JOHN R. THOMPSON

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PROFESSIONAL EXPERIENCE

Professor of Physics — September 2016 to present
Member, Maine Center for Research in STEM Education
Cooperating Professor of STEM Education

Chair, Department of Physics and Astronomy — July 2017 to June 2022; July 2023 to present

Associate Professor of Physics — September 2008 to August 2016
Member, Maine Center for Research in STEM Education
Cooperating Associate Professor of STEM Education
University of Maine, Orono, ME

Visiting Professor, Fulbright Scholar — September 2008 to July 2009
Physics Education Research Group, School of Physics
Dublin Institute of Technology (now Technological University Dublin),
Dublin, Ireland

Assistant Professor of Physics — September 2002 to August 2008
Member, Center for Science and Mathematics Education Research
Cooperating Assistant Professor of Education
University of Maine, Orono, ME

Assistant Professor of Physics, — August 2000 to August 2002
Grand Valley State University, Allendale, MI

Research Associate, Physics Education Group — September 1997 to July 2000
Department of Physics, *University of Washington,* Seattle, WA

EDUCATION

Brown University, Providence, RI — Ph.D., Physics, May 1998; Sc.M., Physics, May 1992

Rensselaer Polytechnic Institute, Troy, NY — B.S., Physics, May 1990

HONORS/AWARDS

Fellow of the American Physical Society (2023)

ΦΚΦ (2021)

Outstanding Referee, *Physical Review* Journals, American Physical Society, 2020

Fulbright Scholar, 2008-2009, School of Physics, Dublin Institute of Technology (now Technical University Dublin), Dublin, Ireland

ΣΠΣ (Physics Honor Society; inducted 1989)

SELECT RECENT PUBLICATIONS

Manuscripts submitted for publication

A. R. Piña, Z. Topdemir, and J. R. Thompson, "Exploring the intersection of modeling and sensemaking in quantum mechanics," submitted to *Physical Review Physics Education Research* Focused Collection "Investigating and Improving Quantum Education through Research," May 2024.

A. R. Akinyemi, M. E. Loverude, and J. R. Thompson, "Solution evaluation strategies used by first-year physics students," submitted to *Physical Review Physics Education Research*, March 2023.

Peer-reviewed journal articles

W. D. Riihiluoma, Z. Topdemir, J. R. Thompson, "Comparative analysis of spins-first and wave functions-first students' understanding of expressions in quantum mechanics," *Physical Review Physics Education Research* 21, 010113 (2025). Part of the Focused Collection "Investigating and Improving Quantum Education through Research."

W. D. Riihiluoma, Z. Topdemir, J. R. Thompson, "Symbolic forms analysis of expressions for probability in Dirac and wave function notations for spins-first students *Physical Review Physics Education Research* **21,** 010105 (2025). Part of the Focused Collection "Investigating and Improving Quantum Education through Research."

W. D. Riihiluoma, Z. Topdemir, J. R. Thompson, "Network analysis of students' conceptual understanding of mathematical expressions for probability in upper-division quantum mechanics," accepted for publication in *Physical Review Physics Education Research* **20,** 020102 (2024).

M. Wawro, A. Pina, J. R. Thompson, Z. Topdemir, and K. Watson, "Student interpretations of eigenequations in linear algebra and quantum mechanics", accepted in *International Journal of Research in Undergraduate Mathematics Education,* (2024). doi:10.1007/s40753-024-00241-7.

A. Piña, Z. Topdemir, and J. R. Thompson, "Student understanding of eigenvalue equations in quantum mechanics: Symbolic forms and sensemaking analysis," *Physical Review Physics Education Research* **20,** 010153 (2024).

B. P. Schermerhorn and J. R. Thompson, "Making context explicit in equation construction and interpretation: Symbolic blending," *Physical Review Physics Education Research* **19**, 020149 (2023). (Editors' Suggestion.)

R. R. Bajracharya, V. L. Sealey, and J. R. Thompson, "Student understanding of the sign of negative definite integrals in mathematics and physics," *International Journal of Research in Undergraduate Mathematics Education,* Special Issue on The Teaching and Learning of Definite Integrals, R. Ely & S. R. Jones, Eds. (2023). doi 10.1007/s40753-022-00202-y.

S. Van den Eynde, B. P. Schermerhorn, J. Deprez, M. Goedhart, J. R. Thompson, and M. De Cock , "Dynamic conceptual blending analysis to model student reasoning processes while integrating mathematics and physics: a case study in the context of the heat equation," *Phys. Rev. Phys. Educ. Res.* **16**, 010114 (2020).

R.P. Springuel, M.C. Wittmann, and J.R. Thompson, "Reconsidering the encoding of data in physics education research," *Physical Review Physics Education Research* **15,** 020103 (2019). Part of the Focused Collection *Quantitative Methods in PER: A Critical Examination*.

B. P. Schermerhorn and J. R. Thompson, "Physics students' construction of differential length vectors in an unconventional spherical coordinate system," *Physical Review Physics Education Research* **15,** 010111 (2019).

B. P. Schermerhorn and J. R. Thompson, "Physics students' construction and checking of differential volume elements in an unconventional spherical coordinate system," *Physical Review Physics Education Research* **15,** 010112 (2019).

Peer-reviewed conference proceedings

W. Riihiluoma, Z. Topdemir, J. R. Thompson, "Applying a symbolic forms lens to probability expressions in upper-division quantum mechanics," *2022 PERC Proceedings* [Grand Rapids, MI, July 13-14, 2022], edited by B. W. Frank, D. Jones, and Q. Ryan (2022), doi:10.1119/perc.2022.pr.Riihiluoma.

Selected Recent Presentations

Invited presentations

American Physical Society (APS) Global Physics Summit, Anaheim, CA, March 2025, "Mathematical reasoning in undergraduate quantum mechanics: eigenvalue equations and probability expressions."

U. Delaware Department of Mathematical Sciences Teaching Seminar, virtual, 4 May 2023, "Mathematical practices in undergraduate physics instruction regarding limits and infinitesimals," with M. E. Loverude.

Colloquium, Department of Physics & Astronomy, Texas Tech University, Lubbock, TX, 6 December 2022, "Student understanding at the physics-mathematics interface: mathematization and evaluation."

Colloquium, Department of Mathematics, Virginia Polytechnic Institute and State University, Blacksburg, VA, 2 December 2022, "Student understanding at the physics-mathematics interface: mathematization and evaluation."

Contributed presentations

American Physical Society (APS) April Meeting, Sacramento, CA, April 2024

"Student understanding of vector products: The effects of context and experience," A. Molinari, Z. Topdemir, J. R. Thompson.

"Improving Student Construction of Quantum Mechanical Position Eigenvalue Equations: Preliminary Findings," A. R. Piña, J. R. Thompson.

26th Conference on Research in Undergraduate Mathematics Education (RUME), Omaha NE, Feb 2024

"Student Reasoning in Quantum Mechanics Examined Through Modeling and Sensemaking", A. R. Piña, Z. Topdemir, J. R. Thompson.

"Student understanding of the direction of vector dot products across contexts and levels," A. Molinari, Z. Topdemir, J. R. Thompson.

CalcConf 2023, Calculus in the Disciplines, Bergen, Norway, June 2023, "How students reason with derivatives of vector field diagrams," Z. Topdemir, M. E. Loverude, J. R. Thompson[†].

Active Grants and Awards

"Collaborative Research: Scaffolding the calculus in calculus-based physics," NSF IUSE, Engaged Student Learning: Level II, DUE-2336912; Collaborating PI, with M.E. Loverude (Lead PI), Calif. St. U. Fullerton, W.M. Christensen (co-PI), N. Dakota St. U.; $251,433 at UMaine, 10/1/24-9/30/27.

"Beyond procedures: a research-based approach to teaching mathematical methods in physics," NSF Education and Interdisciplinary Research (EIR), PHY-1912087; Collaborating PI, with M.E. Loverude (Lead PI), Calif. St. U. Fullerton, W.M. Christensen (co-PI), N. Dakota St. U.; $544,293 at UMaine, 9/1/2019-8/31/25.

Teaching Experience *([M]UMaine; [D]DIT/TUD; [G]GVSU; [W]UW)*

Physics courses

Introductory algebra-based mechanics.[W]
Introductory calculus-based physics.[G]
Introductory physics: Problem-Based Learning.[D]
Experimental Methods in Physics.[G]
Mathematical Methods for Physics.[M]
Intermediate Modern Physics[G]*/Quantum Mechanics*[G]*/Quantum and Atomic Physics.*[M]
Introduction to Physics and Engineering Physics.[M]
Physics Seminar II.[M] (career preparation seminar.)

Courses related to K-12 teacher preparation, physics education, and physics education research

Physics by Inquiry.[M,G,W] (courses for preservice and in-service K-12 teachers)
Postgraduate Certificate courses in *Third-Level Teaching and Learning*.[D]
Integrated Approaches to Physics Education I and *II.*[M] (graduate courses in M.S. in Teaching)
Graduate Seminar in Physics Education Research.[M]
Graduate Seminar: Group Teaching and Learning.[M]
Research-related Curriculum Development in Science and Mathematics.[M]
Independent Study in Physics Education Research.[M]
Senior Project in Physics / Honors Thesis in Physics.[M]
Seminar in Teaching Physics.[W]

Service Highlights

Member, (Inaugural) Planning Committee, Online Physics Education Research Journal Club, Fall 2022-present. Joint effort of *Physical Review Physics Education Research* (PRPER) and American Physical Society Topical Group on Physics Education Research (GPER).

Chair line, APS GPER Executive Committee (nationally elected office): Vice Chair, 2016; Chair-Elect, 2017; Chair, 2018; Past Chair, 2019.

Participant, Congressional Visits Day, American Physical Society, Washington, DC: Jan 2017; Feb 2018; Jun 2018; Jun 2021 (virtual).

Member, Editorial Board, *Physical Review Physics Education Research,* 1 January 2014 – 31 December 2016.

Co-founder, American Physical Society Topical Group on Physics Education Research (GPER), April 2013.

Physics Education Research Leadership and Organizing Council (AAPT), April 2009 – February 2012
Chair, January 2011 – February 2012.

American Physical Society Forum on Education Executive Committee, Member-at Large, April 2008 – April 2011; Programs Committee for 2009, 2010, and 2011 March and April meetings.

Conference and conference session organization and presentations

Co-presenter, "We just do stuff that works: The view from (at least a subset of) physics," with T.I. Smith and M.E. Loverude, for the Working Group on Education Research at the Interface of Mathematics and Physics: Limits and Infinitesimals across the STEM Disciplines, 25th Conference on Research in Undergraduate Mathematics Education (RUME), Omaha NE, Feb 2023.

Co-organizer, 2017 Physics Education Research Conference, "Mathematization in Physics Education Research," Covington, KY, 26-27 July 2017.

Co-organizer, *Transforming Research on Undergraduate STEM Education,* the University of St. Thomas, St. Paul, MN, 5-9 July 2017, as co-PI of NSF grant DUE-1551038; the University of St. Thomas, June 3-7, 2012, and the University of Maine, Orono, ME, June 14-18, 2010, as co-PI of NSF grant DUE-0941191.

Consulting and Advisory Committees

External Advisory Board, Department of Physics and Astronomy, KU Leuven, Leuven, Belgium, 2024-2028.

Advisory board member, "Research Initiation: Facilitating Knowledge Transfer within Engineering Curricula," NSF EEC-2205022, PFE: Research Initiation in Engineering Formation program, A. J. DeRosa (Stevens Institute of Technology, NJ) PI, T. Reed, co-PI; 9/1/2022-8/31/2025.

Reviewer, "Upper-level physics curriculum section" in "A Guide to Effective Practices for Physics STEM Programs (EP3)", S. McKagan, D. A. Craig, M. Jackson, and T. Hodapp, Eds., (American Physical Society, College Park, MD, Version 2021.1), 2021. https://ep3guide.org/

Participating instructor, "An Interdisciplinary Investigation of Learning: Student Understanding of Linear Algebra in Physics," NSF CAREER grant, Megan Wawro (Virginia Tech) PI, 9/1/2015-8/30/2022.

Grant proposal reviewer: National Science Foundation; Research Foundation Flanders (Fonds Wetenschappelijk Onderzoek); Fulbright Ireland Student Awards

Referee

American Journal of Physics
Physics Education Research, A Supplement to the American Journal of Physics
International Journal of Research in Undergraduate Mathematics Education
Journal of Chemical Education
Journal of Engineering Education
Physical Review Physics Education Research
The Physics Teacher
Physics Education Research Conference Proceedings
Conference on Research in Undergraduate Mathematics Education Research, Proceedings

Professional Memberships

American Association of Physics Teachers: Physics Education Research Topical Group; New Engl. Sec.

American Physical Society: Topical Group on Physics Education Research; Forum on Education; Forum on History of Physics; New Engl. Sec.

American Association for the Advancement of Science