

Dr. Tigran Kalaydzhyan

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PROFESSIONAL EXPERIENCE

Adjunct Physics Professor at Abilene Christian University and Cisco College. Sep. 2020 – now

Teaching Mathematical Physics in Spring 2021 at Abilene Christian University, Department of Engineering and Physics. Taught university and college mechanics in Fall 2020 at Cisco College, Abilene Campus.

Quantitative Analyst at A.R.T. Advisors LLC, New York. Jan. 2019 – Apr. 2020

Created and implemented new mid- and low-frequency statistical arbitrage strategies for a \$5B stock portfolio (including idea generation, research, data acquisition, backtesting, and writing production code for live trading), achieving Sharpe 2 marginal P&L. Responsible for maintaining and improving 30% of the fund's preexisting forecasts in production. Developed various parts of trading and simulation infrastructure. Experience with traditional datasets (e.g., Reuters Fundamentals, Factset) and alternative data.

Research Associate at NASA-JPL, California Institute of Technology. Oct. 2016 – Oct. 2018

Developed simulation software for NASA fundamental physics programs on board the International Space Station. Played a role of consultant and lead theorist for various space missions. Sole contributions include: (a) Theory of relativistic clock desynchronization for systems of communicating clocks subject to gravitational forces, data analysis for the ACES atomic clock mission, tests of gravity and dark matter searches; (b) Simulation of atomic clouds and Bose-Einstein Condensates in a magnetic trap created in the NASA Cold Atom Laboratory (currently in space).

Research Associate in Theoretical Nuclear Physics, University of Illinois at Chicago. Sep. 2015 – Oct. 2016

Research Associate in Theoretical Nuclear Physics, Stony Brook University. Sep. 2013 – Aug. 2015

Developed a set of theoretical hydrodynamic methods predicting properties of quark-gluon plasma in heavy-ion collisions, cosmic rays and the early universe. Multiple awards granted on the basis of extraordinary ability in the field. Selected contributions include: (a) Discovery of hydrodynamic properties of high-multiplicity collision states of two protons at LHC. Monte-Carlo protein-folding codes, and molecular dynamics codes for solving many-body problems; (b) Exact solutions of hydrodynamic equations in presence of electromagnetic fields, rotation and quantum anomalies (in- and out-of-equilibrium).

Scientific fellow of the String Theory Group. DESY-Hamburg, Germany. May 2010 – Aug. 2013

Developed a set of theoretical methods, connecting dynamics of classical fields and strings in high-dimensional curved spaces with real-life properties of quark matter in accelerator experiments. Wrote numerical solvers for time-dependent nonlinear ODEs and PDEs (general relativity, supergravity and string theory).

Research fellow of the ITEP Lattice Group, Moscow, Russia. Aug. 2009 – Jul. 2012

Wrote a high-performance Monte-Carlo package for lattice QCD. The code predicted electromagnetic and topological properties of quark matter at high temperatures and in strong magnetic fields. Developed a set of algorithms for the international GRID computing system.

EDUCATION

- 2017 Coursera.org certificate in Deep Learning, License# HAW4JL726QV9
- 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".

TECHNICAL SKILLS

Analysis of experimental and simulated data. Statistical and spectral methods. Knowledge of C, C++ (98, 11, 14), Python, Perl, Matlab, Mathematica, Maple, Fortran, x86/ARM assembly. Object-oriented software design, low latency programming, version control (git), system programming, databases (SQL), static and dynamic testing. Leading researcher with 34 papers in top journals, 750+ citations, 100+ talks.

RESEARCH PUBLICATIONS

- **T. Kalaydzhyan**, N. Yu, "Searching for stochastic background of ultra-light fields with atomic sensors", Universe 2018, 4(10), 99.
- **T. Kalaydzhyan**, N. Yu, "Extracting dark matter signatures from atomic clock stability measurements", Phys. Rev. D 96 (2017) 075007.
- **T. Kalaydzhyan**, E. Murchikova, "Thermal chiral vortical and magnetic waves: new excitation modes in chiral fluids", Nucl. Phys. B 919 (2017) 173.
- **T. Kalaydzhyan**, "Comment on Testing Planck-scale gravity with accelerators", Phys. Rev. Lett. 116, 209001 (2016).
- **T. Kalaydzhyan**, "Gravitational mass of positron from LEP synchrotron losses", Sci. Rep. 6, 30461 (2016) [Nature Publishing Group].
- **T. Kalaydzhyan**, "Gravitational mass of relativistic matter and antimatter", Phys. Lett. B 751 (2015) 29.
- **T. Kalaydzhyan**, "Testing general relativity on accelerators", Phys. Lett. B 750 (2015) 112.
- **T. Kalaydzhyan**, E. Shuryak, "Collective flow in high-multiplicity proton-proton collisions", Phys. Rev. C 91 (2015) 054913.
- **T. Kalaydzhyan**, E. Shuryak, "Gravity waves generated by sounds from Big Bang phase transitions", Phys. Rev. D 91 (2015) 083502.
- **T. Kalaydzhyan**, E. Shuryak, "Explosive regime should dominate collisions of ultra-high energy cosmic rays", arXiv:1407.3270 [hep-ph].
- **T. Kalaydzhyan**, E. Shuryak, "Collective interaction of QCD strings and early stages of high multiplicity pA collisions", Phys. Rev. C 90 (2014) 014901.
- **T. Kalaydzhyan**, "On the temperature dependence of the chiral vortical effects", Phys. Rev. D 89 (2014) 105012
- **T. Kalaydzhyan**, E. Shuryak, "Self-interacting QCD strings and string balls", Phys. Rev. D 90 (2014) 025031.
- M. N. Chernodub, **T. Kalaydzhyan**, J. Van Doorselaere, H. Verschelde, "Fermion zero modes in a chromomagnetic vortex lattice", Phys. Rev. D 89 (2014) 065021
- Id. Ben-Dayan, **T. Kalaydzhyan**, "Constraining the primordial power spectrum from SNIa lensing dispersion", Phys. Rev. D 90 (2014) 083509.
- M.N. Chernodub, **T. Kalaydzhyan**, J. Van Doorselaere, H. Verschelde, "On chromoelectric (super)conductivity of the Yang-Mills vacuum", Phys. Lett. B 730 (2014) 63
- **T. Kalaydzhyan**, "Chiral superfluidity of the quark-gluon plasma", Nucl. Phys. A 913 (2013) 243.

- Il. Gahramanov, **T. Kalaydzhyan**, I. Kirsch, “Anisotropic hydrodynamics, holography and the chiral magnetic effect”, Phys. Rev. D 85, 126013 (2012).
- P. V. Buividovich, **T. Kalaydzhyan**, M. I. Polikarpov, “Fractal dimension of the topological charge density distribution in $SU(2)$ lattice gluodynamics”, Phys. Rev. D 86, 074511 (2012).
- **T. Kalaydzhyan**, I. Kirsch, “Fluid-gravity model for the chiral magnetic effect”, Phys. Rev. Lett. 106, 211601 (2011).
- V. Braguta, P. Buividovich, **T. Kalaydzhyan**, S. Kuznetsov, M. Polikarpov, “The Chiral Magnetic Effect and chiral symmetry breaking in $SU(3)$ quenched lattice gauge theory”, Phys. Atom. Nucl. 75, 488.
- N. Evans, **T. Kalaydzhyan**, K. -y. Kim, I. Kirsch, “Non-equilibrium physics at a holographic chiral phase transition”, JHEP 1101, 050 (2011).
- **T. Kalaydzhyan**, I. Kirsch, “Holographic dual of a boost-invariant plasma with chemical potential”, JHEP 1102, 053 (2011).
- P. V. Buividovich, M. N. Chernodub, D. E. Kharzeev, **T. Kalaydzhyan**, E. V. Luschevskaya, M. I. Polikarpov, “Magnetic-Field-Induced insulator-conductor transition in $SU(2)$ quenched lattice gauge theory”, Phys. Rev. Lett. 105, 132001 (2010).
- **T. Kalaydzhyan**, “Testing gravity on accelerators”, Proceedings of CPT'16, Bloomington, Indiana, USA.
- **T. Kalaydzhyan**, “Testing general relativity on accelerators”, Proceedings of KSM2015 conference, Frankfurt, Germany.
- **T. Kalaydzhyan**, “Chiral Superfluidity for QCD”, Proceedings of QUARKS-2014 conference, Suzdal, Russia.
- **T. Kalaydzhyan**, E. Shuryak, “Why is the radial flow in central pA collisions stronger than in AA?”, Nucl. Phys. A 931 (2014) 899.
- **T. Kalaydzhyan**, “Chiral Superfluidity for the Heavy Ion Collisions”, PoS CONFINEMENT X, 302 (2013).
- **T. Kalaydzhyan**, I. Kirsch, “Chiral magnetic effect and holography”, PoS CONFINEMENT X, 262 (2013).
- V. Braguta, P. Buividovich, **T. Kalaydzhyan**, M.I. Polikarpov, “Topological and magnetic properties of the QCD vacuum probed by overlap fermions”, PoS CONFINEMENT X, 085 (2013).
- P. V. Buividovich, M. N. Chernodub, **T. Kalaydzhyan**, D. E. Kharzeev, E. V. Luschevskaya, M. I. Polikarpov, “Magnetic-field-induced insulator-conductor transition in quenched lattice gauge theory”, PoS LATTICE2010, 076 (2010).
- V. V. Braguta, P. V. Buividovich, **T. Kalaydzhyan**, S. V. Kuznetsov, M. I. Polikarpov, “The Chiral Magnetic Effect and chiral symmetry breaking in $SU(3)$ quenched lattice gauge theory”, PoS LATTICE2010, 190 (2010).
- M. I. Polikarpov et al., “Conductivity of $SU(2)$ gluodynamics vacuum induced by magnetic field”, AIP Conf. Proc. 1343, 630-631 (2011).

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)
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)
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, Moscow 2009)

RESEARCH VISITS AND INVITED SEMINAR TALKS

- 2020 McMurry University, Physics Department, Abilene, TX, U.S.A. (talk) Host: Tikhon Bykov.
- 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 Gursoy.
- 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 Schafer.
- 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.
- 2009 DESY Theory group. Host: Volker Schomerus.

RESEARCH LECTURES

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 super fluidity 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)

SERVICE FOR COMMUNITY

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| 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 - 2016 | Serving as a 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 | Organizer of the Russian National Physics Olympiad at the state stage. |

OTHER INTERESTS AND HOBBIES

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| Languages: | English (fluent), Russian (native), German (fluent), French (intermediate), Armenian (basic). |
| Sports: | Karate (brown belt, 1 kyu, former instructor at JKA Hu Shin Kai dojo), tennis, soccer, ping-pong. |
| Hobbies: | Playing music, poetry writing, Middle Eastern languages and culture, philosophy, programming, immigration law, corporate law, social Latin dances (past: instructor at the Caltech Salsa Club). |