, February 2001
56. University of Pennsylvania, Philadelphia, March 2001
57. Séminaire Sud-Rhodanien de Géométrie, Atelier billiards, Montpellier, June 2001; mini-course of 5 lectures
58. Ruhr University, Bochum, July 2001
59. Dynamical systems conference, Penn State, October 2001
60. Tel Aviv University, December 2001
61. Haifa Institute of Technology (Technion), December 2001
62. Georgia Institute of Technology, Atlanta, April 2002
63. Institut de Mathématiques de Luminy, May 2002
64. Université de Province, Marseille, May 2002
65. Université Claude Bernard, Lyon, May 2002
66. International workshop on piecewise isometries, Luminy, June 2002
67. University of South Carolina, Columbia, March 2003
68. AMS Meeting (Differential geometry), Bloomington, April 2003
69. AMS Meeting (Applications of Teichmuller theory), Bloomington, April 2003
70. AMS Meeting (Algebraic and topological combinatorics), New York, April 2003
71. University of Florida, Gainsville, April 2003

72. Conference on hyperbolic dynamics, Zurich, June 2003
73. Conference on topology and robotics, Zurich, June 2003
74. Novos Talentos em Matemática, Luso, Portugal, September 2003
75. Tel Aviv University, January 2004
76. Haifa Institute of Technology (Technion), January 2004
77. University of Toronto, March 2004
78. SUNY at Stony Brook, March 2004
79. University of Pennsylvania, April 2004
80. Ohio State University, Columbus, May 2004
81. Geometry conference, Oberwolfach, September 2004
82. University of Dortmund, July 2005
83. Dynamics conference, Oberwolfach, July, 2005
84. Independent University of Moscow, October, 2005
85. Max-Planck-Instutit, Bonn, January 2006
86. Koeln University, February 2006
87. Brussels-Koeln Symplectic Seminar, March 2006
88. University of Dortmund, April 2006
89. Max-Planck-Instutit, Bonn, April 2006
90. Alexander von Humbold Foundation conference, Bonn, April 2006
91. University of Lille, May 2006
92. Institut de Mathématiques de Luminy, May 2006
93. Université Claude Bernard, Lyon, June, 2006
94. Geometry conference, Oberwolfach, October 2006
95. University of Toronto, October 2006
96. Dartmouth College, October 2006
97. Brown University, April 2007
98. SUNY Stony Brook, April 2007
99. Hebrew University, Jerusalem, June 2007
100. "Different approaches to complexity", Technion, Haifa, June 2007
101. Dynamical systems, mathematical billiards and related problems in complex geometry. Summer school, Cologne, July 2007; mini-course of 3 lectures
102. Novos Talentos em Matemática, Lisbon, Portugal, September 2007; mini-course of 6 lectures
103. Temple University, October 2007
104. AMS Southeast Meeting, Murfreesboro, November 2007; invited address
105. University of Illinois, March 2008
106. University of Southern California, April 2008
107. Low complexity dynamics, BIRS, May 2008
108. University of Chicago, June 2008

Service and outreach activities

MASS Director, Department of Mathematics, Penn State, 2000–
Honors Director, Department of Mathematics, Penn State, 2000–

Member of committees: Student Awards, Undergraduate Studies, VIGRE, Promotion and Tenure, Graduate Studies; Department of Mathematics; Outreach Council, ECoS, Penn State, 2000–

Member of committees: Undergraduate, Hiring, Steering, Library, Spring Lecture Series, Graduate, VIGRE; Department of Mathematics, UARK, 1990–2000

Honors Director, Department of Mathematics, UARK, 1996–2000

Referee for various research journals, DMS NSF, reviewer for Mathematical Reviews

Canada/USA Binational Mathematical Summer Program, Invited lecturer, Colby College, 2001; Colorado College, 2002

Mathematical Club for grade school students (with J. Duncan), UARK, 1990–93; Park Forest Elementary School, 2002 and Radio Park Elementary School, State College, 2003–05

American Mathematics Competitions, Advisory Panel, member, 2002–2004

Young Scholars Awards Committee, AMS, 2007–