

CURRICULUM VITAE

Dr. Mikhail Stepanov

PERSONAL DETAILS

Address Department of Mathematics, The University of Arizona, 617 N. Santa Rita Ave., Tucson, AZ 85721, USA

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Marital status married, one daughter

Date and place of birth August 6, 1974, Novosibirsk, USSR

Citizenship Russia

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RESEARCH INTERESTS

- Information theory, error-correcting codes
- Turbulence theory
- Non-adiabatic molecular dynamics
- Fiber optics
- Diffusion-limited aggregation
- Data clusterization
- Nonlinear spectroscopy

EMPLOYMENT

- aug 2006 – present** Assistant professor, Department of Mathematics, The University of Arizona, Tucson, AZ 85721, USA
- jul 2004 – aug 2006** Postdoctoral fellow, T-13 / CNLS, Los Alamos National Laboratory, Los Alamos, NM 87545, USA
- jan 2004 – jun 2004** Research associate, Department of Mathematics, University of Arizona, Tucson, AZ 85721, USA
- nov 2002 – may 2003** Member, School of Mathematics, Institute for Advanced Study, Princeton, NJ 08540, USA
- oct 1999 – dec 2001** Postdoctoral fellow, Physics of Complex Systems, Weizmann Institute of Science, Rehovot 76100, Israel
- may 1999 – present** Research fellow (senior research fellow from November 2003), Photonics Laboratory, Institute of Automation and Electrometry, Novosibirsk 630090, Russia (on leave)

EDUCATION

- jul 1997 – apr 1999** Ph.D. student, Laser Physics Laboratory, Institute of Automation and Electrometry, Novosibirsk 630090, Russia
- sep 1995 – jun 1997** M.Sc. student, Department of Physics, Novosibirsk State University, Novosibirsk 630090, Russia
- sep 1991 – jun 1995** B.Sc. student, Department of Physics, Novosibirsk State University, Novosibirsk 630090, Russia

Ph.D. thesis: “Strong field effects in nonlinear plasma spectroscopy”
M.Sc. thesis: “Diffusive broadening of Autler-Townes doublet”
B.Sc. thesis: “Narrowing of nonlinear resonances in a collisional plasma”
Ph.D./M.Sc./B.Sc. supervisors: D.A. Shapiro and E.V. Podivilov

AWARDS AND DISTINCTIONS

2008 NSF grant DMS-0807592 “Asymptotic Performance of Error Correcting Codes” (sole PI, \$106475, 3 years)
2005 Co-PI in DOE sponsored project “Novel Physics Inspired Approach to Error-Correction”, FY06–08
2002 travel grant for “Stochastic PDE and Models of Turbulence” program, Institute for Advanced Study, Princeton
2000 travel grant for Les Houches 2000 Summer School “New Trends in Turbulence”
1998 INTAS grant within the program of the ICFPM for best young physicists-theorists in Russia
1998 George Soros graduate student grant
1995, 1997 B.Sc. and M.Sc. honor diplomas, Novosibirsk State University
1995, 1996, 1997 George Soros student grant

PROFESSIONAL AND TEACHING ACTIVITIES

- Fall 2009: MATH 575A Numerical Analysis, University of Arizona
- Spring 2009: MATH 355 Analysis of Ordinary Differential Equations, University of Arizona
- Fall 2008: MATH 215 Introduction to Linear Algebra, University of Arizona
- Spring 2008: MATH 424/524 Theory of Complex Variables, University of Arizona
- Fall 2007, Fall 2008: MATH 421/521 Complex Variables with Applications, University of Arizona
- Fall 2007: MATH 125 Calculus I, University of Arizona
- Spring 2007, Fall 2009: MATH 129 Calculus II, University of Arizona
- Fall 2006: MATH 124 Calculus I with Applications, University of Arizona
- Teaching assistant, Spring 2004: MATH 322, University of Arizona
- Teaching assistant, 5 terms, “Methods of mathematical physics”, Novosibirsk State University, Novosibirsk, Russia
- Organizer of “Subjects in and Around Fluid Dynamics” special session at AMS meeting #1027 (April 21–22, 2007, University of Arizona)
- Organizer of Modeling & Computation seminar (Program in Applied Mathematics, University of Arizona), Fall 2006–present
- Organizer of “Los Alamos Days 2005” (January 28–29, 2005, University of Arizona)
- Organizer of CNLS summer student seminar (Los Alamos National Laboratory), 2005
- Referee for Physical Review Letters, Physical Review E, Physics of Fluids, Physica D, IEEE Transactions on Communications
- Supervising high school physics project of Nathaniel Indik, academic year 2007/2008
- Mentoring Marija Vucelja, summer GRA, Los Alamos National Laboratory, 2006
- Mentoring Konstantin Turitsyn, summer GRA, Los Alamos National Laboratory, 2005
- Mentoring Dmitri Zakharov, summer GRA, Los Alamos National Laboratory, 2004

MEDIA COVERAGE

- P. Ball, *Turbulence whips up rainstorms*, Nature Science Update (12 Sep 2002)
- D. Blumenthal, *Weather: rain math*, Newsweek (18 Nov 2002)
- S. Graham, *Turbulence within clouds triggers rain*, Sci. Am. (12 Sep 2002)

PUBLICATIONS

- [24] M. Shkarayev, M.G. Stepanov, *New bisoliton solutions in dispersion managed systems*, **Physica D** **238**, 840845 (2009).
- [23] M. Chertkov, M.G. Stepanov, *An efficient pseudocodeword search algorithm for linear programming decoding of LDPC codes*, **IEEE Trans. Inf. Theory** **54** (4) 1514–1520 (2008).
- [22] I. Gabitov, R. Indik, L. Mollenauer, M. Shkarayev, M. Stepanov, P.M. Lushnikov, *Twin families of bisolitons in dispersion-managed systems*, **Opt. Lett.** **32** (6) 605–607 (2007).
- [21] G. Falkovich, M.G. Stepanov, M. Vucelja, *Rain initiation time in turbulent warm clouds*, **J. Appl. Met. Climat.** **45** (4) 591–599 (2006).
- [20] M.G. Stepanov, V. Chernyak, M. Chertkov, B. Vasic, *Diagnosis of weaknesses in modern error correction codes: a physics approach*, **Phys. Rev. Lett.** **95** (22) 228701 (2005).
- [19] A. Piryatinski, M. Stepanov, S. Tretiak, V. Chernyak, *Semiclassical scattering on conical intersections*, **Phys. Rev. Lett.** **95** (22) 223001 (2005).
- [18] V. Chernyak, M. Chertkov, M.G. Stepanov, B. Vasic, *Error correction on a tree: an instanton approach*, **Phys. Rev. Lett.** **93** (19) 198702 (2004).
- [17] A.M. Balk, G. Falkovich, M.G. Stepanov, *Growth of density inhomogeneities in a flow of wave turbulence*, **Phys. Rev. Lett.** **92** (24) 244504 (2004).
- [16] S.A. Babin, M.G. Stepanov, D.V. Churkin, D.A. Shapiro, *Coulomb broadening of the peak of electromagnetically induced transparency in plasma*, **Zh. Eksp. Teor. Fiz.** **125** (5) 1092-1099 (2004) [Engl. transl.: **JETP** **98** (5) 953-959 (2004)].
- [15] G. Falkovich, A. Fouxon, M.G. Stepanov, *Acceleration of rain initiation by cloud turbulence*, **Nature** **419**, 151-154 (2002).
- [14] G. Falkovich, M.G. Stepanov, *Role of interaction in causing errors in optical soliton transmission*, **Opt. Lett.** **27** (1) 13-15 (2002).
- [13] G.E. Falkovich, M.G. Stepanov, S.K. Turitsyn, *Statistics of interacting optical solitons*, **Phys. Rev. E** **64** (6) 067602 (2001).
- [12] D. Volk, M.G. Stepanov, *Resampling methods for document clustering*, **cond-mat/0109006**.
- [11] A.I. Chernykh, M.G. Stepanov, *Large negative velocity gradients in Burgers turbulence*, **Phys. Rev. E** **64** (2) 026306 (2001).
- [10] M.G. Stepanov, L.S. Levitov, *Laplacian growth with separately controlled noise and anisotropy*, **Phys. Rev. E** **63** (6) 061102 (2001).
- [9] S.A. Babin, S.I. Kablukov, S.V. Khorev, E.V. Podivilov, V.V. Potapov, D.A. Shapiro, M.G. Stepanov, *Resonant peak in the output spectral profile of an ionic anti-Stokes Raman laser*, **Phys. Rev. A** **63** (6) 063804 (2001).
- [8] Yu.I. Belousov, E.V. Podivilov, M.G. Stepanov, D.A. Shapiro, *Nonlinear resonances free of field and Doppler broadening*, **Zh. Eksp. Teor. Fiz.** **118** (2) 328-339 (2000) [Engl. transl.: **JETP** **91** (2) 287-297 (2000)].

- [7] I. Kolokolov, V. Lebedev, M. Stepanov, *Passive scalar in a large-scale velocity field*, **Zh. Eksp. Teor. Phys.** **115** (3) 920-939 (1999) [**JETP** **88** (3) 506-516 (1999)].
- [6] M.G. Stepanov, *Autler-Townes doublet probed by strong field*, **J. Phys. B** **32** (3) 649-661 (1999).
- [5] D.A. Shapiro, M.G. Stepanov, *Diffusion-broadened line shape near a turning point*, **Pis'ma v Zh. Eksp. Teor. Fiz.** **68** (1) 27-32 (1998) [**JETP Letters** **68** (1) 29-35 (1998)].
- [4] D.A. Shapiro, M.G. Stepanov, *Power broadening of a diffusion resonance*, **Zh. Eksp. Teor. Fiz.** **113** (5) 1632-1648 (1998) [Engl. transl.: **JETP** **86** (5) 888-896 (1998)].
- [3] D.A. Shapiro, M.G. Stepanov, *Diffusion-broadened lineshape under strong field*, **J. Phys. B** **30** (11) L377-L381 (1997).
- [2] E.V. Podivilov, M.G. Stepanov, D.A. Shapiro, *Narrowing of nonlinear resonances in a collisional plasma*, **Zh. Eksp. Teor. Fiz.** **107** (2) 418-428 (1996) [Engl. transl.: **JETP** **82** (2) 221-227 (1996)].
- [1] E.V. Podivilov, D.A. Shapiro, M.G. Stepanov, *Narrowing of the Bennett hole in collisional plasma*, **Phys. Rev. Lett.** **74** (20) 3979-3982 (1995).

PRESENTATIONS

- [P12] *Pseudo-codeword Landscape*, 2007 IEEE International Symposium on Information Theory (June 24–29, 2007, Nice, France).
- [P11] *Dynamical structures in iterative decoding*, Algorithms, Inference, & Statistical Physics (May 1–4, 2007, Santa Fe, NM, USA).
- [P10] *Improving convergence of belief propagation decoding* — 44th Allerton Conference on Communication, Control, and Computing (September 27–29, 2006, Allerton House, Monticello, IL, USA).
- [P9] *Instanton analysis of low-density parity-check codes in the error-floor regime* — 2006 IEEE International Symposium on Information Theory (July 9–14, 2006, Seattle, WA, USA).
- [P8] *Diagnosis of weaknesses in modern error correction codes: a physics approach* — APS March Meeting 2006 (March 13–17, Baltimore, MD, USA).
- [P7] *The error-floor of LDPC codes in the Laplacian channel* — 43rd Allerton Conference on Communication, Control, and Computing (September 28–30, 2005, Allerton House, Monticello, IL, USA), cs.IT/0507031.
- [P6] *Instanton approach for codes without/with loops* — Applications of Statistical Physics to Coding Theory (January 10–12, 2005, Santa Fe, NM, USA).
- [P5] *Instanton method of post-error-correction analytical evaluation* — 2004 IEEE Information Theory Workshop (October 24–29, 2004, San Antonio, TX, USA).
- [P4] *Collision rate of droplets in a turbulent cloud* — Conference on Turbulence (March 20–22, 2003, IAS, Princeton, NJ, USA).
- [P3] *Viscous instanton for large negative velocity gradients in Burgers turbulence* — Solitons, collapses and turbulence (August 18–22, 2002, LITP, Chernogolovka, Russia).
- [P2] *Modification of spectra of three-level system driven by strong field under soft collisions* (poster) — International Conference “Quantum Optics IV” (June 17–24, 1997, Jaszowiec, Poland).
- [P1] *Diffusion broadening of ion line in strong light field* — Fundamental Atomic Spectroscopy 15 (December 1996, Zvenigorod, Russia).