Alexander G. Abanov

Curriculum Vitae

Department of Physics & Astronomy
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Education and Academic Employment:

	Weizmann Institute of Science, *Rehovot, Israel.*
Spring, 2023	Rosi and Max Varon Visiting Professor
	Galileo Galilei Institute and INFN, *Florence, Italy.*
Fall, 2022	GGI Visiting Scientist
	Stony Brook University, *Stony Brook, NY.*
2016 – pres.	Professor, theoretical Condensed Matter Physics
2012 – 2022	Deputy Director, Simons Center for Geometry and Physics
2006 – 2015	Associate Professor, theoretical Condensed Matter Physics
2000 – 2006	Assistant Professor, theoretical Condensed Matter Physics
	Massachusetts Institute of Technology, *Cambridge, MA.*
1998 – 2000	Postdoctoral fellow, theoretical Condensed Matter Physics
	James Franck Institute, University of Chicago, *Chicago, IL.*
1997 – 1998	Postdoctoral fellow, theoretical Condensed Matter Physics
	University of Chicago, *Chicago, IL.*
1992 – 1997	Ph.D. in Theoretical Physics.
	Landau Institute for Theoretical Physics, *Chernogolovka, Russia.*
1990 – 1992	Graduate Research Assistant. Research in theoretical physics.
	Moscow Institute of Physics and Technology, *Moscow, Russia.*
1984 – 1990	M.S. in physics with Honorary Diploma.

Research Experience:

Research on strongly correlated electronic systems: hydrodynamic approach to correlated systems, collective theory of Calogero-Sutherland models, phase slips in disordered superconducting wires, quantum anomalies, topological terms in the effective actions induced by fermions, Quantum Hall Effect, topological phasers of matter, high temperature superconductivity, multifractal properties of exactly solvable models (Hofstadter problem), quasi-one-dimensional magnets, applications of quantum geometry.

Ph.D. from the University of Chicago. Thesis:

"Interference effects in strongly correlated electronic systems."

Teaching Experience:

Undergraduate courses: "Introductory: Classical Physics A", "Electromagnetic theory I–II". Graduate courses: "Methods of Mathematical physics", "Classical Mechanics", "Statistical Mechanics","Quantum Mechanics I,II" "Solid State Physics II (Many body theory)","Quantum magnetism", "Graduate Seminar (Atomic, Molecular, Optical and Solid State)", "Topological terms in condensed matter physics". The courses on Quantum magnetism and on topological terms in condensed matter physics were original courses for advanced graduate students interested in working in theoretical condensed matter physics. Series of lectures on topological terms in non-linear sigma-models for graduate students and researchers at MIT and at EPFL, Lausanne, and RIKEN, Japan. The advanced one-semester graduate class on topological terms in condensed matter physics. Invited lectures at international schools and workshops. Undegraduate recitations, etc. Teaching physics and mathematics to high school students, Krasnoyarsk, Russia.

Awards:

	Weizmann Institute of Sciencel
2023	Rosi and Max Varon Visiting Professorship, Spring, 2023
2016	**APS Fellow**
	Journal of Physics A: Mathematical and Theoretical
2010	Best Paper Prize 2010
	Department of Physics and Astronomy, Stony Brook University
2006	Outstanding Teacher Award
2004	**Award of NSF CAREER Grant (400K, 5 years)**
2002	**Award of James H. Simons Fellowship**
2001	**Award of Alfred P. Sloan Fellowship**
	University of Chicago
1997	First prize in 2nd annual James Franck Institute Symposium.
1996	Sixth annual Nathan Sugarman award for excellence in research.
1996	Award of Hulda B. Rothschild Fellowship.
1993	Valentine Telegdi prize for the best performance in the Candidacy Examination.
	Moscow Institute of Physics and Technology
1984-1990	University Award for outstanding academic achievements.
	high school, Krasnoyarsk
1982-1984	The member of Soviet Union team on the International Olympiad in Physics (1984). First Prize Winner at the All-USSR Olympiad in Physics, other national awards from Russia.

Alexander G. Abanov
Publications

80. Abanov, A.G., Candelori, L., Steinacker, H.C., Wells, M.T., Busemeyer, J.R., Hogan, C.J., Kirakosyan, V., Marzari, N., Pinnamaneni, S., Villani, D., Xu, M., Musaelian, K.,
arXiv:2507.21135 (2025)
Quantum Geometry of Data.

79. Di Caro, G., Kirakosyan, V., Abanov, A.G., Busemeyer, J.R., Candelori, L., Hartmann, N., Lam, E.T., Musaelian, K., Samson, R., Steinacker, H., Villani, D., Wells, M.T., Wenstrup, R.J., Xu, M.,
arXiv:2506.03199 (2025)
Quantum Cognition Machine Learning for Forecasting Chromosomal Instability.

78. Abanov, A.G. and Gangardt, D.M., SciPost Physics, **18**, 122 (2025)
Emptiness Instanton in Quantum Polytropic Gas.

77. Cardoso, G., Stéphan, J.M. and Abanov, A.G., J. Phys. A: Math. Theor. **58**, 245002 (2025)
The density profile of a Coulomb plasma on a cylinder: boundary oscillations.

76. Cardoso, G., Yeh, H.C., Korneev, L., Abanov, A.G. and Mitra, A., Phys. Rev. B, **111**, 125162 (2025)
Gapless Floquet topology.

75. Candelori, L., Abanov, A.G., Berger, J., Hogan, C.J., Kirakosyan, V., Musaelian, K., Samson, R., Smith, J.E., Villani, D., Wells, M.T. and Xu, M., Scientific reports, **15**, 6933 (2025)
Robust estimation of the intrinsic dimension of data sets with quantum cognition machine learning.

74. A. G. Abanov and A. Cappelli, J. High Energ. Phys. 2024, 57 (2024)
Hydrodynamics, anomaly inflow and bosonic effective field theory.

73. J. S. Pallister, S. H. Pickering, D. M. Gangardt, and A. G. Abanov, Phys. Rev. Res., **7**, L022008 (2025)
Phase transitions in full counting statistics of free fermions and directed polymers.

72. H-C. Yeh, G. Cardoso, L. Korneev, D. Sels, A. G. Abanov, A. Mitra, Phys. Rev. **B** 108, 165143 (2023)
Slowly decaying zero mode in a weakly non-integrable boundary impurity model.

71. A Abanov, B Doyon, J Dubail, A Kamenev, and H Spohn, J. Phys. A: Math. Theor. **56** 370201 (2023)
Hydrodynamics of low-dimensional quantum systems.

70. A. G. Abanov and P. B. Wiegmann, J. Phys. A: Math. Theor. **55** 414001 (2022)
Anomalies in fluid dynamics: flows in a chiral background via variational principle.

69. J. S. Pallister, D. M. Gangardt, and A. G. Abanov, J. Phys. A: Math. Theor. **55**, 304001 (2022)
Limit shape phase transitions: a merger of arctic circles.

68. P. B. Wiegmann and A. G. Abanov, J. High Energ. Phys. 2022, **38** (2022)
Chiral anomaly in Euler fluid and Beltrami flow.

67. A. G. Abanov and P. B. Wiegmann, Phys. Rev. Lett. **128**, 054501 (2022)
Axial-Current Anomaly in Euler Fluids.

66. Gustavo M. Monteiro, Alexander G. Abanov, Sriram Ganeshan, arXiv:2105.01655 (2021)
Hamiltonian structure of 2D fluid dynamics with broken parity.

65. Daniel J. Yates, Alexander G. Abanov, and Aditi Mitra, Commun. Phys. **5**, 43 (2022)
Long-lived period-doubled edge modes of interacting and disorder-free Floquet spin chains.

64. L. A. Korneev, D. E. Kharzeev, and A. G. Abanov, Physics of Fluids **33**, 083110 (2021)
Chiral propulsion: The method of effective boundary conditions.

63. G. Cardoso, J.-M. Stéphan, A. G. Abanov, J. Phys. A: Math. Theor. **54**, 015002 (2021)
The boundary density profile of a Coulomb droplet. Freezing at the edge.

62. D. J. Yates, A. G. Abanov, A. Mitra, Phys. Rev. B **102**, 195419 (2020)
Dynamics of almost strong edge modes in spin chains away from integrability.

61. D. J. Yates, A. G. Abanov, A. Mitra, Phys. Rev. Lett. **124**, 206803 (2020)
Lifetime of almost strong edge-mode operators in one dimensional, interacting, symmetry protected topological phases.

60. A. G. Abanov, Nature Physics, v. **15**, i. 11, 1109-1110 (2019)
Model oddity.

59. A. G. Abanov, T. Can, S. Ganeshan, G. M. Monteiro, arXiv:1907.11196 (2019)
Hydrodynamics of two-dimensional compressible fluid with broken parity: variational principle and free surface dynamics in the absence of dissipation.

58. A. G. Abanov, G. M. Monteiro, Phys. Rev. Lett. **122**, 154501 (2019)
Free surface variational principle for an incompressible fluid with odd viscosity.

57. A. G. Abanov, T. Can, S. Ganeshan, SciPost Phys. **5**, 010 (2018)
Odd surface waves in two-dimensional incompressible fluids.

56. A. G. Abanov, in "Topology and Condensed matter physics", Eds. S. M. Bhattacharjee, Mahan Mj, and A. Bandyopadhyay, (Springer, New York, 2017).
Topology, geometry and quantum interference in condensed matter physics.

55. S. Ganeshan and A. G. Abanov, Phys. Rev. Fluids **2**, 094101 (2017)
Odd viscosity in two-dimensional incompressible fluids.

54. D. Banerjee, A. Souslov, A. G. Abanov, V. Vitelli, Nature Communications **8**, 1573 (2017)
Odd viscosity in chiral active fluids.

53. G. M. Monteiro, A. G. Abanov, and D. E. Kharzeev, Phys. Rev. B **92**, 165109 (2015)
Magnetotransport in Dirac metals: chiral magnetic effect and quantum oscillations.

52. A. Gromov, K. Jensen, and A. G. Abanov, arXiv.org/cond-mat/arXiv:1506.07171 (2015)
Boundary effective action for quantum Hall states.

51. A. Gromov, G. Y. Cho, Y. You, A. G. Abanov, and E. Fradkin, Phys. Rev. Lett. **114**, 016805 (2015) Erratum: Phys. Rev. Lett. **114**, 149902 (2015)
Framing Anomaly in the Effective Theory of the Fractional Quantum Hall Effect.

50. G. M. Monteiro, A. G. Abanov, and V. P. Nair, Phys. D **91**, 125033 (2015)
Hydrodynamics with gauge anomaly: Variational principle and Hamiltonian formulation.

49. A. Gromov and A. G. Abanov, Phys. Rev. Lett. **114**, 016802 (2015)
Thermal Hall Effect and Geometry with Torsion.

48. A. Gromov and A. G. Abanov, Phys. Rev. Lett. **113**, 266802 (2014)
Density-curvature response and gravitational anomaly.

47. A. G. Abanov and A. Gromov, Phys. Rev. B **90**, 014435 (2014)
Electromagnetic and gravitational responses of two-dimensional non-interacting electrons in background magnetic field.

46. P. Wiegmann and A. G. Abanov, Phys. Rev. Lett. **113**, 034501 (2014).
Anomalous Hydrodynamics of Two-Dimensional Vortex Fluid.

45. D. A. Ivanov and A. G. Abanov, J. Phys. A: Math. Theor. **47**, 015001 (2014).
Fisher-Hartwig expansion for the transverse correlation function in the XX spin-1/2 chain.

44. D. A. Ivanov and A. G. Abanov, J. Phys. A: Math. Theor. **46**, 375005 (2013).
Fisher-Hartwig expansion for Toeplitz determinants and the spectrum of a single-particle reduced density matrix for one-dimensional free fermions.

43. A. G. Abanov, J. Phys. A: Math. Theor. **46**, 292001 (2013).
On the effective hydrodynamics of the fractional quantum Hall effect.

42. S. Ganeshan, A. G. Abanov, and D. V. Averin, Phys. Rev. B **86**, 235309 (2012).
Fractional quantum Hall interferometers in strong tunneling regime: The role of compactness of edge fields.

41. M. Kulkarni and A. G. Abanov, Phys. Rev. A **86**, 033614 (2012).
Hydrodynamics of cold atomic gases in the limit of weak nonlinearity, dispersion, and dissipation.

40. D. A. Ivanov and A. G. Abanov, Phys. Rev. E **87**, 022114 (2013).
Characterizing correlations with full counting statistics: classical Ising and quantum XY spin chains.

39. D. A. Ivanov, A. G. Abanov and V. V. Cheianov, J. Phys. A: Math. Theor. **46**, 085003 (2013).
Counting free fermions on a line: a Fisher-Hartwig asymptotic expansion for the Toeplitz determinant in the double-scaling limit.

38. A. G. Abanov, D. A. Ivanov, and Y. Qian, J. Phys. A: Math. Theor. **44**, 485001 (2011).

Quantum fluctuations of one-dimensional free fermions and Fisher-Hartwig formula for Toeplitz determinants.

37. A. G. Abanov, A. Gromov, and M. Kulkarni, J. Phys. A: Math. Theor. **44**, 295203 (2011).
Soliton solutions of Calogero model in harmonic potential.

36. J. Joseph, J. Thomas, M. Kulkarni, and A. G. Abanov, Phys. Rev. Lett. **106**, 150401 (2011).
Observation of shock waves in a strongly interacting Fermi gas.

35. M. Kulkarni and A. G. Abanov, Nucl. Phys. **B 846** [FS], 122136 (2011).
Cold Fermi gas with inverse square interaction in a harmonic trap.

34. D. A. Ivanov and A. G. Abanov, Europhys. Lett. **92**, 37008 (2010).
Phase transitions in full counting statistics for periodic pumping.

33. M. Kulkarni, F. Franchini, and A. G. Abanov, Phys. Rev. B **80**, 165105 (2009).
Nonlinear dynamics of spin and charge in spin-Calogero model.

32. A. G. Abanov, and D. Ivanov, Phys. Rev. B **79**, 205315 (2009).
Factorization of quantum charge transport for noninteracting fermions.

31. A. G. Abanov, E. Bettelheim, and P. Wiegmann, J. Phys. A: Math. Theor. **42**, 135201 (2009).
Integrable hydrodynamics of Calogero-Sutherland model: bidirectional Benjamin-Ono equation.

30. E. Bettelheim, A. G. Abanov, and P. Wiegmann, J. Phys. A: Math. Theor. **41**, 392003 (2008).
Quantum hydrodynamics and nonlinear differential equations for degenerate Fermi gas.

29. A. G. Abanov, and D. Ivanov, Phys. Rev. Lett. **100**, 086602 (2008).
Allowed Charge Transfers between Coherent Conductors Driven by a Time-Dependent Scatterer.

28. E. Bettelheim, A. G. Abanov, and P. Wiegmann, Phys. Rev. Lett. **97**, 246402 (2006).
Orthogonality catastrophe and shock waves in a non-equilibrium Fermi gas.

27. E. Bettelheim, A. G. Abanov, and P. Wiegmann, Phys. Rev. Lett. **97**, 246401 (2006).
Nonlinear Quantum Shock Waves in Fractional Quantum Hall Edge States.

26. O. A. Starykh, A. V. Chubukov, and A. G. Abanov, Phys. Rev. B **74**, 180403(R), (2006)
Flat spin-wave dispersion in a triangular antiferromagnet.

25. E. Bettelheim, A. G. Abanov, and P. Wiegmann, J. Phys. A: :Math. Theor. **40**, F193-F207 (2007).
Nonlinear dynamics of quantum systems and soliton theory.

24. A. G. Abanov and P. B. Wiegmann, Phys. Rev. Lett **95**, 076402 (2005)
Quantum Hydrodynamics, the Quantum Benjamin-Ono equation, and the Calogero Model.

23. A. G. Abanov in Application of random matrices in physics, Brezin, E.; Kazakov, V.; Serban, D.; Wiegmann, P.; Zabrodin, A. (Eds.) NATO Science Series II: Mathematics, Physics and Chemistry, Vol. 221 Springer

Hydrodynamics of correlated systems and spacing distribution in Random Matrices.

22. F. Franchini and A. G. Abanov, J. Phys. A: Math. Gen. **38**, 5069-5095 (2005)
Emptiness Formation Probability for the Anisotropic XY model in a Magnetic Field.
J. Phys. A: Math. Gen. **39**, 14533-14534 (2006). *Corrigendum.*

21. R. Requist, J. Schliemann, A. G. Abanov, D. Loss, Phys. Rev. B, **71**, 115315 (2005)
Double Occupancy Errors in Quantum Computing Operations: Corrections to Adiabaticity.

20. A. G. Abanov and M. Braverman, Comm. Math. Phys. **259**, 287-305 (2005)
Topological Calculation of the Phase of the Determinant of a Non Self-Adjoint Elliptic Operator.

19. P. B. Allen and A. G. Abanov, R. Requist, Phys. Rev. A **71**, 043203 (2005)
Quantum Electrical Dipole in Triangular Systems: a Model for Spontaneous Polarity in Metal Clusters.

18. A. G. Abanov and F. Franchini, Phys. Lett. A **316**, 342-349 (2003)
Emptiness Formation Probability for the Anisotropic XY model in a Magnetic Field.

17. O. Tchernyshyov, O. A. Starykh, R. Moessner, and A. G. Abanov, Phys. Rev. B **68**, 144422 (2003)
Bond order from disorder in the planar pyrochlore magnet.

16. Y. Lin, E. E. Mendez, and A. G. Abanov, Phys. Rev. B, **66**, 195311 (2002)
Tunneling Characteristics of an Electron-Hole Trilayer in a Parallel Magnetic Field.

15. A. G. Abanov and V. E. Korepin, Nucl. Phys. **B647** [FS], 565-580 (2002)
On the probability of ferromagnetic strings in antiferromagnetic spin chains.

14. A. G. Abanov and Ar. Abanov, Phys. Rev. B, **65**, 184407 (2002)
Berry phase for ferromagnet with fractional spin.

13. A. G. Abanov and P. B. Wiegmann, JHEP **10** (2001) 30
On the correspondence between fermionic number and statistics of solitons.

12. A. G. Abanov and P. B. Wiegmann, Phys. Rev. Lett. **86**, 1319-1322 (2001)
Chiral Nonlinear σ Models as Models for Topological Superconductivity.

11. A. G. Abanov, Phys. Lett. **B492**, 321-323 (2000)
Hopf term induced by fermions.

10. A. G. Abanov and P. B. Wiegmann, Nucl. Phys. **B570**, 685-698 (2000)
Theta-terms in non-linear sigma-models.

9. A. G. Abanov, J. C. Talstra, and P. B. Wiegmann, Nucl. Phys. **B525** [FS], 571-596 (1998)
Hierarchical structure of Azbel-Hofstadter problem: Strings and loose ends of the Bethe Ansatz.

8. A. G. Abanov, J. C. Talstra, and P. B. Wiegmann, Phys. Rev. Lett., **81**, 2112 (1998)
Asymptotically exact solutions of Harper equation.

7. A. G. Abanov and P. B. Wiegmann, Phys. Rev. B **57**, pp. 8532-8548 (1998)
Tunneling in the Topological Mechanism of Superconductivity.

6. A. G. Abanov and J. C. Talstra, Phys. Rev. B **55**, No 20, 13361-13364 (1997)
Period doubling in the two-dimensional antiferromagnet: Gauge fields and their anomalies.

5. A. G. Abanov and P. B. Wiegmann, Phys. Rev. Lett. **78**, 4103-4106 (1997)
Tunneling and orthogonality catastrophe in the topological mechanisms of superconductivity.

4. A. G. Abanov and O. A. Petrenko, Phys. Rev. B **50**, No 9, 6271 (1994)
Enhancement of Anisotropy Due to Fluctuations in Quasi-One-Dimensional Antiferromagnets.

3. A. G. Abanov, Sov. Phys. JETP **74**, No 6, 1036 (1992)
Phase Transitions in Dimer Systems.

2. A. G. Abanov, M. G. Polonskaia, E. Smirnova, AMSE Transactions, Scientific Siberian, Series A: Exact & Natural Sci., vol.**1** Ecology, pp.162-187 (1991)
Correlations between Physiological Parameters and Pathological Process.

1. A. G. Abanov and D. V. Khveshchenko, Mod. Phys. Lett. **B4**, No 10, 689 (1990)
On Calculation of Energy of Planar Lattice Fermions in a Magnetic Field.