

# Andrei Sobolevski

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Born July 15, 1974 in Moscow. Languages: Russian (native), English (fluent), French.

Russian Academy of Science Professorship (awarded 2015)

Doctor of Sci. 2014, Physics Department, Moscow State University

*Thesis Dynamics and singularities in nonlinear models of mass transfer*

Cand. Sci. (Ph.D.) 1999, Physics Department, Moscow State University

*Thesis Generalized variational principles and the method of vanishing viscosity for some quasi-linear equations and systems of equations. Advisor: Prof. Ya. G. Sinai*

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

## Employment

### A. A. Kharkevich Institute for Information Transmission Problems

February 2017: elected Director

February 2016: appointed Acting Director (election pending)

2011-2016: Deputy Director for research

2009-2011: Senior research associate

### National Research University Higher School of Economics

2015-present: Professor, Faculty of Computer Science

2014-2015: Deputy Dean for Research and International Development

2011-2015: Associate Professor, Faculty of Computer Science

### Laboratoire J.-V. Poncelet (UMI 2615 CNRS), Moscow

2012-present: Member of *Conseil du laboratoire*

2006-present: Research Associate

#### **Projects:**

*Optimal transport: Theory and Applications to Reconstruction in cosmology and Image processing (OTARIE)*, project of Agence Nationale de la Recherche, ANR 07-BLAN-0235 CSD5:

Project coordinator, 2008-2012; workshop and conference organization, 2009-2012

[the project included teams from Moscow, Paris, and Nice;

exceptionally, Moscow was the coordinating partner]

*Dynamics and Cooperative Phenomena in Complex Physical and Biological Media (DCP-PhysBio)*, project FP7-PEOPLE-2010-IRSES 269139 (Marie Curie actions/International Research Staff Exchange Scheme):

Team coordinator, 2011-2014

*Euler Equations: 250 Years On* (Aussois, France, June 2007, over 100 participants):

Member of the Organizing Committee

### **The Independent University of Moscow**

2011-present: member of the Management Committee

2008-present: Associate professor

### **Physics Department, Moscow State University**

2005-2009 Associate professor

2000-2004 Assistant professor

1999-2000 Junior research associate

### **Observatoire de la Côte d'Azur**

2000-present: visiting

2003: Postdoctoral fellow (bourse Henri Poincaré)

#### **Projects:**

Workshop organization: 2003, 2004, 2006

### **Selected visiting positions**

Mathematics Department, University of Toronto, 2008, 2009

Georgia Institute of Technology, 2004

Isaac Newton Institute for Mathematical Sciences, 2002

Abdus Salam International Center for Theoretical Physics, 1998

Centre for Parallel Computing, KTH (Stockholm), 1996

### **Teaching**

*Introduction into Stochastic Analysis*: National Research University "Higher School of Economics" (since 2015)

*Probabilistic tools in complex systems modeling*: National Research University "Higher School of Economics" (since 2012)

*Probability Theory and Statistics for Physicists*: Independent University of Moscow (since 2009), Physics department, Moscow State University (2006-2009)

*Statistical Physics*: Physics department, Moscow State University (2000-2009)

## Service to community

Referee for *Physica D*, *Mathematical Physics Electronic Journal*, *Linear Algebra and Applications*, *Moscow Mathematical Journal*, *Funkcional'nyi analiz i ego Prilozheniya*, *AMS Contemporary Mathematics* proceedings series.

Translator, *Turbulence: The Legacy of A.N. Kolmogorov*, by U. Frisch, Cambridge, CUP, 1995 (Russian translation: Moscow, Phasis, 1998)

Translator and scientific editor, *Numerical Toolbox for Verified Computing I: Basic Numerical Problems*, by R. Hammer, M. Hocks, U. Kulisch, D. Ratz, Berlin etc, Springer, 1993 (Russian translation: Izhevsk, RCD, 2005)

## Principal publications

1. K. Khanin, A. Sobolevski, On Dynamics of Lagrangian Trajectories for Hamilton–Jacobi Equations, *Archive for Rational Mechanics and Analysis*, 2015, 1–25 (to appear), [arXiv:1211.7084](https://arxiv.org/abs/1211.7084).
2. J. Delon, J. Salomon, and A. Sobolevskii. Fast transport optimization for Monge costs on the circle. *SIAM J. Appl. Math.*, **70**(7):2239–2258, 2010.
3. K. Khanin, D. Khmelev, and A. Sobolevskii. On velocities of Lagrangian minimizers. *Moscow Math. J.*, **5**:157–169, 2005.
4. 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.
5. 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.
6. 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); *Sbornik Math.*, **190**(10):1487-1504 (in English).

## All 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); *Doklady Math.*, **56**(2):707–709, 1997 (in English).
- [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); *Sbornik Math.*, **190**(10):1487-1504 (in English).
- [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, 2005, 161–179.
- [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. *J. Math. Sciences*, **133**:1539–1542, 2006.
- [17] A. Kurnosov and A. N. Sobolevski. A variational approach to the reconstruction of galactic peculiar velocities. *Moscow University Physics Bulletin*, **62**(3):147–150, 2007. Original Russian publication in *Vestnik Moskovskogo Universiteta, Ser. 3 Fizika i Astronomiya*, No. 3, 2007, p. 18-21.
- [18] A. N. Sobolevski, A. A. Andrievsky, and S. N. Gurbatov. Ballistic aggregation in symmetric and nonsymmetric flows. *J. Exper. and Theor. Physics*, **104**(6):885–894, 2007. Original Russian publication in *Zhurnal Exper. Teor. Fiziki*, **131**(6):1018–1029, 2007. See also preliminary version at [arXiv.org:nlin.PS/0601006](http://arXiv.org:nlin.PS/0601006)
- [19] A. N. Sobolevskii. Convex analysis, tropical algebra, and processing of astronomical data. In: *Mathematical Forum*, vol. 2: Studies in Convex Analysis. V. M. Tikhomirov, ed. Vladikavkaz, 2009. P. 230–233 (in Russian).
- [20] R. Mohayaee and A. Sobolevskii. The Monge–Ampère–Kantorovich approach to reconstruction in cosmology. *Physica D*, **237**(14–17):2145–2150, 2008. See also [arxiv:0712.2561](http://arxiv.org:0712.2561)
- [21] J. Delon, J. Salomon, and A. Sobolevskii. Fast transport optimization for Monge costs on the circle. *SIAM J. Appl. Math.*, **70**(7):2239–2258, 2010. See also [arxiv:0902.3527](http://arxiv.org:0902.3527)
- [22] J. Delon, J. Salomon, A. Sobolevski. Local matching indicators for concave transport costs. *C. R. Acad. Sci. Paris Sér. I Math.*, **348**:901-905, 2010. See also [arxiv:0912.0179](http://arxiv.org:0912.0179).
- [23] G. Litvinov, V. P. Maslov, A. Sobolevski, and A Ya. Rodionov. Universal Algorithms, Mathematics of Semirings and Parallel Computations. In: *Coping with Complexity: Model Reduction and Data Analysis*. Lecture Notes in Computational Science and Engineering, Vol. 75, 2011, pp. 63–89.

- [24] K. Khanin and A. Sobolevski. Particle dynamics inside shocks in Hamilton–Jacobi equations. Theme issue “Turbulent mixing and beyond.” *Phil. Trans. R. Soc. A*, **368**(1916):1579–1593, 2010. See also [arxiv:1001.0498](https://arxiv.org/abs/1001.0498)
- [25] K. Khanin, S. Nechaev, G. Oshanin, A. Sobolevski, and O. Vasilyev. Ballistic deposition patterns beneath a growing Kardar–Parisi–Zhang interface. *Phys. Rev. E* **82**:061107 (2010). See also [arXiv:1006.4576](https://arxiv.org/abs/1006.4576)
- [26] J. Delon, J. Salomon, A. Sobolevski, Minimum-weight matching for non-intrinsic distances on the line, *J. Mathematical Sciences*, 2012, DOI [10.1007/s10958-012-0714-6](https://doi.org/10.1007/s10958-012-0714-6). See also: idem, *Zapiski nauchnykh seminarov POMI* **390** (2011) 52-68 (in English) and [arXiv:1102.1558](https://arxiv.org/abs/1102.1558)
- [27] J. Delon, J. Salomon, A. Sobolevski Local matching indicators for concave transport costs. *SIAM J. Discrete Math.* **26** (2012) 801-827, DOI [10.1137/110823304](https://doi.org/10.1137/110823304); see also [arXiv:1102.1795](https://arxiv.org/abs/1102.1795).
- [28] M. Novaga, E. Stepanov, and A. Sobolevski, Droplet condensation and isoperimetric towers, *Pacific J. Math.*, 262:2 (2012) 457-480; see also [CVGMT preprint](#).
- [29] G. L. Litvinov, A. Y. Rodionov, S. N. Sergeev, A. N. Sobolevski, Universal algorithms for solving the matrix Bellman equations over semirings, *Soft Computing*, **17**:10 (2013) 1767–1785
- [30] S. Nechaev, A. Sobolevski, and O. Valba, Planar diagrams from optimization for concave potentials. *Phys. Rev. E* **87** (2013) 012102 (9 стр.), [arXiv:1203.3248](https://arxiv.org/abs/1203.3248).
- [31] K. Khanin, A. Sobolevski, On Dynamics of Lagrangian Trajectories for Hamilton–Jacobi Equations, *Archive for Rational Mechanics and Analysis* **219** (2016) 112-125, [arXiv:1211.7084](https://arxiv.org/abs/1211.7084).