

TIGRAN KALAYDZHIAN

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PERSONAL

Born on 23 September 1987 in Yerevan, Armenia (USSR)
Citizenship of Russian Federation. U.S. permanent resident.

RESEARCH INTERESTS

- Tests of fundamental physics in space, dark matter detection with atomic clocks
- Theory of gravitational wave detection, Astrophysics, Cosmology
- Relativistic hydrodynamics, Quark-Gluon Plasma, Lattice QCD, Nuclear Theory, QCD phase diagram
- AdS/CFT-correspondence, String Theory, nonperturbative methods in Quantum Field Theory

EDUCATION

- 2010 - 2013 Ph.D. studies at the University of Hamburg, Germany. Degree of Doctor of Natural Sciences, with honors. Thesis: "Quark-gluon plasma in strong magnetic fields".
- 2004 - 2010 Lomonosov Moscow State University. Diploma in Theoretical Physics, with honors. (GPA: 4.0/4.0, *Summa cum laude*) Department of Physics. Chair of Quantum Statistics and Field Theory. Thesis: "Black hole creation in three-dimensional anti-de Sitter space".

RESEARCH EXPERIENCE

- 2016 - pres Postdoctoral associate at Jet Propulsion Laboratory, California Institute of Technology.
- 2015 - 2016 Postdoctoral associate in Theoretical Nuclear Physics, University of Illinois at Chicago, U.S.A.
- 2013 - 2015 Postdoctoral associate in the Nuclear Theory Group, Stony Brook University, NY, U.S.A.
- 2010 - 2013 Scientific fellow of the String Theory Group. Forschungszentrum DESY-Hamburg, Germany.
- 2009 - 2012 Research assistant in the ITEP Lattice Group, Moscow, Russia.
- 2007 - 2009 Student assistant at the Steklov Mathematical Institute. Russian Academy of Sciences.
- 2007 - 2009 Summer research intern. Forschungszentrum DESY-Hamburg, Germany.
- 2005 - 2006 Student assistant at the Lomonosov Moscow State University, Moscow, Russia.

RESEARCH VISITS AND INVITED SEMINAR TALKS

- 2017 University of Nevada, Reno, NV, U.S.A. (invited colloquium) Host: Andrei Derevianko.
- 2017 TAPIR, California Institute of Technology, U.S.A. (talk) Host: Jonathan Squire.
- 2017 University of Tours, Tours, France. (with talk) Host: Maxim Chernodub.
- 2017 Arizona State University, Mesa, AZ, U.S.A. (with talk) Hosts: Kohei Kamada, Igor Shovkovy.
- 2017 Forschungszentrum DESY, Hamburg, Germany. (with talk) Host: Kai Schmidt-Hoberg.
- 2017 University of Chicago, Chicago, IL, U.S.A. (with talk) Host: Henry Frisch.
- 2017 Northwestern University, Evanston, IL, U.S.A. (with talk) Host: Michael Schmitt.
- 2016 Stony Brook University. Stony Brook, NY, U.S.A. (with talk) Host: Edward Shuryak.
- 2016 California Institute of Technology. Pasadena, CA, U.S.A. Host: Dmitry Duev.
- 2015 Brookhaven National Laboratory. Upton, NY, U.S.A. (with talk) Host: Soeren Schlichting.
- 2015 DESY Theory Group. Germany. (with talk) Host: Volker Schomerus.
- 2014 MIT. Cambridge, MA, U.S.A. (with talk) Host: Krishna Rajagopal.
- 2014 Brookhaven National Laboratory. Upton, NY, U.S.A. (with talk) Host: Shu Lin.

2014 McGill University. Montreal, Canada. (with 2 talks) Host: Sangyong Jeon.
 2014 University of Utrecht. Netherlands. (with talk) Host: Umut Gürsoy.
 2014 Institute for Theoretical Physics Madrid. Spain. (with talk) Host: Karl Landsteiner.
 2014 DESY Theory Group. Germany. (with talk) Host: Volker Schomerus.
 2014 University of Regensburg. Germany. (with talk) Host: Pavel Buividovich.
 2013 Ghent University. Belgium. Host: Henri Verschelde.
 2012 Princeton University. U.S.A. (with talk) Host: Igor Klebanov.
 2012 University of Minnesota. U.S.A. (with talk) Host: Mikhail Shifman.
 2012 Stony Brook University. U.S.A. (with talk) Host: Dmitri Kharzeev.
 2012 Brookhaven National Laboratory. U.S.A. (with talk) Host: Robert Pisarski.
 2012 Goethe University Frankfurt. Germany. (with talk) Host: Owe Philipsen.
 2012 Technical University Munich. Germany. (with talk) Host: Norbert Kaiser.
 2012 MPI for Physics. Munich, Germany. (with talk) Host: Johanna Erdmenger.
 2012 University of Regensburg. Germany. (with talk) Host: Andreas Schäfer.
 2012 University of Giessen. Germany. (with talk) Host: Christian Fischer.
 2012 Ghent University. Belgium. (with talk) Host: Henri Verschelde.
 2011 ITEP Lattice Group. Moscow, Russia. (with talk) Host: Mikhail Polikarpov.
 2011 Ghent University. Belgium. (with talk) Host: Henri Verschelde.
 2007-09 DESY Theory group. Host: Volker Schomerus.

CONFERENCE PRESENTATIONS

1. Dark matter searches with atomic clocks in space (NASA JPL, Postdoc poster workshop, 2017)
2. Searching for dark matter with atomic clocks in space (ACES Workshop, UZH, Zurich, Switzerland, 2017)
3. Testing gravity on accelerators (CPT and Lorentz symmetry, Indiana University, Bloomington, USA, 2016)
4. Topological defects and anomalous transport (2016 QCD workshop on Chirality in HIC, UCLA, CA, USA)
5. Testing gravity on accelerators (2015 Midwest Relativity Meeting, Northwestern University, IL, USA)
6. Collective flow in high-multiplicity proton-proton collisions (Quark Matter 2015, Kobe, Japan)
7. Collective flow in high-multiplicity proton-proton collisions (18th MWTGT, Argonne National Laboratory)
8. QCD string interactions and implications for high energy collisions ("Gauge Field Topology: From Lattice Simulations and Solvable Models to Experiment", Simons Center for Geometry and Physics, NY, USA)
9. Testing gravity on accelerators (KSM2015, FIAS, Frankfurt, Germany)
10. Topological defects and anomalous transport (Schladming, Austria, 2015)
11. Chiral Superfluidity for QCD (QUARKS 2014, Suzdal, Russia)
12. Chiral superfluidity in Quantum Chromodynamics (Quark Matter 2014, Darmstadt, Germany)
13. Applications of the chiral superfluidity to QCD (SCGP, Simons Center 2014, Stony Brook, USA)
14. QCD in strong magnetic fields (PIF 2013, Hamburg, Germany)
15. Chiral superfluidity of the quark-gluon plasma (PIF 2013, Hamburg, Germany)
16. Magnetic catalysis in an expanding quark-gluon plasma and on the lattice (HMCCSB 2012, Dublin)
17. Topological and magnetic properties of QCD vacuum probed by overlap fermions (Confinement 2012, Munich)
18. Chiral Superfluidity for the Heavy-Ion Collisions (Confinement 2012, Munich)
19. Chiral Superfluidity for the Heavy-Ion Collisions (DESY Theory Workshop, Hamburg 2012)
20. Chiral superfluidity of the quark-gluon plasma (SEWM 2012, Swansea University, UK)
21. Chiral superfluidity of the quark-gluon plasma (RETUNE 2012, Uni Heidelberg)
22. Quark-Gluon Plasma: from Superstrings to Supercomputers (SFB Block Meeting, Uni Hamburg 2012)
23. Local CP-violation in quark-gluon plasma: a holographic study (DESY Theory Workshop, Hamburg 2011)

24. Local CP-violation in quark-gluon plasma: a lattice study (DESY Theory Workshop, Hamburg 2011)
25. Fluid/gravity model for the chiral magnetic effect (ICTP, Trieste 2011)
26. Fluid/gravity model for the Chiral Magnetic Effect (Humboldt-Universität, Berlin 2011)
27. Conductivity and Superconductivity of the vacuum of Lattice Gluodynamics at Strong Magnetic Fields (15th Lomonosov Conference on Elementary Particle Physics, Moscow 2011)
28. Strong magnetic fields in lattice gluodynamics (St. Goar, Germany 2011)
29. CME and chiral symmetry breaking in SU(3) quenched lattice gauge theory (Workshop "Chiral magnetic effect and QCD with magnetic fields from the lattice", Universität Regensburg, 2010)
30. Holographic Chiral Magnetic Effect (Workshop "Chiral magnetic effect and QCD with magnetic fields from the lattice", Universität Regensburg, 2010)
31. Properties of the QCD Vacuum Induced by Strong Magnetic Field (DESY Theory Workshop, Hamburg 2010)
32. The Chiral Magnetic Effect and symmetry breaking in SU(3) quenched theory (Lattice 2010, Villasimius)
33. Quark-gluon plasma at Strong Magnetic Fields (FAIR-Russia research centre, Moscow, Russia 2011)
34. Strong magnetic fields in lattice QCD ("Bogoliubov Readings", Dubna, Russia 2010)
35. Gluodynamics in the strong magnetic field (Extreme QCD 2010, Bad Honnef, Germany 2010)
36. Insulator-conductor transition induced by magnetic field in lattice gauge theory (Confinement 2010, Madrid)
37. Quark mass dependence of Chiral Magnetic Effect in SU(2) gluodynamics (Confinement 2010, Madrid)
38. Magnetic Field Induced Conductivity of the Vacuum of Gluodynamics (BNL, Brookhaven 2010)
39. Black hole creation in three-dimensional anti-de Sitter space (Lomonosov Conference, MSU, Moscow 2009)

PEDAGOGICAL LECTURES AND SEMINARS (since 2010 only)

1. Dark matter searches with atomic clocks in space (NASA JPL, Postdoc seminar series)
2. Dark matter searches with atomic clocks and atom interferometers (NASA JPL, Section 332J)
3. Low-frequency gravitational wave searches with satellite Doppler shift measurements (UIC, 2016)
4. Gravitational wave report (University of Illinois at Chicago, 2016)
5. Testing gravity on accelerators (University of Illinois at Chicago, 2015)
6. Testing antimatter gravity (CFEL, DESY-Hamburg, Germany, 2015)
7. Superfluidity in quantum field theory (Stony Brook University, NY, 2015)
8. Collective interaction of QCD strings (Stony Brook University, NY, 2014)
9. Chiral superfluidity in QCD (Simons Center for Geometry and Physics, NY, 2014)
10. Holographic fluids and superfluids (Simons Center for Geometry and Physics, NY, 2014)
11. Holographic inverse magnetic catalysis (Stony Brook University, NY, 2013)
12. Copenhagen vacuum structure and fermions (Stony Brook University, NY, 2013)
13. Testing Planck-Scale Gravity at DESY (DESY, Hamburg 2013)
14. Monopoles and Domain Walls (DESY, Hamburg 2013)
15. Lax representation and monodromy matrix (DESY, Hamburg 2013)
16. Critical exponents: QFT methods for Statistical Physics (DESY, Hamburg 2013)
17. Axial anomaly (DESY, Hamburg 2012)
18. Dual superconductivity as the nature of quark confinement (DESY, Hamburg 2012)
19. Convex and non-convex potentials (DESY, Hamburg 2011)
20. Holographic Thermalization (DESY, Hamburg 2011)
21. Brief overview of the Lattice QCD topics and techniques (DESY, Hamburg 2010)
22. GRID computing for the Lattice QCD (ITEP Lattice Group, Moscow 2010)

JOURNAL PUBLICATIONS AND PREPRINTS (cumulative citations: 632)

1. **“Searching for stochastic background of ultra-light fields with atomic sensors”**
T. Kalaydzhyan and N. Yu, arXiv:1801.07577 [astro-ph.CO].
2. **“Extracting dark matter signatures from atomic clock stability measurements”**
T. Kalaydzhyan and N. Yu, **Phys. Rev. D** 96 (2017) 075007.
3. **“Thermal chiral vortical and magnetic waves: new excitation modes in chiral fluids”**
T. Kalaydzhyan, E. Murchikova, **Nucl. Phys. B** 919 (2017) 173.
4. **Comment on “Testing Planck-scale gravity with accelerators”**
T. Kalaydzhyan, **Phys. Rev. Lett.** 116, 209001 (2016).
5. **“Gravitational mass of positron from LEP synchrotron losses”**
T. Kalaydzhyan, **Sci. Rep.** 6, 30461 (2016) [Nature Publishing Group]
6. **“Gravitational mass of relativistic matter and antimatter”**
T. Kalaydzhyan, **Phys. Lett. B** 751 (2015) 29.
7. **“Testing general relativity on accelerators”**
T. Kalaydzhyan, **Phys. Lett. B** 750 (2015) 112.
8. **“Collective flow in high-multiplicity proton-proton collisions”**
T. Kalaydzhyan and E. Shuryak, **Phys. Rev. C** 91 (2015) 054913.
9. **“Gravity waves generated by sounds from Big Bang phase transitions”**
T. Kalaydzhyan and E. Shuryak, **Phys. Rev. D** 91 (2015) 083502.
10. **“Explosive regime should dominate collisions of ultra-high energy cosmic rays”**,
T. Kalaydzhyan and E. Shuryak, arXiv:1407.3270 [hep-ph].
11. **“Collective interaction of QCD strings and early stages of high multiplicity pA collisions”**
T. Kalaydzhyan and E. Shuryak, **Phys. Rev. C** 90 (2014) 014901.
12. **“On the temperature dependence of the chiral vortical effects”**
T. Kalaydzhyan, **Phys. Rev. D** 89 (2014) 105012
13. **“Self-interacting QCD strings and string balls”**
T. Kalaydzhyan and E. Shuryak, **Phys. Rev. D** 90 (2014) 025031.
14. **“Fermion zero modes in a chromomagnetic vortex lattice”**
M. N. Chernodub, T. Kalaydzhyan, J. Van Doorselaere, H. Verschelde, **Phys. Rev. D** 89 (2014) 065021
15. **“Constraining the primordial power spectrum from SNIa lensing dispersion”**
I. Ben-Dayan and T. Kalaydzhyan, **Phys. Rev. D** 90 (2014) 083509.
16. **“On chromoelectric (super)conductivity of the Yang-Mills vacuum”**
M. N. Chernodub, T. Kalaydzhyan, J. Van Doorselaere, H. Verschelde, **Phys. Lett. B** 730 (2014) 63
17. **“Chiral superfluidity of the quark-gluon plasma”**,
T. Kalaydzhyan. **Nucl. Phys. A** 913 (2013) 243.
18. **“Anisotropic hydrodynamics, holography and the chiral magnetic effect”**
I. Gahramanov, T. Kalaydzhyan and I. Kirsch. **Phys. Rev. D** 85, 126013 (2012).
19. **“Fractal dimension of the topological charge density distribution in SU(2) lattice gluodynamics”**
P. V. Buividovich, T. Kalaydzhyan, M. I. Polikarpov. **Phys. Rev. D** 86, 074511 (2012).
20. **“Fluid-gravity model for the chiral magnetic effect”**
T. Kalaydzhyan, I. Kirsch. **Phys. Rev. Lett.** 106, 211601 (2011).
21. **“The Chiral Magnetic Effect and chiral symmetry breaking in SU(3) quenched lattice gauge theory”**
V. Braguta, P. Buividovich, T. Kalaydzhyan, S. Kuznetsov, M. Polikarpov. **Phys. Atom. Nucl.** 75, 488.
22. **“Non-equilibrium physics at a holographic chiral phase transition”**
N. Evans, T. Kalaydzhyan, K. -y. Kim, I. Kirsch. **JHEP** 1101, 050 (2011).
23. **“Holographic dual of a boost-invariant plasma with chemical potential”**
T. Kalaydzhyan, I. Kirsch. **JHEP** 1102, 053 (2011).

24. **“Magnetic-Field-Induced insulator-conductor transition in SU(2) quenched lattice gauge theory”**
P. V. Buividovich, M. N. Chernodub, D. E. Kharzeev, T. Kalaydzhyan, E. V. Luschevskaya, M. I. Polikarpov.
Phys. Rev. Lett. 105, 132001 (2010).

CONFERENCE PUBLICATIONS

1. **“Testing gravity on accelerators”**
T. Kalaydzhyan, arXiv:1608.07458, Proceedings of CPT’16, Bloomington, Indiana, USA.
2. **“Testing general relativity on accelerators”**
T. Kalaydzhyan, Proceedings of KSM2015 conference, Frankfurt, Germany.
3. **“Chiral Superfluidity for QCD”**
T. Kalaydzhyan, arXiv:1412.0536, Proceedings of QUARKS-2014 conference, Suzdal, Russia.
4. **“Why is the radial flow in central pA collisions stronger than in AA?”**
T. Kalaydzhyan, E. Shuryak, **Nucl. Phys. A** 931 (2014) 899.
5. **“Chiral Superfluidity for the Heavy Ion Collisions”**
T. Kalaydzhyan, **PoS CONFINEMENT X**, 302 (2013).
6. **“Chiral magnetic effect and holography”**
T. Kalaydzhyan, I. Kirsch, **PoS CONFINEMENT X**, 262 (2013).
7. **“Topological and magnetic properties of the QCD vacuum probed by overlap fermions”**
V. Braguta, P. Buividovich, T. Kalaydzhyan, M.I. Polikarpov, **PoS CONFINEMENT X**, 085 (2013).
8. **“Magnetic-field-induced insulator-conductor transition in quenched lattice gauge theory”**
P. V. Buividovich, M. N. Chernodub, T. Kalaydzhyan, D. E. Kharzeev, E. V. Luschevskaya, M. I. Polikarpov.
PoS LATTICE2010, 076 (2010).
9. **“The Chiral Magnetic Effect and chiral symmetry breaking in SU(3) quenched lattice gauge theory”**
V. V. Braguta, P. V. Buividovich, T. Kalaydzhyan, S. V. Kuznetsov, M. I. Polikarpov.
PoS LATTICE2010, 190 (2010), arXiv:1011.3795 [hep-lat].
10. **“Conductivity of SU(2) gluodynamics vacuum induced by magnetic field”**
M. I. Polikarpov, O. V. Larina, P. V. Buividovich, M. N. Chernodub, T. K. Kalaydzhyan, D. E. Kharzeev,
E. V. Luschevskaya. **AIP Conf. Proc.** 1343, 630-631 (2011).

PROGRAMMING, ENGINEERING, DATA ANALYSIS

- 2005 - pres. Programming in Python, C/C++, Perl, Matlab, Mathematica for theoretical physics research. Additional knowledge of Assembler, Basic, Fortran, Pascal, PHP, HTML, Maple.
- 2016 - pres. Physical modeling and simulations for the NASA Cold Atom Laboratory mission.
- 2016 - pres. Analysis of the MEX and VEX spacecraft Doppler residuals to establish upper limits on the gravitational wave spectra in the region of frequencies $10^{-7} - 10^{-2}$ Hz.
- 2015 Analysis of the HERA, Tevatron, LHC and LEP accelerators data and design to establish limits on possible deviations of the antimatter gravity from the general relativity predictions.
- 2015 Analysis of the CMS detector charged particle transverse spectra in various multiplicity bins to establish the onset of the quark-gluon plasma production in 7 TeV proton-proton collisions
- 2014 - 2015 Using stochastic Monte Carlo algorithms, protein folding algorithms and molecular dynamics for various applications to phenomenology of nuclear collisions. Stony Brook University.
- 2010 - 2013 Using and developing various algorithms for solving nonlinear ODEs and PDEs for numerical relativity and supergravity. DESY-Hamburg, Germany. (see in papers).
- 2009 - 2012 Multi-core/grid computing, Monte Carlo simulations, data analysis for the lattice quantum chromodynamics. Using stochastic methods (Heat bath, Metropolis, Cabibbo-Marinari, overrelaxation, etc), Krylov subspace methods (Arnoldi, Lanczos, GMRES, BiCGSTAB, etc), use of various mathematical libraries (BLAS, LAPACK, ARPACK, GSL, etc.). ITEP-Moscow.
- 2010 Developing packages for the parallel lattice QCD calculations at International Lattice Data Grid.
- 2005 - 2006 Circuit design for medical electronics, Assembler programming. Lasertek Ltd, Moscow, Russia.
- 2005 - 2006 Developing fast algorithms for adaptive laser optics. Use of Zernike polynomials and decompositional approach to matrix computations. Moscow State University, Russia.

SERVICE FOR COMMUNITY

- 2012 - pres. Journal referee for Physical Review Letters, Physical Review D, Physical Review E, Physics Letters B, Annals of Physics and Journal of High-Energy Physics.
- 2015 - pres. Member of various postdoc organizations, providing legal information for immigration purposes.
- 2015 - 2016 Serving as host for visiting Physics Seminar speakers. University of Illinois at Chicago.
- 2016 Faculty judge at the Student Research Forum. University of Illinois at Chicago.
- 2015 - 2016 Panelist at U.S. NSF GRFP (Graduate Research Fellowship Program).
- 2015 Reviewer for the postdoc applications at RF Flanders (FWO), Belgium.
- 2012 - 2013 Organization and supervision of the "DESY PhD seminars on Theoretical Physics".
- 2012 Supervision of a Summer Student (Jasdeep Bains) at DESY-Hamburg.
- 2010 - 2013 DESY Theory Group system administrator.
- 2004 - 2009 Organizer of the Russian National Physics Olympiad at the state stage (lecturing, consultation, examination, appeal etc.)

ACADEMIC HONORS, GRANTS AND AWARDS

- 2016 U.S. Permanent Residence granted on the basis of extraordinary ability in High-Energy and Nuclear Theory.
- 2015 Schwarzschild-Springer prize honorable mention.
- 2014 The best young Russian scientist, according to the "Russkij Pereplet" rating.
- 2014 Prize for the best PhD thesis. VFFD, DESY-Hamburg, Germany. \$2000.
- 2014 "Best PhD defence" prize. University of Hamburg, Germany. \$700.
- 2009, 2010 Personal grants of the ITEP Research-and-Educational Center. Russia. \$5000.
- 2009 Personal grant of the "Foundation for Fundamental Physics Support". Russia. \$1000.
- 2009 Lomonosov Scholarship for outstanding undergraduate students. \$1200.
- 2009, 2010 Personal grant of the "Dynasty Foundation". Russia. \$2500.
- 2006 Winner of the Term Paper Competition. MSU, Faculty of Physics.
- 2004 Winner of the Moscow State Physics Olympiad.
- 2004 Winner of the Russian Federal Agency for Nuclear Power Olympiad (Physics and Mathematics)
- 2004 Winner of the Moscow Research Projects Competition (Programming)
- 2003 Winner of the Saveliev Physics Olympiad, of the Kurchatov Physics Olympiad and of the Russian National Mathematics Olympiad (up to III stage including)

OTHER INTERESTS AND HOBBIES

- Languages:** Russian (native), English (fluent), German (fluent), French (basic), Armenian (basic).
- Sports:** Karate (brown belt, 1 kyu, Japan Karate Association, past: assistant instructor at the JKA Hu Shin Kai dojo, Chicago, IL, USA), tennis, football, ping-pong.
- Hobbies:** Electrical engineering, programming, biological sciences, social Latin dances, playing music (piano, duduk, darbuka, vargan), poetry writing, Middle Eastern languages and culture, philosophy, immigration law, stock market investing, stock options trading.