

# Dr. Katrina Hay, Associate Professor and Director of Dual-Degree Engineering

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## Education

2002-2008 Oregon State University Corvallis, Oregon

### **Physics Doctorate, Emphasis in Fluid Physics**

- Pore-scale Fluid Physics, Fluid Instabilities, Quantum Physics, Electromagnetism, Dynamics, Thermodynamics, Statistical Mechanics, Solid State Physics, Atomic Molecular Optics, Quantum Field Theory, Computational Physics, Geodynamics, Crustal Seismology, Physics and Chemistry of the Earth, Teaching Seminar

1998-2002 Linfield College McMinnville, Oregon

### **Bachelor of Science in Physics and Bachelor of Science in Mathematics**

- Deans List 2001-2002

## Experience

### **Assistant (2008-2014) and Associate (2014-present) Professor of Physics, Pacific Lutheran University, Fall 2008-present**

- Research-based interactive teaching in advanced and introductory level physics classes
- Direct Dual-Degree Engineering Program, acting as liaison to affiliate universities, to help students graduate with degrees in engineering
- Fluid physics and observational astronomy research and physics education research, mentoring students
- Write and peer-review scholarly work
- Physics and astronomy public presentations for children and adults
- Service and committee participation

### **Online Physics Quiz Author, W.H. Freeman and Company Publishers, 2012**

- Authored 560 multiple choice questions with answer-specific feedback to accompany physics textbook, "University Physics for Life Sciences"

### **Soil Physics Research Intern, Oregon State University Crop and Soil Science Department, 2005-2008**

- Experimental investigation of fluid transport in fractures to develop a theoretical transport equation

### **Mentor Teacher, Oregon State University Physics Department, 2007**

- Worked closely with physics instructor learning to organize a course and plan lectures, demonstrations and tests for Introductory Physics course and Astronomy course

### **Research Mentor, Oregon State University Soil Science Program, Summer 2007**

- Designed fluid physics research project and guided an undergraduate through an experimental research experience
- Evaluated student's work for submission as a senior thesis and national conference presentation

**Science Intern, NASA Jet Propulsion Laboratory, Summer 2005**

- Timeline development for the Dawn mission spacecraft in its orbit around asteroid Vesta, using a spacecraft-specific computer software
- Weekly meetings with the Dawn Spacecraft Science Team

**Teaching Assistant, Oregon State University Physics Department, 2002-2005**

- Recitation and Lab for Introductory Physics with Calculus, Astronomy, Paradigms of Physics (year-long junior level)

**Geophysics Researcher, Oregon State University Geophysics Department, Summer 2004**

- Calibrated raw data from the MBARI (Monterey Bay Aquarium Research Institute) June 2000 cruise, developed and analyzed thermal profiles of Southern Hydrate Ridge (off the Oregon coast)

**Laser Optics Lab Researcher, Oregon State University Physics Department, Winter 2004**

- Instrumentation repair of hardware malfunction in Argon Ion Laser

**Nuclear Physics Researcher, Linfield College Physics Department, 2001-2002, Undergraduate Senior Thesis**

- Revised and wrote FORTRAN programs to simulate Heavy Ion collisions, and compare to Au-Au collisions at RHIC (Relativistic Heavy Ion Collider) in Brookhaven, New York.
- Oral Presentation of Senior Thesis at 2001 Murdock Science Conference

**Astronomy Intern, Pacific Northwest National Laboratory, Summer 2000**

- Repaired Rattlesnake Mountain Observatory telescope instrumentation to improve tracking for telescope automation
- Captured astrophotographs and created an educational web page on sun spots, led public tours of observatory

**Camp Program Director (Summer 2003) and Counselor (Summer 2002), Camp Lutherwood Oregon**

- Directed and created summer camp programs, counseled and directed staff
- Counselor for campers ages 7-17, responded to emergencies
- Presented weekly "Star Talks" for staff and campers to discuss astronomy and cosmology
- Designed program and instructed "model rocket" camp

**Adventures in Learning Teacher, Oregon State University, Summer 2004**

- Taught Rollercoaster Physics and Astronomy courses (daily, two weeks each) to middle school students

**Teaching Assistant, Linfield College Physics Department, 2000-2002**

- Bi-weekly tutor for students in the Introductory Physics with Calculus classes
- Graded Introductory Physics assignments

### **Academic Physics Peer Advisor, Linfield College Office of Academic Advising, 2000-2002**

- Worked closely with a Faculty Advisor to co-teach an academic orientation semester class to freshmen interested in physics
- Guided 20 students each year through a college orientation and advised them individually throughout their freshman year

### **Resident and Student Apartment Advisor, Linfield College Housing, 1999-2001**

- Created academic, social and spiritual programs for residence hall students
- Responded to incidents and emergencies, filed reports

### **Science Community Service, 1999-2002**

- Presented physics concepts in theatre productions to elementary school students and community members
- Judged middle school science fair projects
- Presented the physics portion of Association of Women in Science event

## **Scholarly Activity**

### **Publications and Authorship**

- “Physical processes that control droplet transport in rock fracture systems” Katrina M. Hay, Physics Ph.D. Thesis, Oregon State University, April 29, 2008.
- “A Theoretical Model for the Wetting of a Rough Surface” Journal of Colloid and Interface Science, Katrina M. Hay, Maria I. Dragila, James Liburdy; Volume 325, Issue 2, 15 September 2008, Pages 472-477.
- “Physics of Fluid Spreading on Roughness”, Special Issue on Modeling, Analysis and Simulations of Multiscale Nonlinear Systems, Conference proceedings, Oregon State University 2007 Katrina M. Hay, Maria I. Dragila; International Journal of Numerical Analysis and Modeling; Vol. 5 (2008).
- “Physics of energy as a travel course”, (Public Intellectual, article) published in EnergyTeachers.org Community Newsletter, Ithaca, NY, February 2012.
- 560 multiple choice questions with answer-specific feedback (Online Quizzes) (Scholarship of Teaching) requested by editor, for the publisher W. H. Freeman to accompany new textbook, “University Physics for Life Science” July 2012.
- “Teaching the Physics of Energy while Traveling by Train” The Physics Teacher, Vol 51 February 2013.
- “How Tongue Size and Roughness Affect Lapping,” M. Hubbard and K. Hay, Journal of Undergraduate Research in Physics, 16 March 2013.
- “Physics of Energy: A Sustainability-Themed University Travel Course” in Handbook of Research on Pedagogical Innovations for Sustainable Development (IGI Global, USA, 2014), pp. 442-453.
- Illustrated Children’s Book “Little Bear’s Big Night Sky,” K. Hay, CreateSpace Independent Publishing, North Charleston, SC, 2015.
- “9. Initial pipe development within epikarst microfractures” M. Dragila, K. Hay, S. Wheatcraft, chapter in The Geological Society of America Special Paper 516, pp. 129-136, DOI: 10.1130/2016.2516(10).
- “In Physics” Blog author, <http://in-physics.blogspot.com>

## Selected Presentations

- Fall 2009, Mentored Student Conference Presentation: Student intern, Jacob Berman, Murdock Conference, Gonzaga University, Spokane, WA. “A video analysis of film left behind fluid droplets in fractured rock.”
- Fall 2009, Research Presentation: American Geophysical Union (AGU) national meeting, “A high-speed video analysis of advancing and receding droplet interfaces in simulated rock fractures.”
- Spring 2010, Co-authored Presentation: (presented by Dr. Carolina Ilie, Professor of Physics at SUNY Oswego College) Fifth SUNY-Oswego Symposium on Learning and Teaching, A Celebration of Meaningful Learning: Engaging Students, “How to Implement JITT - Just In Time Teaching.”
- Spring 2010, Co-authored Presentation: (presented by Dr. Carolina Ilie) Conference on Instructional Technologies in Plattsburgh, NY May 2010, titled “Do you JITT? Benefits of using Just In Time Teaching at SUNY Oswego and Pacific Lutheran University.”
- Spring 2010, Research Presentation: Co-presenter (with Dr. Alex Chediak, California Baptist University), American Physical Society (APS) Spring 2010 Meeting, “Improving the Force Concept Inventory.”
- Spring 2010, Conference Presentation: (Co-authored with Dr. Carolina Illie) American Physical Society (APS) Spring 2010 Meeting, “How to Implement JITT - Just In Time Teaching?”
- Fall 2010, Invited Research Presentation: Oral presentation on environmental fluid physics research to the University of Puget Sound science community.
- Spring 2011, Scholarly Presentation: “Physics of Energy, A Travel Course,” Pacific Northwest Association of Physics Teachers (PNACP), Moscow, Idaho.
- Summer 2011, Scholarly Presentation: “Physics of Energy by Train,” 2011 American Association of Physics Teachers national meeting, Omaha, Nebraska.
- Fall 2011, Mentored Student Conference Presentation: Murdock Conference for undergraduate research, student intern, Matthew Hubbard, presented poster on our fluid physics research project, Seattle University.
- Spring 2012, Co-authored Research Presentation: Alex Chediak, Carolina Ilie (presenter), Katrina Hay, Trevor Johnson-Steigelman, “Assessment Tool Expanded: Force Concept Inventory”, April 18 2012, Quest - Research Conference at SUNY Oswego, Oswego, NY.
- Spring 2012, Mentored Student Research Presentation: Research intern Matthew Hubbard presented an oral presentation about our summer research entitled, “The Physics of Cat Lapping” to the PLU Board of Regents meeting.
- Spring 2012, Mentored Research Presentation: Research Intern, Matthew Hubbard, presented a poster on our research, “How does Tongue roughness affect Lapping?” Student-Faculty Collaborative and Creative Projects Celebration.
- Summer 2012, Scholarly Presentation: “Cat lapping: a fluid physics project for undergraduate students,” Beyond First Year Physics Laboratory Conference, Philadelphia July 2012.
- Summer 2012, Scholarly Presentation: “Pre-Course Student Questions as Motivators for Class Lessons” at the 2012 national meeting of American

Association of Physics Teachers, Philadelphia August 2012.

- Fall 2012, Co-author Conference Research Presentation: Research Intern, Matthew Hubbard presented “How tongue size and roughness affect lapping” Northwest Section American Physical Society, Vancouver, B.C., Canada.
- Fall 2012, Co-author Scholarly Presentation: “Curiosity Questions” poster presented (by Dr. Carolina Illie), Symposium on Learning and Teaching, SUNY Oswego.
- Fall 2013, Co-Author Research Presentation: “Erosion potential of capillary solitons in fluid transport through the epikarst” Maria Inés Dragila and Katrina M. Hay, Geoscience Association Denver, Colorado, October 2013.
- Fall 2013, Co-Author Research Presentation: “Capillary Droplets Embedded in a Lubricating Film: Enhancing rock-liquid solute transfer” Maria Inés Dragila and Katrina M. Hay, Geoscience Association Denver, Colorado, October 2013
- Spring and Fall 2014, Guest Lecture Series “Cosmology of the early universe,” “Space and time, not what they appear to be,” Gig Harbor Women’s Correctional Facility, Freedom Education Project
- Fall 2014, organized and hosted PLU’s first annual “Physics Demo Show”
- January 2016, “Celestial Navigation: Wise Ones Navigate by the Stars,” K. Hay, Agnus Dei Lutheran Church, Gig Harbor, Washington.
- Fall 2016, Mentored Student Conference Presentation: Student intern, Kimberly Belmes, Murdock Conference, Gonzaga University, Spokane, WA. “Sunspot Decay Rate Correlations and Temperature Ratios.”
- Fall 2016, Invited Talk “LightBoard Videos for a Flipped Classroom,” K. Hay, J. Stoeber, Northwest Academic Computing Consortium (NWACC), November 2016.
- Spring 2017, Guest on PLU Faculty Podcast “Open to Interpretation,” Host Amy Young, Episode titled, “Stress.”
- Summer 2018, Outreach website creation with Observational Astronomy Research Team, “PLU Astronomy Research” <https://pluastronomyresearch.weebly.com>
- Summer 2018, Invited Talk, “Our Place in the Universe: The Structure and Fabric of Space-Time,” K. Hay, event: Grit City Think and Drink UW Tacoma, WA, August 2018.
- Fall 2018, Mentored Student Conference Presentation: Student interns Justin deMattos and Megan Longstaff, Murdock Conference, Vancouver, WA. “Observational Astronomy in Tacoma: Analyzing Jupiter’s Rotation and the Brightness of Saturn’s Rings.”

## Research Mentorship

- Summer 2009, Research: Research: Mentored, with a Grant from Murdock Trust and NSCI, a Summer Undergraduate Research Intern (Jacob Berman, chemistry major), project on Environmental Fluid Physics.
- Summer 2009, Host Research Event: “Fluid Lab Open House” for PLU summer science research community (see Lab Photos on Dr. Hay’s website).
- Summer 2011, Research: Mentored, with a Grant from Murdock Trust and NSCI, a Summer Undergraduate Research Intern (Matthew Hubbard, physics

major), project on Pet Physics: Current Fluid Physics Phenomenology.

- Summer 2016, Research: Co-Mentored, with a Grant from Murdock Trust and NSCI, a Summer Undergraduate Research Intern (Kimberly Belmes, physics major) project on Sunspot Evolution.
- Summer 2018, Research: Co-Mentored, with a Grant from Murdock Trust and NSCI, a Summer Undergraduate Research Interns (Justin DeMattos, physics major, and Megan Longstaff, applied physics major) projects on Jupiter's Great Red Spot Rotation and Saturn's Rings' Intensity.

## Achievements and Activities

- *Outstanding Student Paper* at conference in Hydrology section for presentation: "Physics of two-phase flow on rough surfaces" at American Geophysical Union Conference 2006, San Francisco.
- *Certificate of Appreciation* for JPL internship and presentation awarded by the Oregon Space Consortium (2005 Annual Affiliate Meeting).
- Teaching Fellowship, Oregon State University 2002-2008.
- Sigma Pi Sigma (physics honor society), inducted in 2002.
- 2001 Murdock Science Conference research grant for summer internship, Nuclear physics with advisor Dr. Joelle Murray.
- ERULF (Energy Research Undergraduate Laboratory Fellowship), 2000, Rattlesnake Mountain Observatory at Pacific Northwest National Lab (PNNL).
- Linfield College Scholarships (4 private, 1 competitive, 1 faculty scholarship), 1998.
- Life Guard, Certification 1999.
- Life-long involvement in artistic performance, lessons and teaching (dance, art, theater and music).