

ANDREĪ SOBOLEVSKIĪ

PERSONAL DATA

Mail Address. Quantum Statistics and Field Theory Division,
Physics Department, M. V. Lomonossov Moscow State University,
119992 Moscow, Russia.

Phone. 7 495 2425366.

Email. `ansobol@obs-nice.fr` (preferred means of communication).

Date and Place of Birth. July 15, 1974, Moscow.

Languages Spoken. Russian (mother tongue), English (fluent), French.

EDUCATION

Ph.D. 1999, Moscow State University.

“Generalized variational principles and the method of vanishing viscosity for some quasilinear equations and systems of equations.”

Advisors: Prof. Ya. G. Sinai, Prof. Yu. M. Loskutov.

Diploma (M.Sc.). 1996, Physics Department, Moscow State University.

Advisor: Prof. Ya. G. Sinai

EMPLOYMENT

M. V. Lomonossov Moscow State University. (Moscow, Russia).

Associate Professor since January 2005.

2000–2004: Assistant Professor

1999–2000: Junior Research Fellow

MITP RAN. (International Institute for Earthquake Prediction Theory and Mathematical Geophysics of the Russian Academy of Sciences, Moscow, Russia)

2000–Present: Research Fellow (part-time).

1997–2000: Junior Research Fellow (part-time).

Postdoctoral Position.

Observatoire de la Côte d’Azur. (Nice, France).

2003: Henri Poincaré Fellowship.

Visiting Positions.

Observatoire de la Côte d’Azur. (Nice, France).

1999, 2000, 2001, 2002, 2004, 2005, 2006.

The above spelling of my name is according to the AMS system; it is an accurate transliteration of my Russian name, АНДРЕЙ СОВОЛЕВСКИЙ. Other spellings appearing in various official documents are ANDREI SOBOLEVSKI (or SOBOLEVSKII) and ANDREY SOBOLEVSKIY.

The Isaac Newton Institute for Mathematical Sciences. (Cambridge, UK).
January and February 2002.

The Abdus Salam International Center for Theoretical Physics. (Trieste, Italy).
December 1998.

Center for Parallel Computing, KTH. (Stockholm, Sweden).
November 1996.

TEACHING

Probability theory. Lectures and problem solving classes for theoretical physics students of the 3rd year, spring term, since 2006.

Thermodynamics and Statistical Physics. Lectures and problem solving classes for physics students of the 4th year, fall and spring terms, since 1999.

For these two courses, see notes in Russian at

<http://ansobol.googlepages.com/courseseng>

(English table of contents).

Optimization Methods in Mathematical Physics. A course for theoretical physics students of the 4th year, fall and spring terms, 2002–2005.

Theoretical Models of Turbulence. A course for theoretical physics students of the 4th year, fall 2001.

Introduction to Idempotent Analysis and its Applications. A course for physics and mathematics/mechanics students, spring 2000, with V. P. Maslov, G. L. Litvinov, and G. B. Shpiz.

OTHER ACTIVITIES

Refereeing. *Physica D*, *The Mathematical Physics Electronic Journal*, *Linear Algebra and Applications*, *AMS Contemporary Mathematics conference proceedings series*, *Moscow Mathematical Journal*.

Book Translation and Publishing.

Turbulence: The Legacy of A. N. Kolmogorov. By U. Frisch. Cambridge, Cambridge Univ. Press, 1995.

Russian edition: Moscow, Phasis, 1998. Translation, \TeX typesetting.

Numerical Toolbox for Verified Computing I: Basic Numerical Problems. By R. Hammer, M. Hocks, U. Kulisch, D. Ratz. Berlin etc, Springer, 1993.

Russian edition: Izhevsk, RCD, 2005. Editing (with A. G. Yakovlev and V. Kreinovich), translation and \TeX typesetting (with S. Korop)

Organization of Conferences.

Euler Equations: 250 Years On. (Aussois, France, June 2007)

Member of the organization group.

The Nonlinear Cosmology Workshop. (Observatoire de la Côte d'Azur, Nice, France, January 2006)

Co-organizer, with U. Frisch, J. Peebles, S. Shandarin, and R. Triay.

The Large-Scale Reconstruction workshop. (Observatoire de la Côte d’Azur, Nice, France, August–September 2004).

Co-organizer, with U. Frisch, R. Mohayaee and R. Brent Tully.

L. V. Kantorovich Memorial Conference. (POMI, St. Petersburg, Russia, January 2004).

Assistance to the program committee (A. M. Vershik).

The Nonlinear Cosmology Programme. (Observatoire de la Côte d’Azur, Nice, France, June–August 2003).

Co-organizer, with U. Frisch and R. Mohayaee.

Other. Endorser for the mathematics, mathematical physics and nonlinear science sections of arXiv (<http://arXiv.org/>) since the introduction of the endorsement system in January 2004.

Personal weblog (in Russian): <http://ansobol.blogspot.com/>

RESEARCH INTERESTS

Quasilinear systems of conservation laws. In my M.Sc. and Ph.D. theses, the method of vanishing viscosity is applied to construct Ya. G. Sinai’s “generalized variational principle” for the zero-pressure one-dimensional flow of “sticky particles” [1]. After a several years’ hiatus, I resumed the study of zero-pressure gas dynamics in several spatial dimensions using a combination of methods from the optimal transportation theory [P1], vanishing viscosity, and a novel reformulation of the equations [P5].

The Hamilton–Jacobi equation and the weak KAM theory. The main result of the study of periodic solutions of a periodically forced Hamilton–Jacobi equation [2, 3, 4] is a uniqueness criterion in terms of the rotation number of the invariant measure of the corresponding Lagrangian dynamical system. This result, also obtained independently by Weinan E, pertains to the “weak KAM” or Aubry–Mather theory.

Another result is an example of a new blow-up phenomenon in solutions to the Hamilton–Jacobi equation in an unbounded domain discovered together with K. Khanin and D. Khmelev in [13, 14].

Optimal mass transportation and its applications. In [9] and [10], a new method of reconstruction of the large-scale past dynamical history of the Universe is proposed. The method is based on a variational technique introduced by Y. Brenier for solving the Monge–Ampère equation and reduces the problem to an instance of linear program (an optimal Euclidean matching problem). A thorough exposition of the new method and its possible extensions is given in [11]. A refined method of reconstruction, based on quadratic rather than linear optimization, is proposed in [P2, P3].

In [P4], “quenched disorder” in a random discrete model of incompressible fluid is studied. The model, originally proposed by Y. Brenier in a deterministic form, is based on a Euclidean matching problem similar to the one used in the reconstruction work.

Idempotent interval analysis. In a series of publications [5, 6, 7, 8], a variant of interval analysis suitable for solving a wide class of (combinatorial) optimization problems is proposed and developed.

REFEREED PUBLICATIONS

- [1] A. N. Sobolevskii. The small viscosity method for a one-dimensional system of equations of gas dynamic type without pressure. *Dokl. Akad. Nauk*, 356(3):310–312, 1997 (in Russian).
- [2] A. N. Sobolevskii. Periodic solutions of the Hamilton-Jacobi equation with a periodic force. *Uspekhi Mat. Nauk*, 53(6(324)):265–266, 1998 (in Russian).
- [3] A. N. Sobolevskii. Periodic solutions of the Hamilton-Jacobi equation with a periodic nonhomogeneity, and the Aubry-Mather theory. *Mat. Sb.*, 190(10):87–104, 1999 (in Russian).
- [4] A. N. Sobolevskii. Aubry-Mather theory and idempotent eigenfunctions of Bellman operator. *Commun. Contemp. Math.*, 1(4):517–533, 1999.
- [5] A. N. Sobolevskii. Interval arithmetic and linear algebra over idempotent semirings. *Dokl. Akad. Nauk*, 369(6):747–749, 1999.
- [6] G. L. Litvinov, V. P. Maslov, and A. N. Sobolevskii. Idempotent mathematics and interval analysis. *Vychisl. Tekhnol.*, 6(6):47–70, 2001.
- [7] G. L. Litvinov and A. N. Sobolevskii. Exact interval solutions of the discrete Bellman equation, and the polynomial complexity of problems in interval idempotent linear algebra. *Dokl. Akad. Nauk*, 374(3):304–306, 2000.
- [8] G. L. Litvinov and A. N. Sobolevskii. Idempotent interval analysis and optimization problems. *Reliab. Comput.*, 7(5):353–377, 2001.
- [9] U. Frisch, S. Matarrese, R. Mohayaee, and A. Sobolevski. A reconstruction of the initial conditions of the Universe by optimal mass transportation. *Nature*, 417:260–262, May 2002.
- [10] R. Mohayaee, U. Frisch, S. Matarrese, and A. Sobolevskii. Back to the primordial Universe by a Monge–Ampère–Kantorovich optimisation scheme. *Astron. & Astrophys.*, 406:393–401, 2003.
- [11] Y. Brenier, U. Frisch, M. Hénon, G. Loeper, S. Matarrese, R. Mohayaee, and A. Sobolevskii. Reconstruction of the early Universe as a convex optimization problem. *Mon. Not. R. Astron. Soc.*, 346:501–524, 2003.
- [12] A. Sobolevskii, U. Frisch. An application of the optimal transport theory to reconstruction of the early Universe. In A.M. Vershik, editor, *Representation Theory and Dynamical Systems*, vol. XI. POMI, St Petersburg, 2004, 303–309 (in Russian).
- [13] K. Khanin, D. Khmelev, and A. Sobolevskii. A blow-up phenomenon in the Hamilton–Jacobi equation in an unbounded domain. In G. Litvinov and V. Maslov, editors, *Idempotent mathematics and mathematical physics*. AMS, Providence, RI, 2004, 161–180.
- [14] K. Khanin, D. Khmelev, and A. Sobolevskii. On velocities of Lagrangian minimizers. *Moscow Math. J.*, 5:157–169, 2005.
- [15] V. I. Keilis-Borok, A. A. Soloviev, C. B. Allègre, A. N. Sobolevskii, and M. D. Intriligator. Patterns of macroeconomic indicators preceding the unemployment rise in Western Europe and the USA. *Pattern Recognition*, 38:423–435, 2005.
- [16] U. Frisch, A. Sobolevskii. Application of optimal transport theory to reconstruction of the early Universe. *Journal of Mathematical Sciences*, 133:1539–1542, 2006.

CURRENT PREPRINTS AND WORK IN PROGRESS

- [P1] A. Andrievskii, S. Gurbatov, A. Sobolevskii. Ballistic aggregation in symmetric and non-symmetric flows. Available at [arXiv.org:nlin.PS/0601006](https://arxiv.org/abs/nlin.PS/0601006); to be submitted to *J. Experimental Theor. Phys*, 2006.
- [P2] A. Kurnosov, A. Sobolevskii. A variational approach to reconstruction of galactic peculiar velocities. Submitted to *Moscow U. Physics Bulletin*, 2006.
- [P3] A. Kurnosov, S. Sergeev, A. Sobolevskii. A fast algorithm for a quadratic optimization problem arising in reconstruction of galactic peculiar velocities. In preparation, 2006.
- [P4] T. Kalaïdzhyan, A. Sobolevskii. Combinatorial optimization, “quenched disorder,” and invariant measures in a discrete model of incompressible fluid. In preparation, 2006.
- [P5] A. Andrievskii, P. Choquard (EPFL, Switzerland), A. Kurnosov, A. Sobolevskii. On weak solutions of zero-pressure gas dynamics in several spatial dimensions. In preparation, 2006.

TALKS

Seminars.

Séminaire de Géométrie, École Polytechnique Federale de Lausanne, Lausanne, Switzerland, 2006.

P. N. Lebedev Physics Institute of the Russian Academy of Sciences, Moscow, Russia, 2005 (with V. P. Maslov).

V. M. Polterovich and V. I. Danilov seminar on mathematical economics, Central Institute of Mathematics and Economics, Moscow, Russia, 2005 (with V. P. Maslov).

Department of Mathematics and Computer Science, Emory University, Atlanta, GA, USA, 2004.

School of Mathematics, Georgia Institute of Technology, Atlanta, GA, USA, 2004.

Section de mathématiques, École Polytechnique Federale de Lausanne, Lausanne, Switzerland, 2004.

Department of Mathematical Sciences, Loughborough University, Loughborough, UK, 2002.

V. V. Kozlov's seminar, Mechanics and Mathematics Department, M. V. Lomonossov Moscow State University, Moscow, Russia, 2000.

Session 74, École de physique des Houches, les Houches, France, 2000 (with J. Bec).

I. A. Shishmarëv's seminar, Computational Mathematics and Kybernetics Department, M. V. Lomonossov Moscow State University, Moscow, Russia, 1999, 2000, 2002.

Physics Department, M. V. Lomonossov Moscow State University, Moscow, Russia, 1999.

Conferences.

Nonlinear Cosmology Workshop 2006, Observatoire de la Côte d'Azur, Nice, France, 2006.

Recent Advances in Calculus of Variations and PDEs, University of Pisa and Scuola Normale Superiore, Pisa, Italy, 2005 (with K. Khanin and D. Khmelëv)

The Large Scale Reconstruction Workshop, Observatoire de la Côte d'Azur, Nice, France, 2004 (with M. Hénon).

L. V. Kantorovich Memorial Conference, POMI, St. Petersburg, Russia, 2004.

Workshop on Optimal Mass Transport and Dynamical Systems, Pacific Institute for Mathematical Sciences, Vancouver, Canada, 2003.

A. N. Kolmogorov Centennial Conference, M. V. Lomonossov Moscow State University, Moscow, Russia, 2003.

Workshop on Idempotent Mathematics and Mathematical Physics, the Erwin Schrödinger Institute for Mathematical Physics, Vienna, Austria, 2003.

6th Workshop on Burgers Turbulence and Beyond, the Erwin Schrödinger Institute for Mathematical Physics, Vienna, Austria, 2002.

6th Workshop on Nonlinear Dynamics and Earthquake Prediction, the Abdus Salam ICTP, Trieste, Italy, 2001.

Control Applications of Optimization, 11th IFAC International Workshop, St. Petersburg, Russia, 2000 (with G. L. Litvinov).

Voronezh Winter Mathematical School, Voronezh University, Voronezh, Russia, 2000.

4th Workshop on Burgers Turbulence and Beyond, Observatoire de la Côte d'Azur, Nice, France, 1999.

L. D. Kudryavtsev's 75th Anniversary Conference, Patrice Lumumba University, Moscow, Russia, 1998.

GRANTS AND AWARDS

Centre National de la Recherche Scientifique, Henri Poincaré Fellowship, 2003.

INTAS Young Scientist Fellowship YSF01-1-172, 2001.

Russian Foundation for Basic Research, Young Scientist Fellowship 01-01-06248, 2001.

3rd Prize, Young Scientists Contest, Physics Department, M. V. Lomonosov Moscow State University, 1999.