

Sergey Syzranov

University of California
Physics Department
Santa Cruz, CA 95064

Phone: +1-831-459-2326
Webpage: syzranov.physics.ucsc.edu
Email: syzranov@ucsc.edu

Research Interests

- Physics of topological semimetals and semiconductors.
Graphene, Dirac and Weyl semimetals
- Spin liquids, spin glasses, geometrically frustrated magnets
- Physics of disordered systems. Localisation-delocalisation transitions
- Quantum chaos. Dynamics of quantum information in dissipative environments
- Disordered bosons. Superfluid-insulator transitions.
- Physics of ultracold particles in optical and magnetic traps

Academic history

- October 2017– present, 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

Teaching Experience

- Winter 2023: “Introduction to Physics III (Electricity and Magnetism)”, PHYS 5C, UCSC
- Spring 2018-2023: “Statistical Mechanics” PHYS 219, UCSC
- Autumn 2020-2023: “Classical Mechanics” PHYS 210, UCSC
- Winter 2022: “Quantum Mechanics II”, PHYS 139B, UCSC
- Winter 2020, 2021: “Mathematical Methods in Physics” PHYS 116B, UCSC
- Winter 2018, 2019: “Condensed Matter Physics” PHYS 232, UCSC
- Summer 2008- Summer 2013, Teaching Assistant
Statistical Physics I, II, and Quantum Mechanics I, Condensed Matter

Professional service and outreach

- July-August 2023, 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
- 2021-2022, 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 Phys. Rev. A, B, X and Lett., New Journal of Physics, Nature Communications, Annals of Physics, J. Low Temp. Phys., npj Quantum Materials (~ 12 assignments per year)
- 2001-2002, Physics and mathematics teacher at Distance Learning School at Moscow Institute of Physics and Technology
- August 2001-2004, co-organised Summer Schools on Ecology for high-school students, gave courses in Optics and Electricity, supervised research projects of high-school students

Honours and awards

- [NSF DMR-2218130](#), “Collaborative Research: Frustration, glassiness and spin liquids: from dirty to pristine materials”
- Fellowship of the Hellman Foundation, 2019-2020
- Feodor-Lynen Research Fellowship of the Alexander von Humboldt Foundation, 2014-2015

Languages

English, German, Russian

Selected publications

- 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 \(2018\)](#)
- Sergey V. Syzranov, Michael Wall, Bihui Zhu, Victor Gurarie, Ana Maria Rey
“Emergent Weyl excitations in systems of polar particles”,
[Nature Comm. 7, 13543 \(2016\)](#)
- 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 Shijun Sun, Arthur P. Ramirez, Sergey Syzranov
“Quasispins of vacancy defects in Ising chains with nearest- and next-to-nearest-neighbour interactions”
[arXiv:2308.01959](#) (under review in Phys. Rev. B)
- 2 Siyu Zhu, Sergey Syzranov
“BCS-like disorder-driven instabilities and ultraviolet effects in nodal-line semimetals”
[arXiv:2305.00990](#) (under review in Ann. Phys.)
- 3 Dmitry K. Efimkin, Sergey Syzranov
“Weyl excitations and arc surface states via helicon-phonon mixing in conducting materials”
[arXiv:2212.08213](#) [under review in Phys. Rev. B (Letters)]

- 4 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)]
- 5 S.V. Syzranov
“Effect of vacancy defects on frustrated magnets and quantum spin liquids”
[Phys. Rev. B **106**, L1402020 \(2022\)](#)
- 6 Siyu Zhu, Grigory Bednik, S.V. Syzranov
“Weyl hydrodynamics in a strong magnetic field”
[Phys. Rev. B **105**, 125132 \(2022\)](#)
- 7 S.V. Syzranov, A.P. Ramirez
“Eminuscent phase in frustrated magnets: a challenge to quantum spin liquids”
[Nature Communications **13**, 2993 \(2022\)](#)
- 8 Shijun Sun, Sergey Syzranov
“Equivalence of interacting semimetals and low-density many-body systems to single-particle systems with quenched disorder”
[arXiv:2104.02720](#) [under review in Phys. Rev. B (Letters)]
- 9 Björn Sbierski, Sergey Syzranov
“Non-Anderson critical scaling of the Thouless conductance in 1D”
[Ann. Phys. **418**, 168169 \(2020\)](#)
- 10 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 \(2021\)](#)
- 11 G. Bednik, K.S. Tikhonov, S.V. Syzranov
“Magnetotransport and internodal tunnelling in Weyl semimetals”
[Phys. Rev. Research **2**, 023124 \(2020\)](#)
- 12 S.V. Syzranov, V. Gurarie
“Duality between disordered nodal semimetals and systems with power-law hopping”
[Phys. Rev. Research **1**, 032035\(R\) \(2019\)](#)
- 13 Markus J. Klug, Sergey V. Syzranov
“Chaos and the dynamics of information in dissipative electronic systems”
[Phys. Rev. B **100**, 094304 \(2019\)](#)
- 14 S.V. Syzranov, Ya.I. Rodionov, B. Skinner
“Adiabatic dechiralisation and thermodynamics of Weyl semimetals”
[Phys. Rev. B **98**, 081114\(R\) \(2018\)](#)

- 15 Victor Galitski, Mehdi Kargarian, Sergey Syzranov
“Dynamo Effect and Turbulence in Hydrodynamic Weyl Metals”
[Phys. Rev. Lett. **121**, 176603 \(2018\)](#)
- 16 Paraj Titum, Victor L. Quito, Sergey V. Syzranov,
“Energy-level statistics in strongly disordered systems with power-law hopping”,
[Phys. Rev. B **98**, 014201 \(2018\)](#)
- 17 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 \(2019\)](#)
- 18 S.V. Syzranov, A.V. Gorshkov, V. Galitski
“Out-of-time-order correlators in finite open systems”
[Phys. Rev. B **97**, 161114\(R\) \(2018\)](#)
- 19 S.V. Syzranov, L. Radzihovsky
“High-Dimensional Disorder-Driven Phenomena in Weyl Semimetals,
Semiconductors and Related Systems”
[Ann. Rev. Cond. Mat. Phys. **9**, 35 \(2018\)](#)
- 20 S.V. Syzranov, B. Skinner
“Electron transport in nodal-line semimetals”
[Phys. Rev. B **96**, 161105\(R\) \(2017\)](#)
- 21 S.V. Syzranov, V. Gurarie, L. Radzihovsky
“Multifractality at non-Anderson disorder-driven transitions in Weyl semimetals
and other systems”
[Ann. Phys. **373**, 694 \(2016\)](#)
- 22 Sergey V. Syzranov, Michael Wall, Bihui Zhu, Victor Gurarie, Ana Maria Rey
“Emergent Weyl excitations in systems of polar particles”,
[Nature Comm. **7**, 13543 \(2016\)](#)
- 23 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 \(2016\)](#)
- 24 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\(R\) \(2015\)](#)
- 25 Ya.I. Rodionov and S.V. Syzranov
“Conductivity of a Weyl semimetal with donor and acceptor impurities”
[Phys. Rev. B **91**, 195107 \(2015\)](#)

- 26 S.V. Syzranov, V. Gurarie, L. Radzihovsky,
“Unconventional localisation transition in high dimensions”,
[Phys. Rev. B **91**, 035133 \(2015\)](#)
- 27 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 \(2015\)](#)
- 28 Sergey V. Syzranov, Michael L. Wall, Victor Gurarie, Ana Maria Rey
“Spin-orbital dynamics in a system of polar molecules”
[Nature Comm. **5**, 5391 \(2014\)](#)
- 29 M. Hoyer, S.V. Syzranov, J. Schmalian,
“Effect of weak disorder on the phase competition in iron pnictides”,
[Phys. Rev. B **89**, 214504 \(2014\)](#)
- 30 S.V. Syzranov, L. Radzihovsky, V. Gurarie,
“Critical transport in weakly disordered semiconductors and semimetals”,
[Phys. Rev. Lett. **114**, 166601 \(2015\)](#)
- 31 S.V. Syzranov, Ya.I. Rodionov, K.I. Kugel, and F. Nori,
“Strongly anisotropic Dirac quasiparticles in irradiated graphene”,
[Phys. Rev. B **88**, 241112\(R\) \(2013\)](#)
- 32 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 \(2013\)](#)
- 33 S.V. Syzranov, O.M. Yevtushenko, and K.B. Efetov,
“Fermionic and bosonic ac conductivities at strong disorder”,
[Phys. Rev. B. **86**, 241102\(R\) \(2012\)](#)
- 34 S.V. Syzranov and J. Schmalian,
“Conductivity close to antiferromagnetic criticality”,
[Phys. Rev. Lett. **109**, 156403 \(2012\)](#)
- 35 S.V. Syzranov, A. Moor, and K.B. Efetov,
“Strong quantum interference in strongly disordered bosonic insulators”,
[Phys. Rev. Lett. **108**, 256601 \(2012\)](#)
- 36 S. Mai, S.V. Syzranov, and K.B. Efetov,
“Photocurrent in a visible-light graphene photodiode”,
[Phys. Rev. B. **83**, 033402 \(2011\)](#)
- 37 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 \(2010\)](#)

- 38 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\(R\) \(2010\)](#)
- 39 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 \(2009\)](#)
- 40 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)]
- 41 S.V. Syzranov, M.V. Fistul, and K.B. Efetov,
“Effect of radiation on transport in graphene”,
[Phys. Rev. B **78**, 045407 \(2008\)](#)
- 42 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:

- 43 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)

Recent talks

- “Effect of quenched disorder on quantum spin liquids”, invited talk
Conference “Landau Week 2023”, Yerevan, Armenia, 24 June 2023
- “Ultraviolet universalities in nodal semimetals and quantum gases”, invited talk
Conference “Localisation 2022”, Sapporo, Japan, 26 August 2022
- “Hidden energy scale in geometrically frustrated magnets”,
APS March Meeting, Chicago, 16 March 2022
- “Ultraviolet phase transitions in nodal semimetals and systems of ultracold
atoms”, virtual talk, Condensed Matter Seminar at the University of California
San Diego, 19 January 2022
- “Hidden energy scale in frustrated magnets”, UCSC colloquium,
14 October 2021
- “Interacting systems equivalent to non-interacting disordered models”, virtual
talk at workshop “Ergodicity Breaking and Anomalous Transport in Quantum
Many-Body Systems”, Dresden, 8 October 2021

- “Weyl Hydrodynamics”, Aspen Summer Programme on electron hydrodynamics and quantum chaos, 27 August 2021
- “Hydrodynamics in Dirty Weyl Semimetals in Magnetic Fields”, invited talk APS March Meeting, 16 March 2021
- “Non-Anderson Disorder-Driven Transitions in Nodal Semimetals and Systems with Long-Range Hopping”, invited talk online conference “Localisation 2020”, 29 August 2020