Sergey Syzranov

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Research Interests

- Spin liquids, spin glasses, geometrically frustrated magnets
- Physics of disordered systems. Localisation-delocalisation transitions
- Topological semimetals and semiconductors.
  Graphene, Dirac and Weyl semimetals
- Quantum chaos. Dynamics of quantum information in dissipative environments

Academic history

- July 2024– present, Associate Professor
  Physics Department, University of California at Santa Cruz
- October 2017– June 2024, Assistant Professor
  Physics Department, University of California at Santa Cruz
- September 2016– September 2017, Research Associate
  Joint Quantum Institute, University of Maryland, USA
- October 2013– August 2016, Research Associate
  University of Colorado at Boulder, USA
- October 2011– September 2013, Research Associate
  (Wissenschaftlicher Mitarbeiter), Karlsruhe Institute of Technology, Germany
- September 2007 – September 2011, PhD student
  (supervised by Prof. K.B. Efetov)
  Ruhr-Universität Bochum, Germany

Education

Ruhr-Universität Bochum, Germany

PhD (Hons) in Theoretical Physics, May 2011
Thesis: “Transport in low-dimensional mesoscopic systems”
Advisor: **Prof. K.B. Efetov**

Moscow Institute of Physics and Technology (State University)

- **M.Sc.** (Hons) in Applied Physics and Mathematics, 8 June 2007
  Thesis: “Effect of noise on Berry phases in multi-level systems”
  Advisor: Dr. Yu. Makhlin

- **B.Sc.** (Hons) in Applied Physics and Mathematics, 23 June 2005
  Thesis: "Dephasing of Josephson qubits close to optimal points"
  Advisor: Dr. Yu. Makhlin

Professional service and outreach

- July-August 2023, 2024, 2026 instructor at COSMOS summer school for high-school students; co-designed and gave, with another instructor, a lecture course on "Quantum Information Science and Engineering", designed students' research projects
- 2021-present, Mentor for Cal-Bridge Programme aimed to increase the number of PhD students from groups traditionally underrepresented in physics and to prepare them for graduate school
- Referee for the journals Phys. Rev. A, B, X and Lett., New Journal of Physics, Nature Communications, Annals of Physics, J. Low Temp. Phys., npj Quantum Materials (~ 10 assignments per year), National Science Foundation (NSF), Department of Energy (DoE)

Selected courses taught

Graduate statistical physics (every year since 2018), graduate classical mechanics and thermal physics (2020-2023, 2025), introductory undergraduate electricity and magnetism (2023, 2024), advanced quantum mechanics (2021, 2026), graduate condensed matter physics (2018, 2019)

Selected publications

- Phillip Popp, Arthur P. Ramirez, Sergey Syzranov
  "Origin of the hidden energy scale and the f-ratio
  in geometrically frustrated magnets"
  Phys. Rev. Lett. **134**, 226701 (2025)
- Arthur P. Ramirez, Sergey Syzranov
  "Short-range order and hidden energy scale
  in geometrically frustrated magnets"
  Mater. Adv. **6**, 1213-1229 (2025)
- S.V. Syzranov, A.P. Ramirez
  "Eminuscent phase in frustrated magnets: a challenge to quantum spin liquids"
  Nature Communications **13**, 2993 (2022)
  Popular highlight: UC Santa Cruz Magazine
- Victor Galitski, Mehdi Kargarian, Sergey Syzranov
  "Dynamo Effect and Turbulence in Hydrodynamic Weyl Metals"
  Phys. Rev. Lett. **121**, 176603 (2018) , "Editor's suggestion"
  Popular highlights: Physics World , Science News , Physics magazine , Phys.org , Russia Today (in Spanish), JQI Maryland

- S.V. Syzranov, L. Radzihovsky
"High-Dimensional Disorder-Driven Phenomena in Weyl Semimetals, Semiconductors and Related Systems"
Ann. Rev. Cond. Mat. Phys. **9**, 35 (2018)

- S.V. Syzranov, L. Radzihovsky, V. Gurarie,
"Critical transport in weakly disordered semiconductors and semimetals",
Phys. Rev. Lett. **114**, 166601 (2015)

Full list of publications

Journal articles:

1 Siyu Zhu, Arthur P. Ramirez, Sergey Syzranov
"Low-temperature entropies and possible states in geometrically frustrated magnets"
arXiv:2511.02899

2 Muhammad Sedik, Siyu Zhu, Sergey Syzranov
"Specific-heat anomaly in frustrated magnets with vacancy defects"
arXiv:2506.17392

3 Arthur P. Ramirez, Sergey Syzranov
"Short-range order and hidden energy scale in geometrically frustrated magnets"
Mater. Adv. **6**, 1213-1229 (2025)

4 Phillip Popp, Arthur P. Ramirez, Sergey Syzranov
"Origin of the hidden energy scale and the f-ratio in geometrically frustrated magnets"
Phys. Rev. Lett. **134**, 226701 (2025)

5 Muhammad Sedik, Shijun Sun, Arthur P. Ramirez, Sergey Syzranov
"Quasispins of vacancy defects and their interactions in disordered antiferromagnets"
Phys. Rev. B **111**, 214427 (2025)

6 Shijun Sun, Arthur P. Ramirez, Sergey Syzranov
"Quasispins of vacancy defects in Ising chains with nearest- and next-to-nearest-neighbour interactions"
Phys. Rev. B **108**, 174436 (2023)

7 Siyu Zhu, Sergey Syzranov
"BCS-like disorder-driven instabilities and ultraviolet effects in nodal-line semimetals"
Ann. Phys. **459**, 169501 (2023)

8 Dmitry K. Efimkin, Sergey Syzranov
"Weyl excitations and arc surface states via
helicon-phonon mixing in conducting materials"
Phys. Rev. B **108**, L161411 (2023)

9 Y. Li, D. Phelan, F. Ye, H. Zheng, E. Krivyakina, A. Samarakoon, P.G. LaBarre, J. Neu, T. Siegrist, S. Rosenkranz, S.V. Syzranov, A.P. Ramirez
"The Geometrically Frustrated Spin Glass $(Fe_{1-p}Ga_p)_2TiO_5$"
arXiv:2207.06354 [under review in Phys. Rev. B (Letters)]

10 S.V. Syzranov
"Effect of vacancy defects on frustrated magnets and quantum spin liquids"
Phys. Rev. B **106**, L140202 (2022)

11 Siyu Zhu, Grigory Bednik, S.V. Syzranov
"Weyl hydrodynamics in a strong magnetic field"
Phys. Rev. B **105**, 125132 (2022)

12 S.V. Syzranov, A.P. Ramirez
"Eminuscent phase in frustrated magnets: a challenge to quantum spin liquids"
Nature Communications **13**, 2993 (2022)

13 Shijun Sun, Sergey Syzranov
"Equivalence of interacting semimetals and low-density many-body systems
to single-particle systems with quenched disorder"
Phys. Rev. B **108**, 195132 (2023)

14 Björn Sbierski, Sergey Syzranov
"Non-Anderson critical scaling of the Thouless conductance in 1D"
Ann. Phys. **418**, 168169 (2020)

15 P. G. LaBarre, D. Phelan, Y. Xin, F. Ye, T. Besara, T. Siegrist, S. V. Syzranov, S. Rosenkranz, A.P. Ramirez
"Fluctuation-Induced Interactions and the Spin Glass Transition in Fe_2TiO_5"
Phys. Rev. B **103**, L220404 (2021)

16 G. Bednik, K.S. Tikhonov, S.V. Syzranov
"Magnetotransport and internodal tunnelling in Weyl semimetals"
Phys. Rev. Research **2**, 023124 (2020)

17 S.V. Syzranov, V. Gurarie
"Duality between disordered nodal semimetals and systems with power-law hopping"
Phys. Rev. Research **1**, 032035(R) (2019)

18 Markus J. Klug, Sergey V. Syzranov
"Chaos and the dynamics of information in dissipative electronic systems"
Phys. Rev. B **100**, 094304 (2019)

19 S.V. Syzranov, Ya.I. Rodionov, B. Skinner
"Adiabatic dechiralisation and thermodynamics of Weyl semimetals"
Phys. Rev. B **98**, 081114(R) (2018)

20 Victor Galitski, Mehdi Kargarian, Sergey Syzranov
"Dynamo Effect and Turbulence in Hydrodynamic Weyl Metals"
Phys. Rev. Lett. **121**, 176603 (2018)

21 Paraj Titum, Victor L. Quito, Sergey V. Syzranov,
"Energy-level statistics in strongly disordered systems with power-law hopping",
Phys. Rev. B **98**, 014201 (2018)

22 S.V. Syzranov, A.V. Gorshkov, and V.M. Galitski,
"Interaction-induced transition in the quantum chaotic dynamics of
a disordered metal",
Ann. Phys. **405**, 1 (2019)

23 S.V. Syzranov, A.V. Gorshkov, V. Galitski
"Out-of-time-order correlators in finite open systems"
Phys. Rev. B **97**, 161114(R) (2018)

24 S.V. Syzranov, L. Radzihovsky
"High-Dimensional Disorder-Driven Phenomena in Weyl Semimetals,
Semiconductors and Related Systems"
Ann. Rev. Cond. Mat. Phys. **9**, 35 (2018)

25 S.V. Syzranov, B. Skinner
"Electron transport in nodal-line semimetals"
Phys. Rev. B **96**, 161105(R) (2017)

26 S.V. Syzranov, V. Gurarie, L. Radzihovsky
"Multifractality at non-Anderson disorder-driven transitions in Weyl semimetals
and other systems"
Ann. Phys. **373**, 694 (2016)

27 Sergey V. Syzranov, Michael Wall, Bihui Zhu, Victor Gurarie, Ana Maria Rey
"Emergent Weyl excitations in systems of polar particles",
Nature Comm. **7**, 13543 (2016)

28 S.V. Syzranov, P.M. Ostrovsky, V. Gurarie, L. Radzihovsky
"Critical exponents at the unconventional disorder-driven
transition in a Weyl semimetal",
Phys. Rev. B **93**, 155113 (2016)

29 M. Gärttner, S.V. Syzranov, A.M. Rey, V. Gurarie, L. Radzihovsky
"Disorder-driven transition in a chain with power-law hopping",
Phys. Rev. B **92**, 041406(R) (2015)

30 Ya.I. Rodionov and S.V. Syzranov
"Conductivity of a Weyl semimetal with donor and acceptor impurities"
Phys. Rev. B **91**, 195107 (2015)

31 S.V. Syzranov, V. Gurarie, L. Radzihovsky,
"Unconventional localisation transition in high dimensions",
Phys. Rev. B **91**, 035133 (2015)

32 M. Hoyer, M.S. Scheurer, S.V. Syzranov, J. Schmalian
"Pair-breaking due to orbital magnetism in iron-based superconductors"
Phys. Rev. B **91**, 054501 (2015)

33 Sergey V. Syzranov, Michael L. Wall, Victor Gurarie, Ana Maria Rey
"Spin-orbital dynamics in a system of polar molecules"
Nature Comm. **5**, 5391 (2014)

34 M. Hoyer, S.V. Syzranov, J. Schmalian,
"Effect of weak disorder on the phase competition in iron pnictides",
Phys. Rev. B **89**, 214504 (2014)

35 S.V. Syzranov, L. Radzihovsky, V. Gurarie,
"Critical transport in weakly disordered semiconductors and semimetals",
Phys. Rev. Lett. **114**, 166601 (2015)

36 S.V. Syzranov, Ya.I. Rodionov, K.I. Kugel, and F. Nori,
"Strongly anisotropic Dirac quasiparticles in irradiated graphene",
Phys. Rev. B **88**, 241112(R) (2013)

37 J. Zimmer, N. Vogt, A. Fiebig, S.V. Syzranov, A. Lukashenko,
R. Schäfer, H. Rotzinger, A. Shnirman, M. Marthaler, A.V. Ustinov,
"Thermally activated conductance in arrays of small Josephson junctions",
Phys. Rev. B **88**, 144506 (2013)

38 S.V. Syzranov, O.M. Yevtushenko, and K.B. Efetov,
"Fermionic and bosonic ac conductivities at strong disorder",
Phys. Rev. B. **86**, 241102(R) (2012)

39 S.V. Syzranov and J. Schmalian,
"Conductivity close to antiferromagnetic criticality",
Phys. Rev. Lett. **109**, 156403 (2012)

40 S.V. Syzranov, A. Moor, and K.B. Efetov,
"Strong quantum interference in strongly disordered bosonic insulators",
Phys. Rev. Lett. **108**, 256601 (2012)

41 S. Mai, S.V. Syzranov, and K.B. Efetov,
"Photocurrent in a visible-light graphene photodiode",
Phys. Rev. B. **83**, 033402 (2011)

42 S.V. Syzranov, I.L. Aleiner, B.L. Altshuler, and K.B. Efetov,
"Coulomb interaction and first order superconductor-insulator transition",
Phys. Rev. Lett. **105**, 137001 (2010)

43 M.V. Fistul, S.V. Syzranov, A.M. Kadigrobov, and K.B. Efetov,
"Radiation-induced quantum interference in low-dimensional n-p junctions",
Phys. Rev. B **82**, 121409(R) (2010)

44 S.V. Syzranov, K.B. Efetov, and B.L. Altshuler,
"dc Conductivity of an array of Josephson junctions in the insulating state",
Phys. Rev. Lett. **103**, 127001 (2009)

45 S.V. Syzranov and Yu. Makhlin,
"Geometric phase via adiabatic manipulations of the environment",
JETP Lett. **87**, 390 (2008) [Pis'ma v ZhETF 87, 453-457 (2008)]

46 S.V. Syzranov, M.V. Fistul, and K.B. Efetov,
"Effect of radiation on transport in graphene",
Phys. Rev. B **78**, 045407 (2008)

47 S.V. Syzranov and Yu. Makhlin
"Dephasing of Josephson qubits close to optimal points",
JETP Lett. **83**, 83-86 (2006) [Pis'ma v ZhETF 83, 93-96 (2006)]

Book chapters:

48 S.V. Syzranov and Yu.G. Makhlin,
"Geometric phases in open multi-level systems", in
"Electron Transport in Nanosystems", pp. 301-314,
eds. J. Bonca and S. Kruchinin (Springer, 2008)