

Tigran Hakobyan

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PERSONAL DATA

Born: 29 January 1965, Yerevan, Armenia
Citizenship: Armenia
Marital status: Married, two children
Languages: Armenian, Russian, English & (not fluent) French
Permanent positions: Associate professor, Chair of theoretical physics,
Leading researcher, Laboratory of theoretical physics
Website: <http://www.ysu.am/faculties/en/Physics/section/staff/person/Tigran-Hakobyan>

EDUCATION

1989 Graduated from Department of Physics, Yerevan State University
1989–1992 Postgraduate Student, Theory Division, Yerevan Physics Institute
1996 PhD in Theoretical & Mathematical physics from Yerevan Physics Institute.
Thesis: *R-matrices and quantum groups*.
2013 Habilitation (Doctor of science) in Theoretical & Mathematical physics from
Yerevan State University. Thesis: *Exact methods in one-dimensional and
quasi-one-dimensional systems*.

PROFESSIONAL EMPLOYMENT

1993–1998 Junior scientific researcher, Theoretical Physics Division, Yerevan Physics
Institute (YerPhI)
1996–1998 Lecturer, Theory Department of Physics Faculty, Yerevan State Univer-
sity (YSU)
1998–1999 PhD, Service de Physique de l'Etat Condense, CEA, Centre d'Etudes de
Saclay, 91191 Gif sur Yvette Cedex, France
1999–2007 Scientific researcher, Theoretical Physics Division, YerPhI
2007–2013 Assistant Prof., Theory Department of Physics Faculty, YSU
Since 2013 Associate Prof., Theory Department of Physics Faculty, YSU

ASSOCIATE POSITIONS

- 2003–2005 Associate Prof., Physics Department of Faculty of Natural Sciences, Ijevan branch of YSU
- 2007–2013 Scientific researcher, Theoretical Physics Division, YerPhI
- 2007–2013 Researcher, Laboratory of Theoretical Physics, YSU
- 2015–2017 Professor, Department of Mathematical Physics, Tomsk Polytechnic University, Tomsk, Russia
- 2013–2021 Senior researcher, Laboratory of Theoretical Physics, YSU
- Since 2021 Leading researcher, Laboratory of Theoretical Physics, YSU

AWARDS

President Prize in Physics for 2010, 02.05.2011

PRESENT & PAST RESEARCH INTERESTS

My research interests are focused on integrable systems, related algebraic or differential structures, as well as on other exact methods in low-dimensional systems. More precisely, they include the following topics:

- Integrable and superintegrable systems of classical and quantum mechanics, Calogero models, related difference-differential (Dunkl) operators, Hamiltonian reduction and matrix models;
- Integrable quantum chains of interacting fermions and spins, quantum groups, Yang-Baxter equations, Heisenberg and Hubbard models, spin ladders;
- Exact group-theoretical methods in study of ground-state degeneracy of spin and fermionic lattice systems, Lieb-Mattis theorem on ordering of energy levels and its extensions to higher symmetries.

COMPUTER PROGRAMMING SKILLS

Working experience in C/C++, Fortran, MPI multi-processor library, Mathematica, Python.

TEACHING

I taught courses in the mathematical physics, quantum mechanics, field theory at the Yerevan State University. In particular,

Bachelor courses:

Mechanics, Quantum mechanics, Electrodynamics, Group theory, Quantum field theory, Modern methods in computer programming

Master courses:

Gauge field theory, Quantum electrodynamics, Advanced group theory, Modern methods of mathematical physics.

PRINCIPAL COLLABORATORS

- Armen Nersessian from Yerevan Physics Institute
- Olaf Lechtenfeld from Leibnitz Universität of Hannover
- Misha Feigin from Glasgow University
- Francisco Correa from Austral University of Chile

- Ara Sedrakyan from Yerevan Physics Institute

PARTICIPATION IN CONFERENCES & WORKSHOPS

- International Workshop devoted to N. Ananikyan's 70th anniversary, Yerevan, May 11-15.05.2022
- Workshop on *Geometry, Integrability and Supersymmetry*, 22-27.08.2021, Yerevan, Armenia
- *Recent Developments in Supergravity Theories and Related Topics*, IMBM, Istanbul, 6-7 December 2019
- Workshops on *Supersymmetry in Integrable Systems (SIS)*:
Yerevan: 9-13.09.2015; 27-30.08.2012; 24-28.08.2010
Dubna, Russia: 13-16.08.2018; 11-13.09.2014
Hannover, Germany: 28-30.12.2013; 01-04.08.2011
- Conference on *Symmetry Methods in Physics (SymPhys)*
Dubna, Russia:
Yerevan: 09-15.07.2017; 03-08.07.2006
- Workshops on *Supersymmetries and Quantum Symmetries (SQS)*
Dubna, Russia: 3-8.08.2015; 29.07-03.08.2009
Yerevan, Armenia: 26-31/08.2019
- The 9th International Conference on *Quantum Theory and Symmetries (QTS-9)*
Yerevan: 13-18.07.2015,
- Inaugural Workshop of the Regional Training Network in Theoretical Physics
14-15.03.2013, Tbilisi
- Armenia-Dubna Workshops on *Problems of (supersymmetric) Integrable Systems*
Dubna, Russia: 24-26.12.2013; 24-25.12.2012
- Workshop on *Aspects of Integrable Systems and AdS/CFT*
Tehran, Iran, 1 November 2012
- XIX Colloquium on *Integrable Systems and Quantum Symmetries*
18-20.06.2009, Prague
- Workshop on *Group-theoretical methods in Physics*
11-17.08.2008, Yerevan
- *Integrable systems: From Strings to Conformal Field Theories*
Nor Amberd-Tbilisi: 1-4.10.2007
- Conference on *Modern Problems of Theoretical and Mathematical Physics*
September 20-25, 2004, Tbilisi, Georgia.
- Meeting, *Gauge Fields and Strings*
May 26-30, 2003, Yerevan, Armenia.
- *Statistical Physics and Dynamical Systems: Methods and Applications*
Workshop, September 18-23, 2003, Nor-Amberd and Tsakhajor, Armenia.
- Conference on *Modern Problems of Theoretical and Mathematical Physics*
September 20-25, 2002, Tbilisi, Georgia.

- Workshop on *Low dimensional integrable models and their applications in field theory and statistical physics*,
May 20-25, 2001, Annecy-le-Vieux, France.

PARTICIPATION IN GRANTS

- Volkswagen Foundation of Germany (Volkswagen Stiftung):
 1. *Regional doctoral program in theoretical and experimental particle physics*, 93 562 (2018-2022)
 2. *Regional training center in theoretical physics*, 86 260 (2013-2017)
 3. *Algebraic and geometric properties of (conformal) mechanics with extended supersymmetry I/84 496* (2009-2011)
 4. *Non-perturbative aspects of quantum field theory in various space-time dimensions* (2005) 2 years.
- State Committee of Science of Armenia (1-3 years each):
 1. *Quantum phenomena with external fields and topology in field theory and condensed matter physics*, 21AG-1C047 (2021)
 2. *Kitaev's toric code and integrability of three-dimensional models*, 20TTAT-QTa009 (2020)
 3. *Bethe's algebraic ansatz on generalized representations and minimal models of conformal field theories*, 20TTWS-1C035 (2020)
 4. *Novel (super)integrable systems on complex and quaternionic projective spaces and their supersymmetrization*, 18T-1C106 (2018)
 5. *Conformal symmetry in classical and quantum integrable systems*, 18RF-002 (2018)
 6. *Magnetolectric effect in low-dimensional multiferroics*, SFU-02 (2017)
 7. 15T-1C367 (2015)
 8. *Supersymmetric integrable models in low dimensions*, 15RF-039 (2015)
 9. *Novel integrable systems in quantum mechanics*, 13-1C114 (2013)
 10. *Supersymmetric integrable systems in quantum mechanics, field theory and gravity*, 13RF-018 (2013)
 11. *Geometric models of two- and one- dimensional integrable systems*, 11-1c258 (2011)
 12. *Mathematical models for low-dimensional quantum structures in external fields*, BFBR 11AB-001 (2011)
- Armenian National Science & Education Fund (ANSEF, 1 year each)
 1. *Integrable generalizations of rational Calogero model*, mathph-4220, project leader (2016)
 2. *Spherical systems related to the rational Calogero models*, mathph-3501, project leader, (2014)
 3. *Conformal mechanics, Calogero models and related spherical systems*, PS-2908, project leader, (2012)

4. *Geometric properties of novel supersymmetric mechanics systems*, 2229-PS (2010)
 5. *Multiple spin exchanges, cubic symmetry and frustrated spin systems*, PS-1386 (2008)
- ICTP Network (International Centre of Theoretical Physics):
 1. *Black holes, supergravity, strings and integrable Systems* (Armenia-Georgia-Iran-Turkey-Ukraine), NT-04, since 2017
 2. *Novel approaches to mesoscopic phenomena*, (Armenia-Georgia-Iran-Morocco-Turkey-Ukraine), NET-68 (2012-2016)
 - CRDF - U.S. Civilian Research and Development Foundation & NFSAT - National Foundation for Science and Advanced Technology (2 years each):
 1. *Algebraic and geometric studies for condensed matter physics*, UCEP 06/07 (University Center of excellence Program), project leader (2007)
 2. *Quantum mechanical models for the higher-dimensional Hall effect*, ARP1-3228-YE-04 (2005)
 - Swiss SCOPE grant.
 - Grants INTAS (The International Association for the Promotion of Co-operation with Scientists from the New Independent States of the Former Soviet Union)
 - INTAS-7928, *Extended supersymmetry, strings and noncommutativity in field theory* (2005) 3 years
 - INTAS-01459, *Low dimensional integrable models and their applications in field theory and statistical physics* (1999) 2 years
 - INTAS-840
 - INTAS-524
 - Grant 211-5291 YPI of the Bundesministerium für Forschung und Technologie.
 - NATO Linkage Grant LG 9303057.
 - Grant A-102 of the International Science Technical Center (ISTC).

LIST OF PUBLICATIONS

1. M. Feigin, T. Hakobyan, *Algebra of Dunkl Laplace-Runge-Lenz vector*, Letters in Mathematical Physics **112**, 59 (2022).
2. T. Hakobyan, S. Vardanyan, *Superintegrable systems related to truncated Calogero model*, POS - Proceedings of Science **394**, 006 (2021).
3. T. Hakobyan, *Lowest energy states of an $O(N)$ fermionic chain*, Physical Review B **102**, 085128 (2020).
4. T. Hakobyan, S. Vardanyan, *Symmetry algebra of dynamical and discrete Calogero models*, Physics of Particles and Nuclei Letters **17**, 734 (2020).
5. T. Hakobyan, *Symmetries of the generalized Calogero model and the Polychronakos-Frahm chain*, Physical Review D **99**, 105011 (2019).
6. H. Demirchian, T. Hakobyan, A. Nersessian, et al, *Myers-Perry conformal mechanics*, Physics of Particles and Nuclei **49**, 860 (2018).

7. T. Hakobyan, A. Nersessian, M.M. Sheikh-Jabbari, *Near horizon extremal Myers-Perry black holes and integrability of associated conformal mechanics*, Physics Letters B **772**, 586 (2017).
8. T. Hakobyan, A. Nersessian, H. Shmavonyan, *Lobachevsky geometry in TTW and PW systems*, Physics of Atomic Nuclei **80**, 598 (2017).
9. T. Hakobyan, A. Nersessian, *Two-center Coulomb problem with Calogero interaction*, Physics of Atomic Nuclei **80**, 383 (2017).
10. T. Hakobyan, A. Nersessian, *Integrability of Calogero-Coulomb problems*, Physics of Particles and Nuclei Letters **14**, 331 (2017).
11. T. Hakobyan, A. Nersessian, H. Shmavonyan, *Constants of motion in deformed oscillator and Coulomb systems*, Physics of Particles and Nuclei Letters, **14**, 400 (2017).
12. T. Hakobyan, A. Nersessian, H. Shmavonyan, *Symmetries in superintegrable deformations of oscillator and Coulomb systems: Holomorphic factorization*, Physical Review D **95**, 025014 (2017).
13. F. Correa, T. Hakobyan, O. Lechtenfeld, A. Nersessian, *Spherical Calogero model with oscillator/Coulomb potential: Quantum case*, Physical Review D **93**, 125009 (2016).
14. F. Correa, T. Hakobyan, O. Lechtenfeld, A. Nersessian, *Spherical Calogero model with oscillator/Coulomb potential: Classical case*, Physical Review D **93**, 125008 (2016).
15. T. Hakobyan, A. Nersessian, *Integrability and separation of variables in Calogero-Coulomb-Stark and two-center Calogero-Coulomb systems*, Physical Review D, **93**, 045025 (1996).
16. M. Feigin, T. Hakobyan, *On Dunkl angular momenta algebra*, Journal of High Energy Physics **2015**, 107 (2015).
17. T. Hakobyan, *Lowest-energy states in parity-transformation eigenspaces of $SO(N)$ spin chain*, Nuclear Physics B **898**, 248 (2015).
18. T. Hakobyan, A. Nersessian, *Runge-Lenz vector in the Calogero-Coulomb problem*, Physical Review A **92**, 022111 (2015).
19. T. Hakobyan, O. Lechtenfeld, A. Nersessian, *Superintegrability of generalized Calogero models with oscillator or Coulomb potential*, Physical Review D **90**, 101701(R) (2014).
20. T. Hakobyan, D. Karakhanyan, O. Lechtenfeld, *The structure of invariants in conformal mechanics*, Nuclear Physics B **886**, 399 (2014).
21. T. Hakobyan, O. Lechtenfeld, A. Nersessian, et al. *Action-angle variables and novel superintegrable systems*, Physics of Particles and Nuclei **43**, 577 (2012).
22. T. Hakobyan, O. Lechtenfeld, A. Nersessian, *The spherical sector of the Calogero model as a reduced matrix model*, Nuclear Physics B **858**, 250 (2012).
23. T. Hakobyan, O. Lechtenfeld, A. Nersessian, et al. *Integrable generalizations of oscillator and Coulomb systems via action-angle variables*, Physics Letters A **376**, 679 (2012).
24. T. Hakobyan, O. Lechtenfeld, A. Nersessian, et al. *Invariants of the spherical sector in conformal mechanics*, Journal of Physics A **44**, 055205 (2011).
25. T. Hakobyan, *Ordering of Energy Levels for Extended $SU(N)$ Hubbard Chain*, SIGMA **6**, 024 (2010).

26. T. Hakobyan, *Energy-level ordering for frustrated spin ladder models*, Physics of Atomic Nuclei **73**, 339 (2010).
27. T. Hakobyan, S. Krivonos, O. Lechtenfeld, et al. *Hidden symmetries of integrable conformal mechanical systems*, Physics Letters A **374**, 801 (2010).
28. T. Hakobyan, A. Nersessian, V. Yeghikyan, *The cuboctahedric Higgs oscillator from the rational Calogero model*, Journal of Physics A **42**, 205206 (2009).
29. T. Hakobyan, A. Nersessian, *Lobachevsky geometry of (super)conformal mechanics*, Physics Letters A **373**, 1001 (2009).
30. T. Hakobyan, *Antiferromagnetic ordering of energy levels for a spin ladder with four-spin cyclic exchange: Generalization of the Lieb-Mattis theorem*, Physical Review B **78**, 012407 (2008).
31. T. Hakobyan, *Energy-level ordering and ground-state quantum numbers for a frustrated two-leg spin-1/2 ladder*, Physical Review B **75**, 214421 (2007).
32. T. Hakobyan, *The ordering of energy levels for $su(n)$ symmetric antiferromagnetic chains*, Nuclear Physics B **699**, 575 (2004).
33. T. Hakobyan, *The possibility of gapless excitations in antiferromagnetic spin chains with long-range interactions*, Journal of Physics A **36**, L599 (2003).
34. T. Hakobyan, J. Hetherington, M. Roger, *Phase diagram of the frustrated two-leg ladder model*, Physical Review B **63**, 144433 (2001).
35. T. Hakobyan, D. Sedrakyan, A. Sedrakyan, et al. *Delocalization of states in two-component superlattices with correlated disorder*, Physical Review B **61**, 11432 (2000).
36. J. Ambjørn, A. Avakyan, T. Hakobyan, A. Sedrakyan, *Bethe ansatz and thermodynamic limit of affine quantum group invariant extensions of the t - J model*, Journal of Mathematical Physics **40**, 5687 (1999).
37. V.V. Harutunyan, T.S. Hakobyan, V.A. Gevorkyan, et al. *Luminescence quantum yield and multiplication of electronic excitations in the corundum crystals*, European Physical Journal B **12**, 31 (1999).
38. V.V. Harutunyan, E.A. Hakhverdyan, T.S. Hakobyan, et al. *Luminescence excitation and influence of radiation on the stimulated processes in corundum crystals*, Physica Status Solidi Applied Research **171**, 623 (1999).
39. J. Ambjørn, A. Sedrakyan, A. Aakyan, T. Hakobyan, *A new family of integrable extended multi-band Hubbard Hamiltonians*, Modern Physics Letters A **13**, 495 (1998).
40. A. Avakyan, T. Hakobyan, A. Sedrakyan, *A family of affine quantum group invariant integrable extensions of the Hubbard Hamiltonian*, Nuclear Physics B **490**, 633 (1997).
41. A. Avakyan, T. Hakobyan, A. Sedrakyan, *Integrable extensions of Hubbard Hamiltonian*, International Journal of Modern Physics B **11**, 3207 (1997).
42. T. Hakobyan, A. Sedrakyan, *On the universal R -matrix of $U_q\widehat{sl}_2$ at roots of unity*, Communications in Mathematical Physics **177**, 157 (1996).
43. T. Hakobyan, A. Sedrakyan, *Spin chain Hamiltonians with affine U_{qg} symmetry*, Physics Letters B **377**, 250 (1996).
44. T. Hakobyan, A. Sedrakyan, *Lattice electrons in constant magnetic field: Bethe like ansatz*, Modern Physics Letters A **10**, 495 (1995).

45. T. Hakobyan, A. Sedrakyan, *Universal R matrix of $U_q sl(n, m)$ quantum superalgebras*, Journal of Mathematical Physics **35**, 2552 (1994).
46. T. Hakobyan, A. Sedrakyan, *R-matrices for $U_q \widehat{osp}(1, 2)$ for highest weight representations of $U_q osp(1, 2)$ for general q and q an odd root of unity*, Physics Letters B **308**, 266 (1993).
47. T. Hakobyan, A. Sedrakyan, *Some new spinor representations of quantum groups $B_q(n)$, $C_q(n)$, $G_q(2)$* , Journal of Mathematical Physics **34**, 2554 (1993).
48. T. Hakobyan, A. Sedrakyan, *R-matrices for highest weight representations of $sl_q(2, C)$ at roots of unity*, Physics Letters B **303**, 27 (1993).