Nathan L. Harshman – Curriculum Vitae

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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:

2009-present	Associate Professor, Department of Physics, American University
2003-2009	Assistant Professor, Department of Computer Science, Audio Technology and Physics, American University
2006	Fulbright Junior Lectureship, Faculty of Physics, University of Trento, Italy.
2001-2003	Wiess Instructor of Physics, Department of Physics and Astronomy, Rice University
1997-2001	Assistant Instructor, Physics Department, University of Texas at Austin

Selected Academic Honors, Awards and Grants:

2009	Faculty Research Visit Grant, Deutscher Akademischer Austausch Dienst (DAAD)
2007	Teaching with Technology Award; Center for Teaching Excellence, American University
2006-2008	Cottrell College Science Award; Research Corporation.
2004, 2006	Mellon Grant; College of Arts and Sciences, American University.
2006	Fulbright Junior Lectureship in Physics at University of Trento, Italy
2004	Faculty Research Award; American University
2000, 2003	NSF Travel Grant for Young Researchers
1998-1999	Heraeus Foundation Fellowship

Publications:

Articles in Refereed Journals

- N.L. Harshman and Kedar Ranade, "Observables can be tailored to change the entanglement of any pure state," Phys. Rev. A, 84 (2011) 012303 (4 pages), arXiv: 1102.0955.
- N.L. Harshman and W.F. Flynn*, "Entanglement in Massive Coupled Oscillators," Quantum Information and Computation, 11 (2011) 278-299, arXiv: 0912.4603.
- K. Vogel, F. Gleisberg, N.L. Harshman, P. Kazemi, R. Mack, L. Plimak, and W.P. Schleich, "Optimally Focusing Wave Packets," Journal of Chemical Physics, 375 (2010), 133-143.
- 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.
- S. Wickramasekara and N.L. Harshman, "Semigroup integrability of point-form dynamics," Reports on Mathematical Physics, 64 (2009), 123-138.
- 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. Reprinted in Virtual Journal of Quantum Information, April 2008.
- 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.
- 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.
- 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.

- N.L. Harshman, "Continuous-Discrete Entanglement: An Example with Non-Relativistic Particles," Quantum Information and Computation 7 (2007) 273-280, arXiv: quant-ph/0607138.
- N.L. Harshman, "Dynamical Entanglement in Non-Relativistic, Elastic Scattering," International Journal of Quantum Information 5 (2007) 273-278, arXiv: quant-ph/0606011.
- 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.
- 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. Reprinted in Virtual Journal of Quantum Information, July 2006.
- 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.
- N.L. Harshman, "Dynamical Entanglement in Particle Scattering," International Journal of Modern Physics A 20 (2005) 6220-6228, arXiv: quant-ph/0506212.
- N.L. Harshman, "Basis States for Relativistic Dynamically-Entangled Particles," Physical Review A 71 (2005), 022312 (8 pages), arXiv: quant-ph/0409204. Reprinted in Virtual Journal of Quantum Information, March 2005.
- N.L. Harshman and N. Licata*, "Clebsch-Gordan Coefficients for the Extended Quantum-Mechanical Poincarè Group and Angular Correlations of Decay Products," Annals of Physics 317 (2005), 182-202, arXiv: hep-ph/0407299.
- N.L. Harshman, "Representations of the Poincaré semigroup and relativistic causality," International Journal of Theoretical Physics 42 (2003), 2357-2370.
- N.L. Harshman, "Visualizing the Mass and Width Spectrum of Unstable Particles," American Journal of Physics 71 (2003), 984-989, arXiv: physics/0305095. Reprinted in Virtual Journal of Nuclear Astrophysics, Vol. 1, Iss. 9.
- 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.
- 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.
- 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.

* Undergraduate co-authors

Articles in Books

- A. Bohm and N.L. Harshman, "Rigged Hilbert Spaces and Time Asymmetric Quantum Physics," accepted in *Compendium of Quantum Mechanics: Concepts, Experiments, History and Philosophy*, eds. Friedel Weinert, Klaus Hentschel, Danial Greenberger, and Bridgitte Falkenburg. (Springer, Berlin, 2009), pp. 660-670.

Articles in Proceedings of Refereed Conferences

- 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.
- 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.
- N.L. Harshman, "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).

- 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.
- 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.

Book Reviews

- Nathan L. Harshman, "Crunching numbers--as well as lines, angles and shapes" Chicago Tribune Books Section, December 3, 2006.
- Nathan L. Harshman, "Charting the path of our geometric knowledge," Chicago Tribune Books Section, March 19, 2007.

Courses Taught:

- Classical Mechanics (undergraduate, American U. 2003, 2005, 2007)
- Electromagnetism (undergraduate, American U., 2004)
- Conceptual Physics (undergraduate, U. Texas at Austin and American U., 1997-2001, 2010)
- Group Theory in Quantum Mechanics (graduate, U. Trento, 2006)
- Introductory Physics with Algebra (undergraduate, American U., 2004)
- Introductory Physics with Calculus (undergraduate, Rice U. and American U., 2001-2008)
- Introductory Physics Laboratories (with and without calculus, undergraduate, U. Texas at Austin and American U., 1995-7, 2003-4)
- The Material World (undergraduate honors colloquium, American U., 2011)
- Quantum Computation (undergraduate, Rice U., 2003)
- Quantum Mechanics (undergraduate, American U., 2005)
- Waves and Optics (undergraduate, American U., 2005, 2007-2009, 2011)

Selected Departmental and University Service/Activities:

2010-present	Undergraduate Advisor, Curriculum Committee Chair, and Search Committee Chair, Department of Physics, American University
2003-present	Faculty advisor for physics majors and sponsor of Society of Physics Students.
2008-2009	Served as member of Faculty Senate subcommittee Joint Committee on Curriculum and Academic Policy, American University.
2008-2009	Served as member of Educational Policy Committee, College of Arts and Science, American University.
2008-2009	Chair of Department of Physics, College of Arts and Science, American University.
2006-2008	Served as member of Mellon Committee, College of Arts and Sciences, American University.
2006-2008	Chaired Curriculum Committee of Department of Computer Science, Audio Technology, and Physics.
2005-2007	Served as member of Educational Policy Committee – Curriculum Committee, College of Arts and Science, American University.

Professional Memberships:

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

Editorial Activities:

Referee for American Journal of Physics, Annals of Physics, European Physical Journal A, Foundations of Physics, Il Nuovo Cimento B, International Journal of Theoretical Physics, Journal of Physics A, Journal of Physics B, New Journal of Physics, Physical Review A.

Presentations

- 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 2008 "Ad Memoriam Carlo Novero," I.N.Ri.M., Turin, Italy, May 2010.
- Lecture: "Entanglement in One or Two Relativistic Particles," Institute for Quantum Theory University of Ulm, Germany, October 2009.
- 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, 27-31 May 2008. Abstract: Bulletin of the American Physical Society, May 2008, v. 53, iss. 7, p. 87.
    - Quantum Information/Bose-Einstein Condensate Talk Series, National Institute of Standards and Technology, 6 August 2008.
- Invited colloquia: "Quantum Entanglement and Particle Scattering,"
    - Physics and Astronomy Department, Bucknell University, 6 March 2008
    - Physics Department, Georgetown University, 8 April 2008.
    - Physics and Astronomy Department, University of Maryland, Baltimore County, 15 October 2008.
- Lecture: "The consequences of space-time symmetries and time-asymmetric boundary conditions for entanglement in particle scattering," Quantum Theory and Symmetries 5, Valladolid, Spain, 22-28 July 2007.
- Lecture: "Entanglement in One-Dimensional Scatter," Workshop on Quantum Information Theory, Pedro Pascual Benasque Center for Science, Benasque, Spain, 10-29 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, 21 March 2007.
- Invited Lecture: "Entanglement of Particles, or 'Dude, Where's My Subsystem?'" Department of Mathematics and Statistics, American University, 10 October 2006.
- Lecture: "Tensor Product Structures, Entanglement, and Particle Scattering," 3rd Feynman Festival, University of Maryland, College Park, 25-29 August 2006.
- Invited Lecture: "Scattering, Entanglement, and Irreversibility," XXV Workshop on Geometric Methods in Physics, Białowieża, Poland, 2-8 July 2006.
- Lecture: "Symmetry Constraints for Entanglement in Non-relativistic, Elastic Particle Scattering," XXXVIII Symposium on Mathematical Physics: Quantum Entanglement and Geometry, Toruń, Poland, 4-7 June 2006.
- Poster: "Dynamical Entanglement in Non-Relativistic, Elastic Scattering," Quantum 2006, 3rd Workshop ad Memoriam Carlo Novera, I.N.Ri.M., Turin, Italy, 2-5 May 2006.
- Poster: "Dynamical Entanglement and Particle Scattering," London Mathematical Society Workshop on Quantum Information Theory, York, England, 6-8 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, 20-26 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, 2-6 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-1 Aug 2003.
- Lecture: "Poincaré Semigroup as an Emergent Property of Unstable Systems"
  - Young Researchers Symposium at the XIVth International Conference on Mathematical Physics, Lisbon, Portugal, 24-26 July 2003.
  - Sixth Workshop on Time Asymmetric Quantum Theory: the Theory of Resonances, Lisbon, Portugal, 23-26 July 2003.
- 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, 29 July-2 August 2002, Trieste, Italy.
- Lecture: "Digital Instruction Videos for Intro Physics," Rice Ideas in Teaching and Education Showcase, Rice University, 12 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.
- Lecture: "Selecting the Mass and Width of Relativistic Resonances"
  - Time Asymmetric Quantum Mechanics and Rigged Hilbert Space Mathematics, 7-11 August 2000, Technical University of Clausthal, Germany.
  - XXIII International Colloquium on Group Theoretical Methods in Physics, 1-5 August 2000, Dubna, Russia.
  - Center for Particle Physics, University of Texas at Austin, October 2001.
- Poster: "Time Asymmetry and Relativistic Resonances," XIII International Conference on Mathematical Physics, 17-22 July 2000, Imperial College, London.
- Lecture: "Time Asymmetry and Relativistic Resonances," Young Researchers Symposium, XIII International Conference on Mathematical Physics, 17-22 July 2000, Imperial College, London.

Other Professional Activities:

2006	Acted as scientific consultant and on-screen commentator on the physics of popular culture objects like Slinky and Silly Putty for television series "Pop Nation," produced by Tiger/Tigress Productions for Discovery Channel.
2005	Reviewed textbook for Thomson Brooks/Cole.
2005	Performed in AU Office of Student Life CIVITAS award-winning training video "Civility in the Classroom", showcased at Sixteenth Annual Ann Ferren Teaching Conference, January 2004.
2001	Acted as scientific consultant and on-screen commentator for documentary "Marie Curie: The Woman behind the Mind," directed by Alana Cash for VibeGirl Productions.
2000-2002	Correlated middle and secondary school science textbooks to state educational objectives for Holt, Reinhart & Winston.
1999	Acted as scientific consultant and on-screen commentator for documentary "Mileva Maric: The Other Einstein," directed by Alana Cash for VibeGirl Productions.