

Physics & Astronomy

WESTERN WASHINGTON UNIVERSITY

Fall 2017

From the Chair



Welcome to our 2017 fall newsletter. You probably noticed that this newsletter comes to you at the start of the academic year instead of the end of Spring quarter. We decided that this time would be better in order to include the many events and awards that happen at the end of an academic year.

Look forward to our newsletter from now on arriving in the fall.

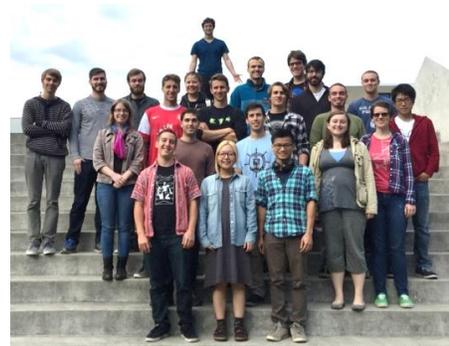
In the AY 2016/17 we graduated 19 students with a B.S. in physics; our 5-year average of 22 graduates ranks nationally in the top 2% out of the 500 universities with a B.S. as the highest degree.

We conducted a search for a new faculty in Physics Education Research in order to bolster our PER group which up to now consisted of only 1(!) faculty member (Dr. Andrew Boudreaux). We are very excited to have Dr. Thanh Le join us in September (you'll find a short blurb from her in this newsletter). Also in September we will have two (newish) alumni as lecturers in our department: Ms. Jennifer Villalva (class of 2009) and Ms. Linda Grabill (class of 2013). Welcome back to both of them! If you keep track, we now have 5 WWU alumni as faculty. In the coming year we will have two new searches for another faculty in PER and a faculty in Experimental Condensed Matter.

As every year, faculty and students have been very active doing research and presenting results at local and national meetings. Various students went to the APS March meeting in New Orleans and the AAS meeting in January in Grapevine, Texas. Our 9th Undergraduate Research Conference during WWU's Scholars week had a record of 16 presenters. Overall during the last AY, faculty and students published about 30 refereed journal articles and had about 25 conference presentations. All these great scholarly achievements were highlighted by Dr. Janelle Leger receiving the Paul J. Olscamp Research Award, given for outstanding scholarly contributions of one faculty member from either the College of Humanities and Social Science or the College of Science and Engineering. Congratulations and well deserved!

Enjoy the newsletter and I'm looking forward to hearing from you about your life after WWU.

Our Seniors 2016-2017



Student Awards 2016-2017

Our **outstanding graduate award** recipient was Huy Nguyen who was also selected as the College's Presidential Scholar. Huy was an exceptional student and researcher while at WWU, actively working on both astronomy and condensed matter physics research projects with Professors Covey and Leger. Huy is now pursuing his PhD in Physics at University of Michigan.



Holly Christensen received our department's **Student Community Service Award**. Among Holly's many contributions to our department: she was the president and a driving force behind the women in physics club, she led many public observing sessions, she was a star TA, and she was very active in undergraduate astronomy research with Professor Larson. Holly is now enrolled in a PhD program at UC Riverside.

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New faces in the Department

Professor Armin Rahmani



Dr. Armin Rahmani is an assistant professor in the WWU Physics and Astronomy Department and a member of the Advanced Materials Science and Engineering Center. He started at WWU in Fall 2016. Armin's research is in theoretical quantum condensed matter physics. He has been teaching senior-level quantum mechanics and first-year electromagnetism at WWU. Armin is interested

in novel strongly correlated phases of low-dimensional quantum matter, frustrated quantum magnetism, and the nonequilibrium dynamics of thermally isolated quantum systems. He is currently working on robust and optimal control of such quantum systems with applications to quantum information processing and other novel technologies, as well as strongly correlated phases of Majorana fermions. Armin received his Ph.D. from Boston University in 2011 and joined WWU after postdoctoral appointments at Los Alamos National Laboratory and the University of British Columbia.

Postdoctoral Fellow Marina Kounkel



Dr. Marina Kounkel is a postdoctoral scholar, working closely with Professor Kevin Covey. She recently graduated with a PhD in Astronomy from University of Michigan, and she was previously a student at the University of Toledo. Her research involves many aspects pertaining to star formation, with a specific

focus on stellar dynamics within the Orion Molecular Cloud Complex. She is using a variety of observational techniques ranging in wavelength from optical to radio to determine distances, proper motions, radial velocities, multiplicity, as well as ages of young stars. With these data, it should be possible to construct the true three-dimensional structure of the star forming regions, observe the dynamical evolution of neighboring clusters, determine how stars within individual clusters interact with each other, as well as trace the evolving history of triggered star formation within the region, in the efforts of trying to answer the questions of how and why clusters form.

Professor Thanh Lê



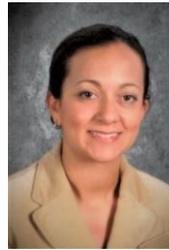
Dr. Thanh Lê is an Assistant Professor in the Department of Physics and Astronomy and the Science, Mathematics, and Technology Education (SMATE) program. Her research focus is physics education. Broadly, her research interest lies in metacognition, or thinking about thinking. In particular, she is interested in understanding how to teach students to think about how they are thinking

and learning about physics.

Prior to completing her Ph.D. in physics at the University of Maine, she was a high school teacher in the Bay Area. She received her B.A., M.A., and teaching credential from the University of California, Berkeley.

After five long winters in Maine, Thanh is happy to be back on the West Coast. She is especially excited about teaching at Western. So far, she has been enjoying Bellingham's mild climate and beautiful scenery.

Laboratory Coordinator Mojdeh Vahid



Mojdeh Vahid is the Physics Lab Coordinator for the lower division labs, a new position for the Department. In this capacity she oversees the setup, maintenance, and storage of the lab equipment; the performance of the 35+ undergraduate laboratory TAs; the evaluation of the lab experience for the 600+ students taking these courses each quarter; and the revision of the labs in coordination with the supervising instructors. She comes back to Western as an

alumnus with a B.S. degree in chemistry. She has experiences working as a quality assurance/validation specialist in manufacturing industry, a bio-analyst in research organizations, and as a high school chemistry teacher. She also served in the Peace Corps with her husband in Ghana as secondary school teachers in 2003-2005, where she taught chemistry and physics.

Northwest Astronomy meeting

In October of 2016, nearly a hundred professional astronomers from throughout the NW -- or even the SW, as our Canadian colleagues reminded us! -- converged on the WWU campus to share their latest research results at the 2016 Northwest Astronomy Meeting. The oral program included 18 research talks by faculty, postdocs and graduate students from regional neighbors (the Univ. of Washington, Univ. of British Columbia, Univ. of Victoria / NRC Herzberg Institute, Central Washington Univ., Whitman College & the College of Idaho), as well as two talks from WWU scientists: Postdoctoral Scholar James Davenport, and the meeting's only undergraduate speaker, WWU Senior Holly Christensen ('17).



Northwest Astronomy Meeting 2016, Western Washington University

Summer Research in the Department

This past summer saw more than 20 students working on research projects with faculty. This was an all-time record for our department! However we would like to be able to offer support for summer projects to even more of our majors. Please read about our **Undergraduate Summer Research Funding Campaign** on the [department website](#) or at vikingfunder.com. Every donation helps us support summer research for our students.

Here are summaries of some of the faculty mentored student projects completed this past summer:

Professor Janelle Leger

Valerie Beale built an experimental setup to study plasmon-polariton modes in the Kretschmann configuration for application to biosensing. **Karissa Langevin** worked to improve the absorption in polymer-based solar cells using a plasmonic waveguide back contact. **MacKenzie Jewell** studied the in-plane confinement in guided-wave plasmon polariton waveguides. **Joshua Spradlin** built and characterized nanoparticle based organic memory devices. **Jo'Elen Hagler** explored how silk/polymer biocomposite electromechanical actuators perform under biologically relevant conditions. **Corbit Samson** used polymerizable ionic liquids to construct a photovoltaic device based on a fixed-junction light emitting electrochemical cell structure. **Ariel Garcia** synthesized polymerizable ionic liquids and studied their electrochemical reactions with semiconducting polymers.

Professor Kevin Covey

Richard Ballantyne identified heavily accreting protostars whose near-infrared spectra feature strong Hydrogen emission lines from the Brackett series of atomic transitions. Measuring the strengths of several different transitions in each protostar's spectrum, Richard was able to infer the density and temperature of the gas the protostar is accreting from its planet forming circumstellar disk. **Jessica Reyna** improved techniques for the identification of close stellar binaries with spectra observed by the Sloan Digital Sky Survey (SDSS) / APOGEE project. Jessica worked to optimize processes for identifying spectra containing spectral features from multiple stars, and worked with colleagues in the math department to apply machine learning techniques to the resulting database of spectral properties to enhance the completeness of our recovery methods. **Jacob Skinner** derived orbital properties of close binaries with very low-mass stellar components. Working with 44 likely close binary stars with SDSS/APOGEE spectra, Jacob developed routines to measure the ratio of the masses of the system's constituent stars, and in cases with a sufficient number of measurements, derived a full description of the binary's orbit.

Professor Andrew Boudreaux

Andrew Hood received a WWU NASA Summer Research fellowship to develop and pilot test a new lab on air resistance for an introductory physics course. Together with Dr. Boudreaux, Andrew oversaw a pilot test of the lab in Dr. Seda's summer mechanics course. During one afternoon in July, the entrance foyer of the building was busy with students dropping foam balls from the 4th floor and figuring out how to position multiple timers to measure terminal speed. As part of the project, Andrew designed posttest questions to assess student learning. Andrew plans to present results at the Winter National AAPT Meeting in San Diego. **Austin Ward**, working with Dr. Boudreaux and supported by a Physics Department Summer research fellowship, developed a virtual-reality, batteries-and-bulbs circuits lab for the Oculus Rift + Touch system. Austin drew from existing research literature on student understanding of DC circuits to guide the design, layout, and features of the VR lab. He pilot-tested the lab with other researchers and students in order to refine the design for a larger organized study this coming year.

Professor Armin Rahmani

Scott Copas worked on the optimal dynamics of a two-qubit quantum system, determining the minimum time it takes to transform all pairs of ground states into each other, and characterizing a new dynamical distance between quantum states. **Dalton Jones** worked on the optimal preparation of a maximally entangled state of three coupled qubits. He has found optimal bang-bang protocols numerically and is working on analytical connections with the Pontryagin's minimum principle. **Kyle Ritland** worked on the optimal dynamics of quantum gates based on noisy Majorana fermions. Noise in control fields is unavoidable. However, he found dynamical protocols, which optimally minimize the harmful effects of noise. **David Seaman** worked on theoretical modeling of the transport properties of polymer-nanoparticle memory devices, in collaboration with Dr. Janelle Leger. He has developed codes to determine the current as a function of the applied voltage. We hope to uncover the mechanism for the operation of these devices with these numerical studies.

NSF Postdoc James Davenport

Riley Clarke, new WWU Physics graduate, worked towards finishing an ongoing project to study the magnetic activity of binary stars. Using data from the Kepler telescope, Riley has been comparing the rates of flares and rotation rates of "wide binary stars", systems where two stars of the same age can be compared directly. In June he presented this work alongside Dr. Davenport at NASA Ames in Mountain View, CA, and is writing a paper for submission this fall to a peer-reviewed journal.

Dr. Brandon Peden

Joseph C. Smith spent Summer 2017 preparing a manuscript based on his research on the theory of Bose-Einstein condensates of rigid rotor molecules. He plans on submitting the paper, tentatively titled *Bogoliubov theory of a Bose-Einstein condensate of rigid rotor molecules*, for publication in Physical Review A by the end of the fall.

Professor Melissa Rice

Natalie Moore and **Jack Boyd** were funded by the NASA Mars Science Laboratory mission to study spectroscopic images from the Curiosity rover and analyze the compositional variations of Mars' surface. They will present their results at the Lunar and Planetary Science Conference next March.

Professor Ken Rines

Nicholas Cemenenkoff worked on estimating the masses of galaxy clusters using dynamical modeling. He is comparing these mass estimates to estimates from simplified dynamical approaches. **Nicholas Earl** worked on determining the distribution of stellar light and stellar mass in galaxy clusters. Comparing radial profiles of stellar mass with profiles of gas mass and total mass will show how stars, gas, and dark matter are distributed within clusters.

Please join us at upcoming events!

Department seminars: most Thursdays at 4pm.

WWU Scholars week: May 14-18, 2018

<http://www.wwu.edu/scholars/>

P&A Undergrad Conference: May 17, 2018

P&A Annual Picnic: June 2018

To contact us for details on these and other events:

phone: (360)650-3818

email: physics@wwu.edu

webpage: cse.wwu.edu/physics



Alumni News

Carly Fengel ('16) is enrolled in the PhD program at Oregon State University.

Andrew Headley ('16) is currently in the Medical Physics DMP Diagnostic program at the Vanderbilt University School of Medicine.

Rachel Owen (Outstanding grad and Student Community Service award, '16) is in the PhD program at the University of Michigan.

David Nichols ('15) is employed as a Test Development Engineer at Qualitel Corporation. His position entails both hardware development and LabVIEW programming.

Clayton Knight ('12) has just released a new album and embarked on a 40-date concert tour of North America and Australia. You can catch up with him at odesza.com

Kellen Rosburg ('12) is employed as an Oceanographic Data Specialist for the physical oceanography branch of the the Hawaii Ocean Time-Series (HOT) at the University of Hawaii at Manoa. His work includes monthly research cruises and managing computer systems for the world's deepest unmanned oceanographic science platform.

Cassandra Cook ('10) is a member of the math faculty at Northwest Indian College and is very involved in the transition to outcomes-based assessment at the college.

Cedar Wolf ('06) is now based in Denver and is a senior recruiter with the Peace Corps.

Arwyn Smalley ('98) went on to get her PhD in Chemistry and is now a tenured member of the Chemistry department at Saint Martin's University.



The College of Science and Engineering together with several WWU student clubs announces the fifth annual fall social, "Movers and Shakers". This inclusive and unique event is geared towards all students on the Western Campus - particularly people from underrepresented groups in all branches of STEM (Science, Technology, Engineering and Math). The goal of the event is to foster inclusion in STEM on a multitude of levels and to change the stereotypical view of what "makes" a scientist, engineer or mathematician. Features of the event include: STEM Trivia, Expert Panel, Raffle Prizes, Free Food and Networking!