

November 14, 2016

## Curriculum Vitae

**Name:** Corinne Alison Manogue

**Address:** Department of Physics  
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**Born:** March 3, 1955 Cincinnati, Ohio, USA

### The University of Texas at Austin

1984 **Ph.D.** in Physics

Dissertation: *The Vacuum in the Presence of Electromagnetic Fields and Rotating Boundaries*

Dissertation Advisor: *Bryce DeWitt*

### Mount Holyoke College

1977 **A.B.** *summa cum laude* in Mathematics & Physics

Honors Thesis: *The Extension Problem for Integrals*

Thesis Advisor: *Lester Senechal*

### Memberships:

American Physical Society

American Association of Physics Teachers

International Society for General Relativity & Gravitation

Indian Association for General Relativity & Gravitation

Australasian Society for General Relativity & Gravitation

Foundational Questions Institute FQXi

**Professional Experience:**

Oregon State University, Department of Physics, Corvallis, OR, USA

9/00—present      Professor  
9/16/93—9/15/00    Associate Professor  
1/1/88—9/16/93    Assistant Professor

School of Natural Sciences, Institute for Advanced Study, Princeton, NJ, USA

2/10—4/10          Visitor

Department of Physics, Utah State University, Logan, UT, USA

9/09—10/09        Visiting Professor

Grinnell College, Grinnell, IA, USA

8/29/02—12/20/02    Noyce Visiting Professor

Mount Holyoke College, Department of Mathematics, South Hadley, MA, USA

9/1/01—6/30/02      Hutchcroft Visiting Professor of Mathematics

University of Adelaide, Department of Mathematical Physics, Adelaide, Australia

2/16/95—8/20/95    Visiting Professor

Lancaster University, School of Physics & Chemistry, Lancaster, UK

8/1/94—2/6/95      Visiting Research Fellow

Mathematical Sciences Research Institute, Berkeley, CA, USA

1/91—6/91          Research Professor

Council for the International Exchange of Scholars, Indo-American Fellow

10/87—12/87        Tata Institute of Fundamental Research, Bombay, India  
7/87—9/87          Institute of Mathematical Sciences, Madras, India

University of Durham, Department of Mathematical Sciences, Durham, UK

9/86—7/87          SERC Postdoctoral Research Fellow

Institute for Advanced Study, School of Natural Sciences, Princeton, NJ, USA

10/84—5/86        Member

**Other Appointments:**

I am a member of the Graduate Faculty in the Departments of Physics, Mathematics, and the College of Education and I hold a Courtesy Professorship in the College of Education.

**Short-Term Visits: (Less than 2 months)**

- 1–2/10 University of Maine, Orono, ME, USA
- 12/09 Arizona State University, Phoenix, AZ, USA
- 11/09 University of Arizona, Tucson, AZ, USA
- 7/07 Digipen Institute of Technology, Seattle, WA, USA
- 12/04 Perimeter Institute, Waterloo, Canada
- 7/99 Universiteit Leiden, Instituut-Lorentz, Leiden, The Netherlands
- 7/99 Scuola Internazionale Superiore di studi Avanzati, Trieste, Italy
- 8/98 Reed College, Department of Physics, Portland, OR, USA
- 6/97 Reed College, Department of Physics, Portland, OR, USA
- 9/93 Lancaster University, School of Physics & Materials, Lancaster, UK
- 9/90 University of York, Department of Mathematics, York, UK
- 7/90 University of Crete, Crete, Greece
- 6–8/88 Science and Engineering Research Council Visiting Scholar:
  - University of York, Department of Mathematics, York, UK
  - University of Durham, Department of Mathematical Sciences, Durham, UK
- 11/87 University of Poona, Pune, India
- 8/87 Raman Research Institute, Bangalore, India
- 9/86 Imperial College, The Blackett Laboratory, London, UK
- 1–6/80 Institute for Theoretical Physics, Santa Barbara, CA, USA

**Grants (External):**

2013-16 National Science Foundation, DUE 1323800	\$649,293
PI (Co-PIs: Tevian Dray, Department of Mathematics, OSU; Elizabeth Gire, David Roundy & Emily van Zee, Department of Physics, OSU)	
<i>Paradigms in Physics: Representations of Partial Derivatives</i>	
2013-15 Templeton Foundation (34808)	\$117,511
Co-PI (PI: Tevian Dray, Department of Mathematics, OSU)	
<i>An Octonionic Description of Fundamental Particles</i>	
2013-14 National Science Foundation, DUE 1256606	\$40,486
Co-PI (PI: Tevian Dray, Department of Mathematics, OSU, Co-PI: Emily van Zee, Department of Science and Mathematics Education, OSU)	
<i>Supplement to: Paradigms in Physics: Interactive Electromagnetism Curricular Materials</i>	
2010-14 National Science Foundation, DUE 09-42983	\$399,922
Co-PI (PI: Tevian Dray, Department of Mathematics, OSU, Co-PI: Emily van Zee, Department of Science and Mathematics Education, OSU)	
<i>Paradigms in Physics: Interactive Electromagnetism Curricular Materials</i>	
2010-12 National Science Foundation, DUE 09-42983	\$249,846
Co-PI (PI: Dedra Demaree, OSU)	
<i>A multi-institutional and department-side approach to 2<sup>nd</sup> generation introductory physics curriculum reform.</i>	
2009-12 National Science Foundation, DUE 08-37829	\$44,563
Co-PI (PI David Roundy, Collaborative with Michael "Bodhi" Rogers, Ithaca College and John Thompson, University of Maine)	
<i>Collaborative Research: Paradigms in Physics: Creating and Testing Materials to Facilitate Dissemination of the Energy and Entropy Module.</i>	
2008-10 Foundational Questions Institute (FQXi)	\$51,393
Co-PI (PI: Tevian Dray, Department of Mathematics, OSU)	
<i>Using Octonionic Cayley Spinors to Describe Fundamental Particles</i>	
2006-11 National Science Foundation, DUE 06-18877	\$498,124
PI and Co-PI (PI in 2009-11: David McIntyre, Co-PI's: Tevian Dray, Barbara Edwards, Emily van Zee)	
<i>Paradigms in Physics: Multiple Entry Points</i>	
2003-07 National Science Foundation, DUE 02-31032	\$217,039
co-PI (PI: Tevian Dray, Department of Mathematics, OSU)	
<i>Bridging the Vector Calculus Gap: Episode II</i>	

Corinne Manogue

2003-07 National Science Foundation, DUE 02-31194 PI (co-PI's: David McIntyre & Allen Wasserman) <i>Paradigms in Physics: Faculty Materials</i>	\$99,941
2001-03 National Science Foundation, DUE 00-88901 co-PI (PI: Tevian Dray, Department of Mathematics, OSU) <i>Bridging the Vector Calculus Gap</i>	\$112,513
1999-00 National Science Foundation, DUE 96-53250 PI (co-PI's Philip Siemens & Janet Tate, Department of Physics, OSU) <i>Paradigms in Physics--Supplement</i>	\$47,063
1997-99 National Science Foundation, DUE 96-53250 PI (co-PI's Philip Siemens & Janet Tate, Department of Physics, OSU) <i>Paradigms in Physics</i>	\$450,000
1993-97 National Science Foundation, HRD 93-53787 PI (co-PI: Kenneth Krane, Department of Physics, OSU) <i>Symposium on Graduate Study in Science for Undergraduate Women</i>	\$75,000
1992-95 National Science Foundation, PHY 92-08494 PI (co-PI: Tevian Dray, Department of Mathematics, OSU) <i>The Wave Equation Isn't As Simple As You Thought</i>	\$75,400
1991-93 National Science Foundation, HRD 91-53982 co-PI (PI: Kenneth Krane, Department of Physics, OSU) <i>Symp. on Graduate Study in the Sciences for Junior-year Undergrad. Women</i>	\$14,842
1989-92 National Science Foundation, PHY 89-11757, PI <i>Aspects of Quantum Gravity</i>	\$34,742

**Grants (Internal):**

2005	Oregon State University, Research Office, Release Time <i>Paradigms in Physics</i>	\$6,000
2004-05	William and Flora Hewlett Foundation (subgrant through OSU COE) co-PI (PI: R. Nafshun, co-PI's E. Momsen, B. Edwards) <i>An Introductory Skills Course for Pre-engineers</i>	\$24,000
2004	Oregon State University, Research Office co-PI (PI: Richard Nafshun, co-PI's Ellen Momsen, Barbara Edwards) <i>Transferring Mathematical Skills to Physical Science, Pilot Evaluation</i>	\$5,000
2003-04	William and Flora Hewlett Foundation (subgrant through OSU COE) co-PI (PI: R. Nafshun, co-PI's E. Momsen, B. Edwards) <i>An Introductory Skills Course for Pre-engineers</i>	\$21,000
2000-01	Oregon State University, Technology Resource Fee co-PI (with Physics: Landau, Jansen; Chemistry: Nafshun, Schuyler, Westall) <i>A Physics &amp; Chemistry Computer-Enhanced Learning Center</i>	\$175,000
1988-89	Oregon State University PI, Research Council Grant	\$4,000

**Fellowships:**

- 2010 Institute for Advanced Study, Princeton:  
*Visitor*
- 2009 Utah State University:  
*Visiting Professor*
- 2002 Grinnell College:  
*Robert N. Noyce '49 Visiting Professorship*
- 2001-02 Mount Holyoke College:  
*Hutchcroft Visiting Professorship*
- 1995-96 Oregon State University:  
*L.L. Stewart Faculty Development Award*
- 1994-95 United States-United Kingdom Educational Foundation:  
*Fulbright-Hays Grant*
- 1992 Oregon State University:  
Vice President for Research, Graduate Studies, & International Programs:  
*Release Time for Development of Research Proposals*
- 1991 Mathematical Sciences Research Institute:  
*Research Professorship*
- 1988 UK Science and Engineering Research Council:  
*Visiting Scholars Grant*
- 1987 Council for the International Exchange of Scholars:  
*Indo-American Fellowship*
- 1986-87 UK Science and Engineering Research Council:  
*Postdoctoral Research Fellowship*
- 1986-87 University of Durham, Van Mildert College:  
*Arthur Prowse Fellowship*
- 1983-84 American Association of University Women:  
*Educational Foundation Fellowship*
- 1977-78 Mount Holyoke College:  
*Class of 1905 & Skinner Fellowships*

**Honors and Awards:**

- 2016 Oregon Academy of Science:  
*Outstanding Educator in Science and Mathematics, Higher Education Award.*
- 2014 American Association of Physics Teachers:  
*Fellow*
- 2008 American Association of Physics Teachers:  
*Award for Excellence in Undergraduate Physics Teaching*
- 2008 Oregon State University:  
*The Richard M. Bressler Senior Faculty Teaching Award*
- 2005 American Physical Society:  
*Fellow*
- 2002 Oregon State University:  
*Elizabeth P. Ritchie Distinguished Professor Award*
- 2000 Oregon State University, College of Science  
*Frederick H. Horne Award for Sustained Excellence in Teaching*
- 2000 Mortar Board  
*Top Prof*
- 1998 Gravity Research Foundation--Essay Competition:  
*Honorable Mention*
- 1992 Mount Holyoke College:  
*Mary Lyon Alumnae Award*
- 1991 Gravity Research Foundation--Essay Competition:  
*Honorable Mention*
- 1977 Sigma Xi
- 1976 Phi Beta Kappa
- 1973-77 Mount Holyoke College--Undergraduate Awards:  
1975-77 *Sarah Williston Prize* (to top five class members)  
1976 *Class of 1937 Prize* (Mathematics)  
1974 *Robert P. Sibley Prize* (English)  
1974 *Bernice Maclean Award* (Biology)
- 1973 National Merit Scholarship



## Publications on Theoretical Physics

### Books:

- Tevian Dray and Corinne A. Manogue, *The Geometry of the Octonions*, World Scientific (2015).

### Refereed Articles:

- D. Y. Smith & C. A. Manogue, *Superconvergence Relations and Sum Rules for Reflection Spectroscopy*, Journal of the Optical Society of America, **71** (1981), 935-947.
- David B. Fairlie & Corinne A. Manogue, *Lorentz Invariance and the Composite String*, Physical Review **D 34** (1986), 1832-1834.
- Corinne A. Manogue, *Vacuum Stability in Rotating Spacetimes*, Physical Review **D 35** (1987) 3783-3795.
- David B. Fairlie & Corinne A. Manogue, *A Parameterization of the Covariant Superstring* Physical Review **D 36** (1987) 475-479.
- Corinne A. Manogue, *The Klein Paradox and Superradiance*, Annals of Physics, **181** (1988) 261-283.
- Corinne A. Manogue, Ed Copeland, and Tevian Dray, *The Trousers Problem Revisited*, Pramana, **30** (1988) 279-292.
- Tevian Dray & Corinne A. Manogue, *Bogolubov Transformations and Completeness*, General Relativity and Gravitation, **20** (1988) 957-965.
- Corinne A. Manogue & Anthony Sudbery, *General Solutions of Covariant Superstring Equations of Motion*, Physical Review **D 40** (1989) 4073-4077.
- David B. Fairlie & Corinne A. Manogue, *The Formulation of Quantum Mechanics in Terms of Phase Space Functions--The Third Equation*, Journal of Physics **A 24** (1991) 3807-3815.
- Tevian Dray, Corinne A. Manogue & Robin W. Tucker, *Particle Production from Signature Change*, General Relativity and Gravitation **23** (1991) 967-971. (Honorable Mention in Gravity Research Foundation 1991 Essay Competition.)

- Tevian Dray, Ravi Kulkarni & Corinne A. Manogue, *Scalar Field Quantization in Stationary, Non-Static Spacetimes*, *General Relativity and Gravitation* **24** (1992) 1255-1266.
- Corinne A. Manogue & Jörg Schray, *Finite Lorentz Transformations, Automorphisms, and Division Algebras*, *Journal of Mathematical Physics* **34** (1993) 3746-3767.
- Tevian Dray, Corinne A. Manogue & Robin W. Tucker, *The Scalar Field Equation in the Presence of Signature Change*, *Physical Review D* **48** (1993) 2587-2590.
- Tevian Dray, Corinne A. Manogue & Robin W. Tucker, *Boundary Conditions for the Scalar Field in the Presence of Signature Change*, *Classical and Quantum Gravity* **12** (1995) 2767-2777.
- Jörg Schray & Corinne A. Manogue, *Octonionic Representations of Clifford Algebras and Triality*, *Foundations of Physics*, **26** (1996) 17-70.
- Tevian Dray, Corinne A. Manogue, Jörg Schray, Robin W. Tucker & Charles Wang, *The Construction of Spinor Fields on Manifolds with Smooth Degenerate Metrics*, *Journal of Mathematical Physics* **37** (1996) 3882-3896.
- Paul Davies, Tevian Dray & Corinne A. Manogue, *Detecting the Rotating Quantum Vacuum*, *Physical Review D* **53** (1996) 4382-4387.
- Tevian Dray, George Ellis, Charles Hellaby & Corinne A. Manogue, *Gravity and Signature Change*, *General Relativity & Gravitation* **29** (1997) 591-597.
- Tevian Dray, C. A. Hurst & Corinne A. Manogue, *Topology Change: The Regulated Trousers and Tin Woodman Models*, *Communications in Mathematical and Theoretical Physics*, **1** (1998) 24-49.
- Tevian Dray & Corinne Manogue, *Finding Octonionic Eigenvectors Using Mathematica*, *Computer Physics Communications*, **115** (1998) 536-547 (invited paper).
- Tevian Dray & Corinne A. Manogue, *The Octonionic Eigenvalue Problem*, *Advances in Applied Clifford Algebras* **8** (1998) 341-364.
- Corinne A. Manogue & Tevian Dray, *Dimensional Reduction*, *Modern Physics Letters A* **14** (1999) 93-97 (invited paper).  
(Honorable Mention in Gravity Research Foundation 1991 Essay Competition.)
- Corinne A. Manogue & Tevian Dray, *Octonionic Mobius Transformations*, *Modern Physics Letters A* **14** (1999) 1243-1255.

- Tevian Dray & Corinne A. Manogue, *The Exceptional Jordan Eigenvalue Problem*, International Journal of Theoretical Physics, **38** (1999) 2901-2916 (invited paper).
- Tevian Dray, Jason Janesky, and Corinne A. Manogue, *Octonionic Hermitian Matrices with Non-Real Eigenvalues*, Advances in Applied Clifford Algebras, **10**, 193-216 (2000).
- Tevian Dray, Corinne A. Manogue, and Susumu Okubo, *Orthonormal Eigenbases over the Octonions*, Algebras, Groups, and Geometry, **19**, 163-180 (2002).
- Tevian Dray and Corinne A. Manogue, *Octonionic Cayley Spinors and E6*, in Proceedings of the **2nd Mile High Conference on Nonassociative Mathematics** (Denver 2009), Comment. Math. Univ. Carolin. **51**, 193–207 (2010).
- Corinne A. Manogue and Tevian Dray, *Octonions, E6, and Particle Physics*, in **Quantum Groups, Quantum Foundations, and Quantum Information: a Festschrift for Tony Sudbery**, J. Phys.: Conf. Ser. **254**, 012005 (2010).
- Tevian Dray, Corinne A. Manogue, and Robert A. Wilson, *A Symplectic Representation of E7*, in Proceedings of the **3rd Mile High Conference on Nonassociative Mathematics** (Denver 2013), Comment. Math. Univ. Carolin. **55**, 387-399 (2014).

## Publications on Curriculum Reform

### Books and Book Chapters:

- Tevian Dray and Corinne A. Manogue, *Bridging the Gap between Mathematics and the Physical Sciences*, in: **NSF Collaboratives for Excellence in Teacher Preparation**, eds. Diane Smith and Elisabeth Swanson, Montana State University, Bozeman, September 2005.
- Tevian Dray and Corinne A. Manogue (2011-2014), *The Geometry of Vector Calculus*, <http://www.math.oregonstate.edu/BridgeBook>.

### Refereed and Invited Articles:

- Tevian Dray and Corinne A. Manogue, *The Vector Calculus Gap*, PRIMUS **9** (1999) 21-28.
- Corinne A. Manogue, Philip J. Siemens, Janet Tate, and Kerry Browne (Department of Physics) & Margaret L. Niess and Adam J. Wolfer (Department of Science and Mathematics Education), *Paradigms in Physics: A New Upper-Division Curriculum*, American Journal of Physics, **69** (2001) 978-990.
- Tevian Dray and Corinne A. Manogue, *Electromagnetic Conic Sections*, American Journal of Physics, **70** (2002) 1129-1135.
- Corinne A. Manogue and Kenneth S. Krane, *The Oregon State University Paradigms Project: Re-envisioning the Upper Level*, Physics Today, **56** (2003) 53-58.
- Tevian Dray and Corinne A. Manogue, *Using Differentials to Bridge the Vector Calculus Gap*, College Mathematics Journal, **34** (2003) 283-290.
- Tevian Dray and Corinne A. Manogue, *The Murder Mystery Method for Determining Whether a Vector Field is Conservative*, College Mathematics Journal, **34** (2003) 238-241.
- Tevian Dray and Corinne A. Manogue, *Conventions for Spherical Coordinates*, College Mathematics Journal, **34** (2003) 168-169.
- Tevian Dray and Corinne A. Manogue, *The Geometry of the Dot and Cross Products*, Journal of Online Mathematics and Its Applications, **6** (2006).
- Corinne A. Manogue, Tevian Dray, & Barbara Edwards, *Why is Ampere's Law So Hard?* American Journal of Physics, **74** (2006) 344-350.

- David H. McIntyre, Janet Tate, and Corinne A. Manogue, *Integrating computational activities into the upper-level Paradigms in Physics curriculum at Oregon State University*, American Journal of Physics, **76**, 340-346 (2008).
- Elizabeth Gire and Corinne A. Manogue, *Resources Students Use to Understand Quantum Mechanical Operators*, 2008 Physics Education Research Conference, Edmonton, Canada: AIP Conference Proceedings, **1064** (2008) 115-118.
- Corinne A. Manogue & Elizabeth Gire, *Cognitive Development at the Middle-Division Level*, 2009 Physics Education Research Conference, Ann Arbor, MI: AIP Conference Proceedings, **1179** 19-22 (2009).
- Tevian Dray and Corinne A. Manogue, *Putting differentials back into calculus*, College Mathematics Journal, **41** 90-100 (2010).
- Emily van Zee & Corinne A. Manogue, *Documenting and Interpreting Ways to Engage Students in 'Thinking Like a Physicist'*, 2010 Physics Education Research Conference, Portland, OR: AIP Conference Proceedings, **1289** 61-64 (2010).
- Corinne A. Manogue, Leonard Cerny, Elizabeth Gire, Donald B. Mountcastle, Edward Price, and Emily van Zee, *Upper-Division Activities that Foster 'Thinking Like a Physicist'*, 2010 Physics Education Research Conference, Portland, OR: AIP Conference Proceedings, **1289** 37-40 (2010).
- Elizabeth Gire and Corinne Manogue, *Making Sense of Quantum Operators, Eigenstates, and Quantum Measurements*, 2010 Physics Education Research Conference, Omaha, NE: AIP Conference Proceedings, **1413**, 195-198 (2011).
- John R. Thompson, Corinne A. Manogue, David J. Roundy, Donald B. Mountcastle, *Representations of Partial Derivatives in Thermodynamics*, 2010 Physics Education Research Conference, Omaha, NE: AIP Conference Proceedings, **1413**, 85-88 (2011).
- Joseph F. Wagner, Corinne A. Manogue, and John R. Thompson, *Representation Issues: Using Mathematics in Upper-Division Physics*, 2010 Physics Education Research Conference, Omaha, NE: AIP Conference Proceedings, **1413**, 89-92 (2011).
- Corinne Manogue, Elizabeth Gire, David McIntyre, Janet Tate, *Representations for a Spins-First Approach to Quantum Mechanics*, 2011 Physics Education Research Conference, Omaha, NE: AIP Conference Proceedings, **1413**, 55-58 (2011).
- Mary Bridget Kustus, David Roundy, Tevian Dray, and Corinne Manogue, *An Expert Path Through the Thermo Maze*, 2012 Physics Education Research Conference, Philadelphia, PA: AIP Conference Proceedings, **1513** 234-237 (2012).

- Elizabeth Gire, Mary Bridget Kustus, and Corinne Manogue, *Supporting and Sustaining the Holistic Development of Students into Practicing Physicists*, 2012 Physics Education Research Conference, Philadelphia, PA: AIP Conference Proceedings, **1513** 19-22 (2012).
- Corinne A. Manogue, Elizabeth Gire, and David J. Roundy, *Tangible Metaphors*, 2013 PERC Proceedings [Portland, OR, July 17-18, 2013], edited by P. V. Engelhardt, A. D. Churukian, and D. L. Jones.
- Justyna P. Zwolak, Mary Bridget Kustus and Corinne A. Manogue, *Re-thinking the Rubric for Grading the CUE: The Superposition Principle*, 2013 PERC Proceedings [Portland, OR, July 17-18, 2013], edited by P. V. Engelhardt, A. D. Churukian, and D. L. Jones.
- David Roundy, Ayush Gupta, Joseph F. Wagner, Tevian Dray, Mary Bridget Kustus, and Corinne A. Manogue, *From Fear to Fun in Thermodynamics*, 2013 PERC Proceedings [Portland, OR, July 17-18, 2013], edited by P. V. Engelhardt, A. D. Churukian, and D. L. Jones.
- Grant Sherer, Mary Bridget Kustus, Corinne A. Manogue, and David Roundy, *The Partial Derivative Machine*, 2013 PERC Proceedings [Portland, OR, July 17-18, 2013], edited by P. V. Engelhardt, A. D. Churukian, and D. L. Jones.
- David Roundy, Corinne Manogue, and Mary Bridget Kustus, *Name the experiment! Interpreting thermodynamic derivatives as thought experiments*. *Am. J. Phys.* 82, 39-46 (2014).
- Mary Bridget Kustus, David Roundy, Tevian Dray, and Corinne A. Manogue, *Partial Derivative Games in Thermodynamics: A Cognitive Task Analysis*, *Physical Review Special Topics—Physics Education Research*, **10**, 010101 (2014).
- D. J. Roundy, E. Weber, G. Sherer, and C. A. Manogue, *Experts' Understanding of Partial Derivatives Using the Partial Derivative Machine*, 2014 PERC Proceedings [Minneapolis, MS, July 30-31, 2014], edited by P. V. Engelhardt, A. D. Churukian, and D. L. Jones, pp. 227-230.
- J. P. Zwolak and C. A. Manogue, *Revealing Differences Between Curricula Using the Colorado Upper-Division Electrostatics Diagnostic*, 2014 PERC Proceedings [Minneapolis, MS, July 30-31, 2014], edited by P. V. Engelhardt, A. D. Churukian, and D. L. Jones, pp. 295-298.
- David Roundy, Tevian Dray, Corinne A. Manogue, Joseph F. Wagner, and Eric Weber, *An Extended Theoretical Framework for the Concept of Derivative*, *Proceedings of the 18th Annual Conference on Research in Undergraduate Mathematics Education*, pp 919-924.
- David Roundy, Eric Weber, Tevian Dray, Rabindra R. Bajracharya, Allison Dorko, Emily M. Smith, and Corinne A. Manogue, *Experts' understanding of partial*

*derivatives using the partial derivative machine*, Phys. Rev. ST Phys. Educ. Res. **11**, 020126 (2015).

- Justyna P. Zwolak and Corinne A. Manogue, *Assessing Student Reasoning in Upper-Division Electricity and Magnetism at Oregon State University*, Phys. Rev. ST Phys. Educ. Res. **11**, 020125 (2015).
- E. Smith, J. Zwolak, and C. Manogue, *Student difficulties with complex numbers*, 2015 PERC Proceedings, [College Park, MD, 2015].
- Tevian Dray, Elizabeth Gire, Corinne A. Manogue, and David Roundy, *Interpreting Derivatives*, PRIMUS, (submitted, invited paper).

**Websites:**

- Paradigms Curriculum Development: <http://physics.oregonstate.edu/portfolioswiki>
- Vector Calculus Bridge Project: <http://www.math.oregonstate.edu/bridge>

## Major Invited Talks, Presentations, Workshops

### Physics and Mathematics:

- June, 1986                      *Boundary Conditions and the Structure of the Vacuum*, NATO Advanced Study Institute on the Physics of Strong Fields, Maratea, ITALY
- October, 1988                      845<sup>th</sup> Meeting of the American Mathematical Society: Special Session on Geometry and Mathematical Physics, Lawrence, KS, USA.
- June 1991                          Soviet-American Workshop on Mathematical Physics with Emphasis on Strings, Berkeley, CA, USA.
- February 11, 1997                      *When Do Rotating Detectors Click?*, Five College Colloquium Series, Mount Holyoke College, South Hadley, MA, USA.
- April 1997                          921<sup>st</sup> Meeting of the American Mathematical Society: Special Session on Octonions and Clifford Algebras, Corvallis, OR, USA (coorganizer).
- October 31, 2002                      *What does Geometry tell us about the Universe?* Scholars' Convocation, Grinnell College, Grinnell, IA, USA. (with Tevian Dray).

### Curriculum Reform:

- April 15, 2000                      *Paradigms in Physics: Revitalizing the Upper-division Curriculum*, American Association of Physics Teachers 2000 Department Chair Conference, College Park, MD, USA.
- April 29, 2000                      *Paradigms in Physics: Revitalizing the Upper-division Curriculum*, American Physical Society April 2000 Meeting, Long Beach, CA, USA.
- March 3, 2001                        *Paradigms in Physics: Revitalizing the Upper-Division Curriculum*, American Physical Society March 2001 Meeting, Seattle, WA, USA.
- October 21, 2001                      *Paradigms in Physics: Revitalizing the Upper-Division Curriculum*, 2001 Academic-Industrial Workshop, Rochester, NY, USA.



- June 13, 2002 *Revitalizing Quantum Mechanics in the Upper-Division Curriculum*, Gordon Science Education and Policy Conference, Mount Holyoke College, South Hadley, MA, USA.
- January 28, 2004 *Envisioning Upper-Division Reform*, American Association of Physics Teachers 2004 Winter Meeting, Miami Beach, FL, USA.
- June 3, 2004 *Paradigms in Physics: Revitalizing the Upper-Division Physics Curriculum*, Symposium on Physics Education: Meeting the Challenges of University Physics Education, Council for Higher Education in Sweden, Lund, SWEDEN
- June 13, 2004 *Revitalizing the Upper-Division Physics Curriculum*, 2004 Annual Congress of the Canadian Association of Physics, Division of Physics Education, Winnipeg, Manitoba CANADA.
- June 14, 2004 *Geometric Reasoning in Classical Mechanics*, Gordon Science Education and Policy Conference, Mount Holyoke College, South Hadley, MA, USA.
- June 15, 2006 *Easing the Transition to Upper-Division E & M*, Gordon Science Education and Policy Conference, Mount Holyoke College, South Hadley, MA, USA.
- January 2007 *Easing the Transition to Upper-Division Physics*, American Association of Physics Teachers 2007 Winter Meeting, Seattle, WA, USA.
- June 26, 2007 *Revitalizing Upper-level Physics*, New Faculty Workshop Reunion, sponsored by the American Association of Physics Teachers, College Park, MD, USA.
- March 15, 2009 *The Oregon State Paradigms Program for Upper-level Physics*, New Faculty Workshop Reunion, sponsored by AAPT, APS, AIP, and NSF, Pittsburgh, PA, USA.
- October 9, 2009 *The Magic of Teaching*, AOK Regional AAPT Meeting, Manhattan, KS, USA.
- October 10, 2009 *Bridging the Gap between Mathematics and Physics*, AOK Regional AAPT Meeting, Manhattan, KS, USA
- July 28, 2009 *Using Guiding Questions and Rubrics to Improve Students' Scientific Writing*, 2009 AAPT Summer Meeting, Ann Arbor, MI, USA.

- July 19, 2010 *The Magic of Teaching Middle-Division Physics Students*  
2010 AAPT Summer Meeting,  
Portland, OR, USA.
- July 20, 2010 *An Interactive Guide to the Paradigms in Physics Program,*  
2010 AAPT Summer Meeting,  
Portland, OR, USA  
Invited Panel Organizer.
- July 22, 2010 *Upper-Division Activities that Foster Thinking Like A Physicist,*  
2010 Physics Education Research Conference  
Portland, OR, USA.  
Panel Organizer
- July 22, 2010 *Documenting and Interpreting Ways to Engage Students in*  
*Thinking Like a Physicist,*  
2010 Physics Education Research Conference,  
Portland, OR USA.  
Panelist.
- June 26, 2010 *Case Study III: Oregon State University,*  
Western Regional SPIN-UP Workshop,  
sponsored by AAPT, APS, AIP, and NSF,  
California Polytechnic State University, San Luis Obispo, CA.
- August 6-10, 2010 *Upper-Division Physics Education Research Conference,*  
Wabash College, Crawfordsville, IN, USA.
- October 4-8, 2010 XIII Semana De Enseñanza de la Física  
Bogotá, COLOMBIA.  
Conferencia: *Active-Engagement Strategies that help students learn how to*  
*'Think Like a Physicist'*  
Curso 3 (sesión 1) *Vectors and Transformations*  
Curso 3 (sesión 2) *Electrostatics and Vector Derivatives*  
Curso 3 (sesión 3) *Electrostatics and Vector Integrals*  
Curso 3 (sesión 4) *Quantum Mechanics*
- October 6, 2010 *Teaching Students to "Think Like a Physicist"*  
Universidad Pedagógica Nacional,  
Bogotá, COLOMBIA.
- November 6, 2010 *Re-envisioning Upper-level Physics: Paradigms in Physics,*  
New Faculty Workshop Reunion,  
sponsored by AAPT, APS, AIP, and NSF,  
College Park, Maryland, USA.

- May 16-20, 2011 V Congreso Nacional de Enseñanza de la Física,  
Bogotá, COLOMBIA.  
Invited Talk: *Enseñanza de la Mecánica Cuántica*  
Workshop: *La Geometría de la Electroestática y la Magnetostática (2 parts)*
- August 4, 2011 *Representation Issues: Using Mathematics in Upper-Division Physics*,  
2011 Physics Education Research Conference  
Omaha, NE, USA  
Panel Organizer
- November 19, 2011 *Upper-Level Physics*, New Faculty Workshop,  
sponsored by AAPT, APS, AIP, and NSF,  
College Park, Maryland, USA.
- April 26, 2012 60<sup>th</sup> Anniversary of Korean Physical Society,  
*Re-envisioning Upper-level Physics*  
Deujon, KOREA
- April 27, 2012 Seoul National University, KOREA  
*Choosing an Appropriate Pedagogy and Fostering and Studying Complex-Reasoning Capabilities*,  
Seoul, KOREA
- June 23, 2012 Foundations and Frontiers in PER: Puget Sound  
*The Upper-Division Curriculum as a Whole*  
North Cascades Environmental Learning Center, Diablo, WA.
- August 2, 2012 *Supporting and sustaining the holistic development of students into practicing physicists.*  
2012 Physics Education Research Conference  
Philadelphia, PA, USA.  
Workshop Organizer
- November 2-4, 2012 *Upper-Level Physics*, New Faculty Workshop Reunion  
sponsored by AAPT, APS, AIP, and NSF,  
College Park, Maryland, USA.
- April 5-7, 2013 *Upper-Level Physics*, Experienced Faculty Workshop  
sponsored by AAPT, APS, AIP, and NSF,  
College Park, Maryland, USA.
- June 17-20, 2013 *Upper-Level Physics*, New Faculty Workshop  
sponsored by AAPT, APS, AIP, and NSF,  
College Park, Maryland, USA.

- July 18, 2013      *From Fear to Fun in Thermodynamics*  
2013 Physics Education Research Conference  
Portland, OR, USA.  
Workshop Organizer.
- July 18, 2013      *Tangible Metaphors*  
2013 Physics Education Research Conference  
Portland, OR, USA.  
Panelist
- November 8-10, 2013      *Upper-Level Physics*, New Faculty Workshop  
sponsored by AAPT, APS, AIP, and NSF,  
College Park, Maryland, USA.
- June 23-26, 2014      *Upper-Level Physics*, New Faculty Workshop  
sponsored by AAPT, APS, AIP, and NSF,  
College Park, Maryland, USA. Invited Talks (2)
- July 24-26, 2014      *Upper-Level Physics*, Experienced Faculty Workshop  
sponsored by AAPT, APS, AIP, and NSF,  
Minneapolis, Minnesota, USA.
- June 5-7, 2015      Workshop on the Status of the Upper-division Physics  
Curriculum, Corvallis, OR, USA. Main Conference Organizer.
- November 7-10, 2015      *Upper-Level Physics*, New Faculty Workshop  
sponsored by AAPT, APS, AIP, and NSF,  
College Park, Maryland, USA. Invited Talks (2)
- March 18-20, 2016      *Upper-Level Physics*, Experienced Faculty Workshop  
sponsored by AAPT, APS, AIP, and NSF,  
College Park, Maryland, USA.
- June 20-23, 2016      *Upper-Level Physics*, New Faculty Workshop  
sponsored by AAPT, APS, AIP, and NSF,  
College Park, Maryland, USA. Invited Talks (2)

**Colloquia:**

Bizillions! Sorry, I quit counting, lost track, don't even have a list available on request.

**Women in Science:**

- February 13, 1991      *Women in the Mathematical Sciences*  
Mathematical Sciences Research Institute, Berkeley,  
California, USA.  
Panelist on panel to encourage high school girls to pursue  
careers in mathematics,
- April 23-25, 1992      *Symposium on Graduate Study in Science for Undergraduate  
Women,*  
Corvallis, OR, USA.  
Welcome Address, Lab Tour, Panelist
- February 19, 1994      *Session on Dual Career Couples,*  
AAAS Meeting,  
San Francisco, CA, USA.  
Invited Talk
- April 14-17, 1994      *Symposium on Graduate Study in Science for Undergraduate  
Women,*  
Corvallis, OR, USA.  
Scientific Organizer
- January 25, 1995      *Women in Physics,*  
Department of Physics & Chemistry,  
Lancaster University, Lancaster, UK.  
Invited Speaker
- May 8, 1995      *Women in Physics at OSU,*  
Women in Physics Group, Adelaide, Australia.  
Invited Speaker
- October 12-15, 1995      *Symposium on Graduate Study in Science for Undergraduate  
Women,*  
Corvallis, OR, USA.  
Scientific Organizer
- October 25-27, 1996      *Symposium on Graduate Study in Science for Undergraduate  
Women,*  
Corvallis, OR, USA.  
Organizer
- November 14-16, 1997      *Symposium on Graduate Study in Science for Undergraduate  
Women,*  
Corvallis, OR, USA.  
Organizer

- March 13, 1997      *Women and Science: Success Stories*,  
OSU Bahá'í Club,  
Oregon State University, Corvallis, OR, USA.  
Panelist
- February 25, 2013      *Women STEMing Out*,  
Women's Center,  
Oregon State University, Corvallis, OR, USA.  
Panelist
- March 20, 2013      *Women in Physics Tea*  
Department of Physics  
University of California at Berkeley,  
Berkeley, CA, U.S.A.  
Invited Speaker
- February 26, 2014      *ΣMPWR: Mentoring and Partnerships for Women in RUME*,  
Preconference to RUME 13, Denver, CO, USA.  
Panelist
- January 15-17, 2016      The APS CUWiP (Conf. for Undergraduate Women in Physics)  
Oregon State University  
Corvallis, OR, U.S.A.  
Lab Tour, Invited Speaker

I played a lead role in four of the five NSF-funded Symposia on Graduate School in Science for Undergraduate Women. These Symposia each invite approximately 100 undergraduate junior women from the Pacific Northwest to OSU for 2-3 days to discuss graduate school in science. We offer panels and workshops on how to choose, apply-to, and fund graduate school, the importance of undergraduate research, and women's experience in graduate school and scientific careers. By providing timely information and encouragement, we hope to help women make better informed decisions about their career paths. I have also been responsible for implementing the evaluation and dissemination aspects of this project.

## Professional Service

### ***Service to the Profession:***

- 2001-04 Editorial Board, Physics Resource Letters, American Journal of Physics
- 2006-07 American Association of Physics Teachers, Committee on Physics in Undergraduate Education
- 2011-13 National Advisory Committee to NSF grant at the University of Colorado, Boulder
- 2012-2014 American Association of Physics Teachers, Undergraduate Curriculum Task Force

Also assorted NSF panel reviews, external letters for P&T reviews in PER, reviewer for several journals.

### ***University Service:***

- 1996-98 Faculty Senate
- 2000-01 College of Science Service Course Workgroup (co-chair)
- 2003-5 Co-developed, applied for funding for, and supervised the teaching of: *Making Connections: A skills course for pre-engineers.*
- 2008-09 Member of the Baccalaureate Core *ad hoc* Review Committee.
- 10/22/2010 Coordinated, for the OSU Foundation, a presentation for the OSU College of Science Board of Visitors that highlighted not only current research at OSU, but also the ways in which our teaching/learning environment is developing and using current best practices.
- 9/15/2011 Coordinated, for the OSU Foundation, a presentation for the OSU Board of Trustees that highlighted not only current research at OSU, but also the ways in which our teaching/learning environment is developing and using current best practices.
- 2011 Member of the Steering Committee responsible for setting up the new Center for Research in Lifelong STEM Learning.
- 2011-12 Hiring Committee for Science Education faculty in the College of Education.
- 2012-13 Hiring committee for Instructors in the Department of Chemistry.
- 2012-13 Member of the University Council on Student Engagement and Experience.
- 2013 Developed and taught the UEngage Course: *Working with Youth in the Community.*
- 2014-15 New Faculty Workshop for the College of Science

- 2008-15 Coordinator for the ESTEME group, a research cluster within the Center for Research in Lifelong STEM Learning.
- 2015- OSU ADVANCE recruitment and advancement implementation group
- 2015-16 New Faculty Workshop for the College of Science

***Departmental Service:***

- 1987-88 Pre-Med. Advising.
- 1988-89 Undergraduate Curriculum Committee (Chair), TA Selection Committee.
- 1989-90 Undergraduate Curriculum Committee (Chair), TA Selection Committee.
- 1990-91 Undergraduate Curriculum Committee.
- 1991-92 Comprehensive Exam Committee.
- 1992-93 Comprehensive Exam Committee, Graduate Curriculum Committee.
- 1993-94 Long-Range Planning Committee, Graduate Curriculum Committee, Nuclear Physics Search Committee, P&T (2 cases).
- 1994-95 Sabbatical
- 1995-96 Undergraduate Curriculum Committee, Apprentice Program.
- 1996-97 Advisory Council, Undergraduate Curriculum Committee, Apprentice Program.
- 1997-98 Chair Search Committee, Advisory Council, Long-range Planning Committee, Undergraduate Curriculum Committee, Advisor to OSU Bahá'í Club.
- 1998-99 Undergraduate Curriculum Committee (Chair), Women in Physics Committee.
- 1999-00 Women in Physics Committee (Chair).
- 2000-01 Colloquium Committee (entire academic year, Chair for Fall Term), Women in Physics Committee (Chair), Departmental Promotion & Tenure Committee (Candidate's Representative).
- 2001-02 Sabbatical
- 2002-03 Director of Paradigms in Physics Group, Colloquium Committee (entire academic year, Chair for Fall Term).
- 2003-04 Director of Paradigms in Physics Group, Wrote Departmental Assessment Plan, Designed and supervised remodel of Weniger 304,
- 2004-05 Director of Paradigms in Physics Group, TA Selection Committee (Chair), Designed and supervised remodel of Weniger 304, Assessment.



- 2005-06 Director of Paradigms in Physics Group (spearheaded writing of successful new grant proposal), Instructor Hiring Committee (Chair), Assessment.
- 2006-07 Director of Paradigms in Physics Group, Faculty Hiring Committee (Chair), Assessment.
- 2007-08 Director of Paradigms in Physics Group, Assessment.
- 2008-09 Director of Paradigms in Physics Group, Lower Division Course Group, Upper Division Course Group (Chair), Colloquium Committee, Teaching Seminar, Assessment.
- 2009-10 Sabbatical, Assessment Plan.
- 2010-11 Director of Paradigms in Physics Group, Lower Division Course Group, Upper Division Course Group (Chair), Colloquium Committee, Teaching Seminar, Assessment, P&T (one case, teaching committee).
- 2011-12 Faculty hiring committee (Chair)—PER, Director of Paradigms in Physics Group, Graduate Admissions, Lower Division Course Group, Upper Division Course Group (Chair), Teaching Seminar, Assessment, P&T (2 cases, teaching committees).
- 2012-13 Director of Paradigms in Physics Group, Lower Division Course Group, Upper Division Course Group (Chair), Design First-Year Experience Course, Teaching Seminar, P&T (two cases, personal representative for one case, teaching committee for two cases), Teaching Trio.
- 2013-14 Department Chair hiring committee, Director of Paradigms in Physics Group, Lower Division Course Group, Upper Division Course Group (Chair), First-Year Experience Course, Investigate APS Bridge Programs, P&T (two cases, personal representative for one case, teaching committee for one case), Teaching Trio.
- 2014-15 Faculty hiring committee—PER, Director of Paradigms in Physics Group, Upper Division Course Group (Chair), First-Year Experience Course, Teaching Trio, P&T (one case).
- 2015-16 Paradigms 2.0 Task Force (Lead), Director of Paradigms in Physics Group, Upper Division Course Group (Chair), First-Year Experience Course, P&T (two cases, teaching committee chair for one case).
- 2016-17 Paradigms 2.0 Task Force (Lead), Director of Paradigms in Physics Group, Upper Division Course Group (Chair), P&T 3<sup>rd</sup> year review (three cases).

## ADVISING

### Postdoctoral Scholars

Paul Emigh, current

Rabindra Bajracharya, 2014-2015

Justyna Zwolak, 2012-14.

Mary Bridget Kustus, 2011-2013.

Elizabeth Gire, 2007-2009.

Now Assist. Prof. @ Missouri Southern

Now Postdoc. Assoc. @ Florida International

Now Assist. Prof. @ DePaul University

Now Assist. Prof. @ Oregon State University

### Graduate Students (Major Professor)

Emily Smith, Ph.D. 2016

*Students Understanding of Complex Numbers in Middle-Division Physics*

Emily Smith, M.S. 2014

*Student and Textbook Presentation of Divergence*

Leonard Thomas Cerny, Ph.D. 2013, College of Education

*Geometric reasoning in an Active-engagement Upper-Division E&M Classroom.*

Leonard Cerny, M.S. 2007

*Using Interrelated Activities to Develop Student Understanding of Electric and Magnetic Fields*

Kerry Browne, Ph.D. 2001

*A Case Study of How Upper-Division Physics Students Use Visualization While Solving Electrostatics Problems*

Katherine Meyer, M.S. 1998

*The Integration of Interactive Activities into Lecture in Upper-Division Theory Courses*

Jörg Schray, Ph.D. 1994

*Octonions and Supersymmetry*

Shawna Kondo, M.S. 1994

*The Rotating Vacuum*

### Undergraduate Thesis Students

Ian Founds, B.S. 2017 (expected)

Michael Goldtrap, B.S. 2016 (expected)

Grant Sherer, B.S. (Honors—De Loach Scholar) 2014

*Examining Upper-Division Thermodynamics Using the Actor-Oriented Transfer Framework.*

Drew Watson, B.S. (Honors) 2008

*The Impact of Guiding Questions and Rubric in the Scientific Writing of Middle-Division Physics Students*

Joshua Stager, B.S. 2006

*Creating the Paradigms Portfolio: A new exercise in web-based curriculum documentation*

Scott Broughton, B.S. 1996: *Octonions*

Brian Brisbane, B.S. 1996: *Casimir Effect*

Milton Cornwall-Brady, B.S. 1994: *Klein Paradox*

**Other Research Students**

<u>Year</u>	<u>Student</u>	<u>Research Topic</u>
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Other Graduate Research Students including Reading & Conference:

1988-89	Love	Relativity
1988-89	Dundon	Complex Variables
1990-91	Symmes	Changing Topology
1995-96	Dragowsky	Klein Paradox
1996-97	Davis-Butts	Physics Education
1997-98	Janesky	Octonionic Eigenvalues

I no longer track the large number of students on whose committees I have served.

Other Undergraduate Research Students:

1989-90	Suek	Klein Paradox
1989-90	Oden	Klein Paradox
1990-91	Larson	Klein Paradox
2013-14	Auparay	Narratives