

Nathan L. Harshman – Curriculum Vitae –2024/07/05

Department of Physics
American University
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Education:

- 1995-2001 Ph.D., Theoretical Particle Physics, University of Texas at Austin (degree, August 2001);
Dissertation: “On Representing Resonances and Decaying States”; Dissertation Advisor:
Professor Arno R. Bohm
- 1991-1995 B.S., Double major: Physics and English, Duke University (degree, May 1995)

Professional Positions:

- 2019-present Professor, Department of Physics, American University
- 2017-present Director, NASA DC Space Grant Consortium
- 2009-2019 Associate Professor, Department of Physics, American University
- 2003-2009 Assistant Professor, Department of Physics, American University
- 2001-2003 Wiess Instructor of Physics, Department of Physics and Astronomy, Rice University
- 1995-2001 Assistant Instructor, Research Assistant and Teaching Assistant, Physics Department,
University of Texas at Austin

Visiting and Affiliate Positions:

- 2024 Fulbright Specialist, Institute of Pure and Applied Mathematics, Polytechnic University of
Valencia, Spain
- 2024 Visiting Faculty, Quantum Systems Group, Okinawa Institute of Science and Technology,
Onna, Okinawa, Japan
- 2023 Deutscher Akademischer Austauschdienst (DAAD) Visiting Research Faculty, Institute for
Theoretical Physics, Technical University of Berlin, Germany
- 2016-2017 Visiting Associate Professor, Institute for Physics and Astronomy, Aarhus University,
Denmark
- 2014 Visiting Faculty, Institute for Nuclear Theory, University of Washington
- 2009-2010 DAAD Visiting Research Faculty, Institute for Quantum Physics, University of Ulm, Germany
- 2006 Fulbright Junior Lectureship in Physics at University of Trento, Italy
- 1998-1999 Heraeus Foundation Fellowship at University of Würzburg, Germany

Selected Grants and Awards:

- 2023 NASA Space Grant Program FY24-25 Funding Renewal for DC Space Grant Consortium
- 2023 DAAD Research Stays for University Academics and Scientists
- 2023 American University, Center for Research, Teaching and Learning, Ann Ferren Curriculum
Design Award (co-awarded with Meg Bentley Ellen Feder, Shari Watkins, and Lauren Weis)
- 2023-2025 Fulbright Specialist Award, US Department of State
- 2021 American University, College of Arts and Sciences, Antiracist Curriculum Development Award
(co-awarded with Raychelle Burks, Jessica Uscinski, and Rachel Borchardt)
- 2020 American University, Outstanding Teaching in a Tenure-Line Faculty Position
- 2020 NASA Space Grant Program FY20-24 Funding Renewal for DC Space Grant Consortium
- 2019 American University, Center for Research, Teaching and Learning, Ann Ferren Curriculum
Design Award (co-awarded with Rachel Borchardt, Cyndee Finkel, Gregg Harry, and Jessica
Uscinski)
- 2019 NASA Space Grant Program FY19-20 Funding Renewal for DC Space Grant Consortium
- 2018 NASA Space Grant Program FY18-19 Funding Renewal for DC Space Grant Consortium
- 2015 NASA DC Space Grant Consortium, AU Faculty STEM Award. Project Title: Ultracold Atomic
Dynamics: Few-Body Systems in Microgravity
- 2013 NASA DC Space Grant Consortium, AU Faculty STEM Award. Project Title: Three-Body
Interactions in Ultracold Atomic Dynamics

Nathan L. Harshman – Curriculum Vitae –2024/07/05

2011	NASA DC Space Grant Consortium, AU Faculty STEM Award. Project Title: Promoting STEM Retention through Best Practices in Summer Research Experiences
2007	American University, Center for Teaching Excellence, Teaching with Technology Award
2006-2008	Research Corporation, Cottrell College Science Award. Project Title: Quantum Information Theory and Particle Physics: Entanglement in Multiparticle Scattering.
2004	American University, Faculty Research Award. Project Title: Applying Clebsch-Gordan Techniques to Composite Particles
2000, 2003	National Science Foundation, Travel Grant for Young Researchers

Publications:

In Submission

1. G. Bougas, N. L. Harshman, P. Schmelcher, "Impact of dark states on the stationary properties of quantum particles with off-centered interactions in one dimension," submitted to Physical Review A, arXiv:2403.10078.

Articles in Refereed Journals

- R1. S. Nagies, B. Wang, A.C. Knapp, A. Eckardt, N.L. Harshman, "Beyond braid anyons: A lattice model for one-dimensional anyons with a Galilean invariant continuum limit," SciPost Phys. 16, 086 (2024), arXiv:2309.04358.
- R2. N.L. Harshman, A.C. Knapp, "Topological Exchange Statistics in One Dimension," Physical Review A 105 (2022) 052214, arXiv:2108.05653.
- R3. D. Yampolsky, N.L. Harshman, V. Dunjko, Z. Hwang, M. Olshanii, "Quantum Chirikov Criterion," SciPost Physics 12 (2022) 035, arXiv: 2104.12193
- R4. T. Fogarty, M.A. Garcia-March, L.F. Santos, N.L. Harshman, "Probing the edge between integrability and quantum chaos in interacting few-atom systems," Quantum 5 (2021), 486, arXiv: 2104.12934.
- R5. X.M. Aretxabaleta, M. Gonchenko, N.L. Harshman, S.G. Jackson, M. Olshanii, G.E. Astrakharchik, "The dynamics of digits: Calculating pi with Galperin's billiards," Mathematics 8 (2020), 509.
- R6. N.L. Harshman, A.C. Knapp, "Anyons from Three-Body Hard-Core Interactions in One Dimension," Annals of Physics 412 (2020) 168003, arXiv: 1803.11000.
- R7. M.A. Garcia-March, N.L. Harshman, H. da Silva, T. Fogarty, Th. Busch, M. Lewenstein, A. Ferrando, "Graded-index optical fiber emulator of an interacting three-atom system: Classical non-separability and illumination control of particle statistics," Quantum 3 (2019), 210 (14 pages), arXiv: 1902.01748.
- R8. Artem G. Volosniev, Aksel S. Jensen, Nathan L. Harshman, Jeremy R. Armstrong, Nikolaj T. Zinner, "A Solvable Model for Decoupling of Interacting Clusters," Europhysics Letters 125 (2019), 20003 (7 pages), arXiv:1810.10281.
- R9. N.L. Harshman, A.C. Knapp, "Coincidence Structures and Hard-Core Few-Body Interactions," Few-body Systems 59 (2018), 79 (7 pages), arXiv: 1801.08753.
- R10. N.L. Harshman, Maxim Olshanii, A.S. Dehkharghani, A.G. Volosniev, Steven Glenn Jackson, N.T. Zinner, "Integrable families of hard-core particles with unequal masses in a one-dimensional harmonic trap," Physical Review X 7 (2017), 041001 (14 pages), arXiv: arXiv:1704.01433.
- R11. Molte Emil Strange Andersen, N. L. Harshman, and Nikolaj Thomas Zinner, "Hybrid model of separable, zero-range, few-body interactions in one-dimensional harmonic traps," Physical Review A 96 (2017), 033616 (10 pages), arXiv: 1706.04413.
- R12. N.L. Harshman, "Infinite Barriers and Symmetries for a Few Trapped Particles in One Dimension," Physical Review A 95 (2017), 053616 (15 pages), arXiv: 1608.07189.
- R13. N.L. Harshman, "Identical Wells, Symmetry Breaking, and the Near-Unitary Limit," Few-Body Systems 58, 41-47 (2017), arXiv: 1701.00949.
- R14. N.L. Harshman, "One-Dimensional Trap, Two-Body Interactions, Few-Body Symmetries I.: One, Two, and Three Particles" Few-Body Systems 57, 11-43 (2016), arXiv: 1501.00215.
- R15. N.L. Harshman, "One-Dimensional Trap, Two-Body Interactions, Few-Body Symmetries II.: N Particles" Few-Body Systems, 57, 45-69 (2016), arXiv: 1505.00659.
- R16. N.L. Harshman, "Spectroscopy for a Few Atoms Harmonically-Trapped in One Dimension," Physical Review A, 89 (2014), 033633 (9 pages), arXiv: 1312.6107.

- R17. N.L. Harshman, "Symmetries of Three Harmonically-Trapped Particles in One Dimension," *Physical Review A*, 86 (2012), 052122 (10 pages), arXiv: 1209.1398.
- R18. Gary A. Morris, Nathan Harshman, Lee Branum-Martin, Eric Mazur, Taha Mzoughi and Stephen D. Baker, "An Item Response Curves Analysis of the Force Concept Inventory," *American Journal of Physics*, 80 (2012), 825-831.
- R19. N.L. Harshman and Kedar Ranade, "Observables can be tailored to change the entanglement of any pure state," *Physical Review A*, 84 (2011) 012303 (4 pages), arXiv: 1102.0955.
- R20. N.L. Harshman and W.F. Flynn, "Entanglement in Massive Coupled Oscillators," *Quantum Information and Computation*, 11 (2011) 278-299, arXiv: 0912.4603.
- R21. K. Vogel, F. Gleisberg, N.L. Harshman, P. Kazemi, R. Mack, L. Plimak, and W.P. Schleich, "Optimally Focusing Wave Packets," *Chemical Physics*, 375 (2010), 133-143.
- R22. E. Kajari, N.L. Harshman, E.M. Rasel, S. Stenholm, G. Süßmann, W.P.Schleich, "Inertial and Gravitational Mass in Quantum Mechanics," *Applied Physics B*, 100 (2010), 43-60, arXiv: 1006.1988.
- R23. S. Wickramasekara and N.L. Harshman, "Semigroup integrability of point-form dynamics," *Reports on Mathematical Physics*, 64 (2009), 123-138.
- R24. N.L. Harshman and G. Hutton, "Entanglement Generation in the Scattering of One-Dimensional Particles," *Physical Review A*, 77 (2008) 042310 (9 pages), arXiv:0710.5776.
- R25. N.L. Harshman and P. Singh, "Entanglement mechanisms in one-dimensional potential scattering," *Journal of Physics A: Mathematical and Theoretical*, 41 (2008) 155304 (12 pages), arXiv:0712.0014.
- R26. N.L. Harshman and S. Wickramasekara, "Tensor Product Structures, Entanglement, and Particle Scattering," *Open Systems and Information Dynamics*, 14 (2007) 341-351, arXiv: quant-ph/0611230.
- R27. N.L. Harshman and S. Wickramasekara, "Galilean and Dynamical Invariance of Entanglement in Particle Scattering," *Physical Review Letters* 98 (2007), 080406 (4 pages), arXiv: quant-ph/0607181. Reprinted in *Virtual Journal of Nanoscale Science and Technology*, March 2007.
- R28. N.L. Harshman, "Continuous-Discrete Entanglement: An Example with Non-Relativistic Particles," *Quantum Information and Computation* 7 (2007) 273-280, arXiv: quant-ph/0607138.
- R29. N.L. Harshman, "Dynamical Entanglement in Non-Relativistic, Elastic Scattering," *International Journal of Quantum Information* 5 (2007) 273-278, arXiv: quant-ph/0606011.
- R30. N.L. Harshman, "Poincaré Semigroup Symmetry as an Emergent Property of Unstable Systems," *International Journal of Theoretical Physics*, 46 (2007) 1929-1946, arXiv: hep-ph/0511298.
- R31. N.L. Harshman "Limits on entanglement in rotationally-invariant scattering of spin systems," *Physical Review A* 73 (2006), 062326 (4 pages), arXiv: quant-ph/0509013.
- R32. Gary A. Morris, Lee Branum-Martin, Nathan Harshman, Stephen D. Baker, Eric Mazur, Suvendra Dutta, Taha Mzoughi, and Veronica McCauley, "Testing the test: Item response curves and test quality," *American Journal of Physics* 74 (2006), 449-453.
- R33. N.L. Harshman, "Dynamical Entanglement in Particle Scattering," *International Journal of Modern Physics A* 20 (2005) 6220-6228, arXiv: quant-ph/0506212.
- R34. N.L. Harshman, "Basis States for Relativistic Dynamically-Entangled Particles," *Physical Review A* 71 (2005), 022312 (8 pages), arXiv: quant-ph/0409204.
- R35. N.L. Harshman and N. Licata, "Clebsch-Gordan Coefficients for the Extended Quantum-Mechanical Poincaré Group and Angular Correlations of Decay Products," *Annals of Physics* 317 (2005), 182-202, arXiv: hep-ph/0407299.
- R36. N.L. Harshman, "Representations of the Poincaré semigroup and relativistic causality," *International Journal of Theoretical Physics* 42 (2003), 2357-2370.
- R37. N.L. Harshman, "Visualizing the Mass and Width Spectrum of Unstable Particles," *American Journal of Physics* 71 (2003), 984-989, arXiv: physics/0305095.
- R38. A. Bohm, N.L. Harshman and H. Walther, "Relating the Lorentzian and exponential: Fermi's approximation, the Fourier transform and causality," *Physical Review A* 66 (2002), 012107 (11 pages), arXiv: quant-ph/0206145.
- R39. A. Bohm, N.L. Harshman, H. Kaldass and S. Wickramasekara, "Time asymmetric quantum theory and the ambiguity of the Z-boson mass and width," *European Physical Journal C* 18 (2000), 333-342.

Nathan L. Harshman – Curriculum Vitae –2024/07/05

- R40. Arno R. Bohm and N.L. Harshman, "On the mass and width of the Z-boson and other relativistic resonances," *Nuclear Physics B* 581 (2000) 91-115, arXiv: hep-ph/0001206.

Book Chapters

- B1. N.L. Harshman, "Symmetry, Structure, and Emergent Subsystems," in *Quantum Worlds*, eds. Olimpia Lombardi, Sebastian Fortin, Cristian Lopez and Federico Holik, (Cambridge University Press, 2019), pp 294-322, arXiv: 1801:08755.
- B2. N.L. Harshman, "Symmetry and Natural Quantum Structures for Three-Particles in One-Dimension," in *Quantum Structural Studies*, eds. Ruth Kastner, Jasmina Jeknić-Dugić, and George Jaroszkiewicz, (World Scientific, Singapore, 2016), arXiv:1607.00560.
- B3. N.L. Harshman, "Physics of Information," in *The Routledge Handbook of Philosophy of Information*, ed. Luciano Floridi, (Routledge, New York, 2016), pp. 7-14.
- B4. A. Bohm and N.L. Harshman, "Rigged Hilbert Spaces and Time Asymmetric Quantum Physics," in *Compendium of Quantum Mechanics: Concepts, Experiments, History and Philosophy*, eds. Friedel Weinert, Klaus Hentschel, Daniel Greenberger, and Bridgitte Falkenburg. (Springer, Berlin, 2009), pp. 660-670.

Articles in Conference Proceedings

- C1. N.L. Harshman, "Five is More: Comments on Symmetry, Integrability, and Solvability for a Few Particles Trapped in One Dimension," in Conference Proceedings of 21st International Conference on Few-Body Problems in Physics, EPJ Web of Conferences 113 (2016), 02007 (5 pgs.), 61, arXiv: 1509.00286.
- C2. N.L. Harshman, "Observables and Entanglement in the Two-Body System," in Conference Proceeding of Quantum Theory: Reconsideration of Foundations 6, AIP Conference Proceedings 1508 (2012) , pp. 386-390, arXiv: 1210.1770.
- C3. Jonathan Bougie, Philip Johnson, Nathan Harshman, Teresa Larkin, Michael Black, "Redesigning a Major: A Case Study of a Changing Curriculum," 2007 American Society for Engineering Education Annual Conference and Exposition, electronic proceedings, article AC 2007-2555. Reprinted with minor changes as "Assessing the Changing Face of the Physics Major: A Case Study," in 37th ASEE/IEEE Frontiers in Education Conference, electronic conference proceedings, paper number 1653, pp. S2G-7 – S2G-11.
- C4. N.L. Harshman, "Kinematic Correlations of Decay Products and the State Spaces of the Relativistic Gamow Vector," in *Proceedings of XXV International Colloquium on Group Theoretical Methods in Physics*, IOP Conference Series 185, Eds. G.S. Pogosyan, L.E. Vicent, and K.B. Wolf, (IOP/Canopus, Bristol, 2005), pp. 293-298.
- C5. N.L. Harshman and A. Bohm, "Selecting the Mass and Width of Relativistic Resonances," in *Proceedings of the XXIII International Colloquium on Group Theoretical Methods in Physics*, Eds. L.G. Mardoyan, G.S. Pogosyan and A.N. Sissakian, (Joint Institute for Nuclear Research Publishing Department, Dubna, Russia, 2002).
- C6. Arno R. Bohm, N.L. Harshman and M. Mithaiwala, "Relativistic Resonances, Relativistic Gamow Vectors and Representations of the Poincaré Semigroup," in *Proceedings of the International Symposium 'Quantum Theory and Symmetries'*, Eds. H.-D. Doebner, V.K. Dobrev, J.-D. Hennig, and W. Leucke, (World Scientific, Singapore, 2000), pp. 191-201, arXiv: hep-ph/9912228.
- C7. A.R. Bohm and N.L. Harshman, "Quantum Theory in the Rigged Hilbert Space—Irreversibility from Causality," in *Irreversibility and Causality in Quantum Theory—Semigroups and Rigged Hilbert Space*, Vol. 504, Springer Lecture Notes in Physics, Eds. A. Bohm, H.-D. Doebner and P. Kielanowski (Springer, Berlin, 1998), pp. 181-237, arXiv: quant-ph/9805063.

Popular Essays and Book Reviews

- P1. Richard C. Sha and Nathan Harshman, "Uncertainty isn't a human flaw, it's a feature of the world," *Psyche*, April 18, 2023. <https://psyche.co/ideas/uncertainty-isnt-a-human-flaw-its-a-feature-of-the-world>. Retrieved April 20, 2023.
- P2. N. L. Harshman, "Unsolvable in the Anthropocene," FXQI Essay Contest *Undecidability, Uncomputability, and Unpredictability* (2020).

Nathan L. Harshman – Curriculum Vitae –2024/07/05

- P3. N.L. Harshman, "Introduction to Quantum Mechanics (3 Ed.)," American Journal of Physics 87 (2019), 237.
- P4. Nathan Harshman, "Structure and Symmetry in Geometry and Dynamics," De Physicus (Technical University Delft) 28 (2), (July 2017), pp. 54-56.
- P5. Matt Leifer and Nathan L. Harshman, "Quantum Mechanics Interpretation Survey: Point/CounterPoint," Quantum Times, Topical Group on Quantum Information, American Physical Society, September 2013.
- P6. Nathan L. Harshman, "Charting the path of our geometric knowledge," Chicago Tribune Books Section, March 19, 2007.
- P7. Nathan L. Harshman, "Crunching numbers--as well as lines, angles and shapes" Chicago Tribune Books Section, December 3, 2006.

Courses Taught:

- Bridging the Two Cultures: Science and Literature (undergraduate, American U., 2012, 2013)
- Classical Mechanics (undergraduate, American U. 2003, 2005, 2007, 2011)
- Electromagnetism (undergraduate, American U., 2004)
- Conceptual Physics (undergraduate, traditional and workshop style, U. Texas at Austin and American U., 1997-2001, 2010, 2015)
- Group Theory in Quantum Mechanics (graduate, U. Trento, Aarhus U, 2006, 2017)
- How Physicists Work (undergraduate, American U., 2012, 2019-2023)
- Introductory Physics with Algebra (undergraduate, American U., 2004)
- Introductory Physics with Calculus (undergraduate, Rice U. and American U., 2001-2008, 2011, 2012, 2014)
- Introductory Physics Laboratories (with and without calculus, undergraduate, U. Texas at Austin and American U., 1995-7, 2004-2005, 2012)
- The Material World/What is the Matter with Us? (undergraduate, American U., 2011, 2017-2022)
- Physics Capstone Seminar (undergraduate, American U., 2012, 2015)
- Quantum Computation (undergraduate, Rice U., 2003)
- Quantum Mechanics (undergraduate, American U., 2005, 2013, 2014, 2016)
- Waves and Optics (undergraduate, American U., 2005, 2007-2009, 2011, 2014, 2018, 2020-2023)

Selected Departmental, College and University Service:

2008-2009, 2012-2016 2017-2020, 2022-2023	Chair of Department of Physics, College of Arts and Sciences, American University
2022-2023	CAS Research Committee, College of Arts and Sciences, American University
2021-2023	CAS Capital Campaign Committee, College of Arts and Sciences, American University
2021-2022	Strategic Imperative 4 Workstream: Faculty-Student Research Collaboration, American University
2003-2009, 2010-2012, 2017-2018, 2021-2022	Director of Undergraduate Studies, Physics Department, American University
2022	STEM Grants and Partnerships Coordinator Search Committee Chair, College of Arts and Sciences, American University
2020-2022	CAS Dean Search Committee, College of Arts and Sciences, American University
2021	Design and Build Lab Search Committee Chair, Physics Department, American University
2020-2021	Science Rank and Tenure Committee Chair, College of Arts and Sciences, American University
2017-2020	Member of Q2 Core Curriculum Committee, American University
2015-2016	Co-organizer, Bi-Weekly STEM Education Workshop, American University
2015-2016, 2017-2018	Partners-in-Teaching Program, CAS and CTRL, American University
2014-2016	Chair of Faculty Committee on the Don Myers Technology and Innovation Building
2010-2012	Curriculum Committee Chair, Department of Physics, American University
2011	Dean's Advisory Council, College of Arts and Sciences, American University

Nathan L. Harshman – Curriculum Vitae –2024/07/05

2008-2009	Member of Faculty Senate Joint Committee on Curriculum and Academic Policy, American University
2008-2009	Member of Educational Policy Committee, College of Arts and Science, American University
2006-2008	Chair of Curriculum Committee of Department of Computer Science, Audio Technology, and Physics
2005-2007	Member of Educational Policy Committee – Curriculum Committee, College of Arts and Science, American University

Selected STEM Recruitment, Retention and Outreach

2022-2023	Member of Advisory Board for AU NSF IUSE Project: Enhanced Teaching and Learning Through Problem-Based Pedagogy (PI Carolyn Parker)
2018-2023	Co-founder and member, Initiative for STEM Education, Equity and Ethics.
2021	Co-organized “Preparing for Quantum Technology Education: A 21st Century Learning Challenge,” STARBASE Hanscom AFB (virtual), May 2020.
2019	Contributed activity to DC Math Circle, enrichment event for pre-teen students.
2018	Team leader for “CUR Broadening Participation Institute” for increasing diversity and inclusion in STEM at AU, Bowie State U in March 2018.
2011-2015	Co-organized three “Science Spooktaculars,” science-themed haunted house for outreach to Washington, DC high school students and American University community.
2013	Co-organized DNA Day, American University, April 24, 2013. Presented talk “X-Ray the DNA! A Diffraction Distraction.”
2010-2018	Co-organizer or participated in outreach booths for USA Science and Engineering Festival, Washington, DC. Theme in 2010 and 2016: “Physics of Music”; theme in 2012 and 2018: “Science in the Kitchen”; theme in 2014: “Science of Sports.”
2010, 2011, 2018	Mentored high school student projects on STEM outreach.
2011	Organized Summer Science Seminars for undergraduate researchers on campus during Summer 2011. Supported by DC NASA Space Grant Consortium.
2010, 2011	Presented at College Awareness events for middle-school students in DC Public Schools

Professional Memberships:

American Physical Society, American Association of Physics Teachers, Anacapa Society: Theoretical and Computational Physicists at Undergraduate Institutions.

Editorial and Other Professional Activities:

2001-present	Referee for American Journal of Physics; Annals of Physics; Central European Journal of Physics; Entropy; European Physical Journal A; European Physical Journal D; Few-Body Systems; Foundations of Physics; Il Nuovo Cimento B; International Journal of Theoretical Physics; Journal of Physics A; Journal of Physics B; Journal of Statistical Mechanics: Theory and Experiment; Mathematical and Computational Applications; New Journal of Physics; Physica A; Physica Scripta; Physical Review Letters; Physical Review A; Physical Review D; Physical Review E; Physical Review X; The Physics Teacher; Soft Computing; Symmetry
2021	Co-organizer: Preparing for Quantum Technology Education: A 21st Century Learning Challenge,” DoD STARBASE Academy at Hanscom AFB. 13 May 13, 2021
2020, 2021	Fulbright Application review for CIES
2017	Reviewer Excellence award from American Association of Physics Teachers for reviews of American Journal of Physics
2016	Outstanding Reviewer Award for Institute of Physics for reviews of New Journal of Physics
2013-2015	Member: American Journal of Physics Editorial Advisor Board
2013	External program reviewer, Department of Physics and Astronomy, Valparaiso University
2003	Co-organizer: Time Asymmetric Quantum Theory: the Theory of Resonances, Lisbon, Portugal, 23-26 July, 2003

Nathan L. Harshman – Curriculum Vitae –2024/07/05

2000 Co-scientific secretary of Third Workshop on Time Asymmetric Quantum Mechanics and Rigged Hilbert Space Mathematics, 7-11 August, 2000, Technical University of Clausthal, Germany

Selected Presentations

* Undergraduate co-authors

- Short course (4 hours in two sessions): “Top 10 Symmetries Every Quantum Mechanics Should Know,” Department of Applied Physics, University of Valencia, March 2024.
- Invited colloquium: “Not Just a Logo: An Insider's Guide to NASA,” Department of Aerospace Engineering, Polytechnic University Valencia, March 2024.
- Invited seminar: “Quantum Technologies: ¿Prepare for Disruption?” Association of Computing Machinery student club, Polytechnic University Valencia, March 2024.
- Invited seminar: “Beyond Braids: Anyons and Topology in One Dimension,” Quantum Technologies, Materials and Photonics Seminar, University of Valencia, March 2024.
- Invited seminar: “Symmetry in Physical Systems: Powerful Tool, Beautiful Guide and Distracting Trickster,” University Institute for Pure and Applied Mathematics, Polytechnic University Valencia, February 2024.
- Workshop (45-minute session, three times): “Quantum Technologies,” International Day of Women and Girls in Science, American Space Valencia, Polytechnic University Valencia, February 2024.
- Short course (5 hours in three sessions): “Solvable Models in Ultracold Atomic Physics,” Okinawa Institute of Science and Technology, Onna, Okinawa, Japan, January 2024.
- Invited colloquium: “Applications of Configuration Space Symmetry and Topology in 1D Few-Body Systems,” Quantum Systems Group, Okinawa Institute of Science and Technology, Onna, Okinawa, Japan, January 2024.
- Short course (8 hours in two sessions): “Applications of Group Theory to Symmetry in Quantum Theory,” Berlin School of Optical Sciences and Quantum Technologies, Technical University Berlin, December 2023.
- Invited seminar: “Beyond Braids: Anyons Exchange Statistics in One Dimension,” FOR24 One-Dimensional Anyon Workshop, TU Berlin, Germany, November 2023.
- Invited colloquium: “Beyond Braids: Anyons Exchange Statistics in One Dimension,” Institute for Theoretical Physics, Kaiserslautern, Germany, November 2023.
- Invited seminar: “Geometry, Symmetry and Topology in Interacting Few-Body Systems,” Eckardt Working Group Conference, Thuringia, Germany, October 2023.
- Contributed Poster: “Beyond Braids: Anyons Exchange Statistics in One Dimension,” Sant Feliu Workshop on Bose-Einstein Condensates, Sant Feliu, Spain, September 2023.
- Invited seminar: “Topological Exchange Statistics and One-Dimensional Anyon Models,” Workshop: The Day of the One-Dimensional Anyon, University of Hamburg, Germany, July 2023.
- Contributed seminar: “Geometry, Symmetry and Topology in Interacting Few-Body Systems,” 6th Local Symmetries Workshop, Le Mans, France, July 2023.
- Contributed talk (co-authors E. Feder, S. Watkins, L. Weis, N.L. Harshman, A. Bentley, & K. Walters-Conte): “Building Equity-Minded Science Educators: Faculty Learning Communities in Postsecondary Environments. In National Association of Research in Science Teaching Annual International Conference. Chicago, April 2023.
- Contributed talk (co-author A.C. Knapp, A. Eckardt, S. Nagies, B. Wang): “Simulating traid anyons with bosons hopping on a lattice,” March APS, Las Vegas, NV, March 2023.
- Contributed poster (co-author P.R Johnson and G. Gurney*): “Nonlocal four-body interactions with non-trivial topological properties in a one-dimensional system of ultracold bosons,” March APS, Las Vegas, NV, March 2023.
- Contributed talk (co-author G. Gurney* and P.R Johnson): “Distribution and scaling of complexity in Conway's Game of Life, and connections to nonequilibrium dynamics,” March APS, Las Vegas, NV, March 2023.

Nathan L. Harshman – Curriculum Vitae –2024/07/05

- Contributed talk (co-authors E. Feder, S. Watkins, L. Weis, N.L. Harshman, A. Bentley, & K. Walters-Conte): “Creating an AU STEM Identity Embedded with Equitable and Inclusive Principles. In Ann Ferren CTRL Conference. American University, January 2023.
- Invited talk: “Topology vs. Dynamics in One-Dimensional Anyons,” Topology and Non-Equilibrium Dynamics, Max Planck Institute for the Physics of Complex Systems, Dresden, Germany, October 2022.
- Contributed talk (co-authors E. Feder, S. Watkins, L. Weis, N.L. Harshman, A. Bentley, & K. Walters-Conte): “Introducing the Ethical STEM Framework—Creating Institutional STEM Identity Embedded with Equitable and Inclusive Principles”. In American Association of College and Universities 2022 Transforming STEM Higher Education Conference. Arlington, VA, October 2022.
- Invited seminar: “Triangulating Intrinsic Indistinguishability,” University of Massachusetts Boston, September 2022
- Invited Seminar: “Symmetry and Topology for a Few Particles on a Lattice,” 5th Local Symmetries Workshop, University of Hamburg, Germany, June 2022
- Invited seminar: “A Review of Anyons in One Dimension,” Technical University of Berlin, Germany, June 2022
- Contributed talk (co-author A.C. Knapp): “Topological Exchange Statistics in One Dimension,” DAMOP 2022, Orlando, FL, May 2022
- Contributed poster (co-author P.R. Johnson): “Simulating Non-Local Multibody Interactions in a One-Dimensional Ultracold Atomic Gas,” DAMOP 2022 Orlando, FL, May 2022
- Contributed talk: “Universality of Contact Interactions and Topological Exchange Statistics,” Living near Unitarity Workshop, Kavli Institute for Theoretical Physics, May 2022
- Contributed talk (co-authors Thomás Fogarty, Miguel A Garcia-March, and Lea F Santos): “Probing the edge between integrability and quantum chaos in interacting few-atom systems,” March APS Meeting (virtual), March 2022
- Contributed poster (co-authors Franscesca Ark* and Adam C. Knapp): “Structure and Statistics of the Traid Group,” March APS Meeting, March 2022
- Invited Seminar (virtual): “Topological Exchange Statistics in One Dimension,”
 - Mini-Workshop on Graph Braids, Bristol University, UK, September 2021
 - RIKEN Interdisciplinary Theoretical and Mathematical Sciences Program, Japan, November 2021
- Contributed Talk: “Dynamics of Digits: Calculating Pi with Galperin Billiards,” American Association of Physics Teachers, Chesapeake Section Meeting (virtual), October 2020.
- Invited Seminar: “Few-Body Physics in One Dimension,” US Naval Academy, Annapolis, October 2019.
- Short Course (three 90-minute lectures): “Symmetry for Control of a Few, Trapped Ultracold Atoms,” Okinawa Institute for Science and Technology, October 2019.
- Invited Panel: “NASA OSTEM Performance and Evaluation,” 2019 Mega Principal Investigators’ Meeting, NASA Office of STEM Engagement, Cleveland, August 2019.
- Invited Seminar: “Topology and Anyons in Few-Body Systems,” Max Planck Institute for Complex Systems, Dresden, June 2019.
- Invited Seminar: “Quantum Quilts and Particle Models,” Workshop on Coordinate Bethe Ansatz, U Mass Boston, February 2019.
- Lecture: “Intentional Mentorship,” NASA DC Space Grant Consortium Affiliate Meeting, February 2019.
- Panelist: “AU’s New Initiative in STEM Education, Equity & Ethics (ISE3)” and “Designing & Teaching a Q2 Course,” Ann Ferren Teaching Conference, American University, January 2019
- Invited Lecture: “Solvability, Symmetry and Unsolvability,” OLLI Science Talks, AU, October 2018.
- Lecture: “Hard-Core Interactions in Low Dimensions,” Small and Medium Sized Cold Atom Systems, Pedro Pasqual Science Center, Benasque, Spain, August 2018.
- Invited seminar: “Anyons from Three-Body Hard-Core Interactions in One Dimension”.
 - Institute for Photonic Science (ICFO), Castelldefels, Spain, July 2018.
 - Department of Physics, Polytechnic University of Catalonia, July 2018.
 - Department of Physics, U Mass Boston, December 2018.

Nathan L. Harshman – Curriculum Vitae –2024/07/05

- DAMOP, Milwaukee, June 2019
- Poster: “Anyons from Three-Body Hard-Core Interactions in One Dimension,” International Conference on Atomic Physics, Barcelona, Spain, July 2018
- Invited seminar: “Hard-Core Few-Body Physics: Geometry, Symmetry and Topology,” Triangle Nuclear Theory Colloquium, Duke University, February 2018.
- Invited Lecture: “Topology, Symmetry, and Control in Few-Body Configuration Space,” Critical Stability in Few-Body Systems, Max Planck Institute for Complex Systems, Dresden, October 2017.
- Invited Lecture: “My Year of Researching Danishly: Geometry and Topology in Few-Body Systems,” Physics Department Colloquium, American University, August 2017.
- Invited Lecture: “Symmetry, Solvability and Emergent Subsystems,” International Workshop: Identity, Indistinguishability and Non-Locality in Quantum Physics, Buenos Aires, June 2017.
- Lecture: “Integrable families of hard-core particles with unequal masses in a one-dimensional harmonic trap,” Integrable Systems and Quantum Symmetries 25, Prague, Czech Republic, June 2017.
- Invited Lecture: “Symmetry and Combinatorics for Identical Quantum Systems,” Quantum Math Seminar, University of Copenhagen, May 2017.
- Invited Lecture: “Symmetry, Solvability and Integrability for Cold Atoms Trapped in One Dimension”
 - Mathematical Physics Seminar, Department of Physics, Lund University, May 2017.
 - Structure and Constituents of Matter Seminar, University of Barcelona, April 2017.
- Lecture: “Solvable Models for a Few Atoms in a Few One-Dimensional Wells”
 - Institute for Photonic Science (ICFO), Castelldefels, Spain, January 2017. (invited)
 - Institute for Quantum Physics, Ulm University, Germany; December 2016. (invited)
 - Institute for Theoretical Nuclear Physics, Technical University Darmstadt, Germany, December 2016. (invited)
 - European Few Body Physics Conference 23, Aarhus, Denmark, August 2016.
 - March Meeting, American Physical Society, Baltimore, Maryland, March 2016.
- Invited Lecture: “Filling Space with Structure: Geometry, Symmetry and Countability,” Fredagsforedrag, Institute for Physics and Astronomy, Aarhus University, December 2016.
- Lecture: “Five is Different: Symmetry, Solvability and Entanglement in Quantum Few-Body Systems,” Workshop for Theorists at Undergraduate Institutions, Kavli Institute for Theoretical Physics, University of California Santa Barbara, June 2015.
- Lecture: “Few-Body Symmetries and Algebraic Solvability in One-Dimensional Traps,” 21st International Conference on Few-Body Problems in Physics, Chicago, May 2015.
- Invited Seminar: “Few-Body Symmetries and Algebraic Solvability in One-Dimensional Traps,”
 - Mathematical Physics Seminar, University of Iowa, March 2015.
- Invited Colloquium: “Five is Different: Symmetry, Solvability and Entanglement in Quantum Few-Body Systems”
 - Aarhus University, October 2016.
 - Grinnell College, March 2015.
 - George Mason University, March 2015.
 - Old Dominion University, February 2016.
 - George Washington University, February 2016.
- Short course (three lectures): “Quantum Information Theory,” Grinnell College, March 2015.
- Invited Lecture: “The Ontic, the Epistemic, and the Worries of Quantum Information,” Fall 2014 Info-Metrics Workshop, Info-Metrics Institute, American University, October 2014.
- Lecture: “Spectroscopy for a few atoms trapped in a one-dimensional harmonic well,” DAMOP 2014, Madison, Wisconsin, June 2014.
- Invited Lecture: “Spectroscopy for a few atoms harmonically-trapped in one dimension,” Universality in Few-Body Systems: Theoretical Challenges and New Directions (INT 14-1), Seattle, March 2014.
- Poster (with J. Revels*): “Optimized basis transformations for the symmetrization of a few ultra-cold atoms in a harmonic trap,” APS March Meeting, Denver, March 2014
- Poster (with J. Verniero* and J. Lansky): “Symmetry methods for five bodies in a one-dimensional harmonic trap,” APS March Meeting, Denver, March 2014

Nathan L. Harshman – Curriculum Vitae –2024/07/05

- Invited Lecture: “Solvability, Symmetry and Information in Quantum Few Body Systems,” Department of Chemistry, American University, November 2013.
- Poster: “Symmetry, entanglement & privileged subsystems applied to few-body physics,” Noise, Information and Complexity at the Quantum Scale, Erice, Italy, October 2013.
- Lecture: “Books that Shaped America: Franklin’s Experiments,” AU Library, September 2013.
- Lecture: “Observables, Entanglement and Subsystem Clustering in Few-Body Systems,” Quantum Theory and Quantum Foundations, Linnaeus University, Växjö, Sweden, June 2013.
- Invited Lecture: “Entanglement in a Few Cold Atoms,” Johns Hopkins Applied Physics Laboratory, Laurel, Maryland, May 2013.
- Poster (with B. Weinstein* and J. Uscinski): “Symmetries of Four Harmonically-Trapped Particles in One Dimension,” APS March Meeting, Baltimore, March 2013.
- Lecture: “Symmetry methods for harmonically trapped, interacting particles,” APS March Meeting, Baltimore, March 2013.
- Invited Lecture: “Physics Conceptual Assessments for Dummies,” Harvard PER Mini-Conference, November 2012.
- Invited Lecture: “Symmetries in a Quantum Three-Body Problem,” Department of Mathematics and Statistics, American University, October 2012.
- Invited Lecture: “Determinism, Entropy and Chaos in *Arcadia*,” Annual Literature Department Colloquium, American University, October 2012.
- Lecture: “Tailored Observables and Entanglement in the Quantum Two-Body System,” 6th Conference on Quantum Theory: Reconsideration of Foundations, Linnaeus University, Växjö, Sweden, June 2012.
- Poster (with N. Klingler*): “Entanglement in Quantum Harmonic Chains,” APS March Meeting, Boston, March 2012.
- Invited Colloquium: “Maximizing Information, Minimizing Correlation: I Come to Bury Entanglement, Not to Praise It,” Valparaiso University, February 2012.
- Invited Lecture: “Classical Correlations, Quantum Correlations, and Magical Correlations,” Spring 2011 Info-Metrics Workshop, Info-Metrics Institute, American University, May 2011.
- Invited Colloquium: “Entanglement is in the Observables of the Quantum Beholder,” Department of Mathematics and Statistics, American University, April 2011.
- Lecture: “Mathematica: Changing the Way Our Majors Do Physics,” AAPT Winter Meeting, Jacksonville, FL, January 2011.
- Lecture: “Entanglement between Atoms in a Diatomic Molecule,” German Physical Society Spring Meeting, Hannover, Germany, March 2010.
- Lecture: “Entanglement and the Quantum Two-Body Problem,”
 - Institute for Theoretical Physics, University of Ulm, Germany, January 2010. (Invited)
 - 11th Annual Ulm-Augsburg Meeting, University of Augsburg, Germany, February 2010. (Invited)
 - Quantum 2010 “Ad Memoriam Carlo Novero,” INRiM, Turin, Italy, May 2010.
- Invited Lecture: “Entanglement in One or Two Relativistic Particles,” Institute for Quantum Theory University of Ulm, Germany, October 2009.
- Invited Lecture: “Entanglement classifications in particle systems and entanglement generation via particle scattering,” Institute for Quantum Theory University of Ulm, Germany, October 2009.
- Lecture: “Entanglement Mechanisms in One-Dimensional Particle Scattering,”
 - 39th Annual Meeting of the Division of Atomic, Molecular, and Optical Physics, State College Pennsylvania, May 2008.
 - Quantum Information/Bose-Einstein Condensate Talk Series, National Institute of Standards and Technology, August 2008. (Invited).
- Invited colloquia: “Quantum Entanglement and Particle Scattering,”
 - Physics and Astronomy Department, Bucknell University, March 2008
 - Physics Department, Georgetown University, April 2008.
 - Physics and Astronomy Department, University of Maryland, Baltimore County, October 2008.

Nathan L. Harshman – Curriculum Vitae –2024/07/05

- Lecture: “The consequences of space-time symmetries and time-asymmetric boundary conditions for entanglement in particle scattering,” Quantum Theory and Symmetries 5, Valladolid, Spain, July 2007.
- Lecture: “Entanglement in One-Dimensional Scatter,” Workshop on Quantum Information Theory, Pedro Pascual Benasque Center for Science, Benasque, Spain, June, 2007.
- Invited Lecture: “The Many Faces of Entanglement in Particle Collisions,” Quantum Information/Bose-Einstein Condensate Talk Series, National Institute of Standards and Technology, March 2007.
- Invited Lecture: “Entanglement of Particles, or ‘Dude, Where’s My Subsystem?’” Department of Mathematics and Statistics, American University, October 2006.
- Lecture: “Tensor Product Structures, Entanglement, and Particle Scattering,” 3rd Feynman Festival, University of Maryland, College Park, August 2006.
- Invited Lecture: “Scattering, Entanglement, and Irreversibility,” XXV Workshop on Geometric Methods in Physics, Białowieża, Poland, July 2006.
- Lecture: “Symmetry Constraints for Entanglement in Non-relativistic, Elastic Particle Scattering,” XXXVIII Symposium on Mathematical Physics: Quantum Entanglement and Geometry, Toruń, Poland, June 2006.
- Poster: “Dynamical Entanglement in Non-Relativistic, Elastic Scattering,” Quantum 2006, 3rd Workshop ad Memoriam Carlo Novero, INRiM, Turin, Italy, May 2006.
- Poster: “Dynamical Entanglement and Particle Scattering,” London Mathematical Society Workshop on Quantum Information Theory, York, England, July 2005.
- Lecture: “Dynamical Entanglement and Particle Scattering,” 27th Montreal-Rochester-Syracuse-Toronto Conference on High Energy Physics, Utica, NY, 16-18 May 2005.
- Lecture: “Factorizability, Coherence and the Spaces of States and Observables in Relativistic Particle Scattering,” Second Feynman Festival, University of Maryland, College Park, August 2004.
- Invited Lecture: “Kinematic Correlations of Resonance Decay Products and the State Space of the Relativistic Gamow Vector,” XXV International Colloquium of Group Theoretical Methods in Physics, Cocoyoc, Mexico, August 2004.
- Invited Lecture: “Emergent Symmetries of Elementary Particles,” Physics and Astronomy Department, St. Olaf College, March 2004.
- Lecture: “Stimulating Classroom Discussion with Personal Response Pads,” Fifteenth Annual Ann Ferren Teaching Conference, American University, January 2004.
- Poster: “Poincaré Semigroup as an Emergent Property of Unstable Systems,” XIVth International Conference on Mathematical Physics, Lisbon, Portugal, 28 July 2003.
- Lecture: “Poincaré Semigroup as an Emergent Property of Unstable Systems”
 - Young Researchers Symposium at the XIVth International Conference on Mathematical Physics, Lisbon, Portugal, July 2003.
 - Sixth Workshop on Time Asymmetric Quantum Theory: the Theory of Resonances, Lisbon, Portugal, July 2003.
- Invited Lecture: “Emergent Properties of Unstable Particle Systems,” Department of Computer Science, Audio Technology, and Physics, American University, April 2003.
- Lecture: “Physics DIVA Solves Problems: Making a Digital Instructional Archive,” 126th AAPT National Meeting, 11-15 January 2003, Austin, Texas. Abstract: *AAPT Announcer*, January 2003, v. 32, iss. 4, pp. 65.
- Invited Lecture: “Representations of the Poincaré semigroup and relativistic causality,” Fifth Workshop on Time Asymmetry in Quantum Mechanics: Conference on ‘Irreversible Quantum Dynamics’, Abdus Salam International Centre for Theoretical Physics, July 2002, Trieste, Italy.
- Invited Lecture: “Digital Instruction Videos for Intro Physics,” Rice Ideas in Teaching and Education Showcase, Rice University, April 2002.
- Invited Lectures: “Exact Symmetries, Violated Symmetries and Asymmetry in Particle Scattering”
 - Physics and Astronomy Department Colloquium, St. Vincent College, January 2001
 - Physics and Astronomy Department Colloquium, Bucknell University, February 2001
 - Physics and Astronomy Department Colloquium, Colgate University, March 2001
 - Physics and Astronomy Department Colloquium, Rice University, March 2001
 - Physics Department Colloquium, Oberlin College, April 2001.

Nathan L. Harshman – Curriculum Vitae –2024/07/05

- Lecture: “Selecting the Mass and Width of Relativistic Resonances”
 - Time Asymmetric Quantum Mechanics and Rigged Hilbert Space Mathematics, August 2000, Technical University of Clausthal, Germany.
 - XXIII International Colloquium on Group Theoretical Methods in Physics, August 2000, Dubna, Russia.
 - Center for Particle Physics, University of Texas at Austin, October 2001. (Invited)
- Poster: “Time Asymmetry and Relativistic Resonances,” XIII International Conference on Mathematical Physics, July 2000, Imperial College, London.
- Lecture: “Time Asymmetry and Relativistic Resonances,” Young Researchers Symposium, XIII International Conference on Mathematical Physics, July 2000, Imperial College, London.