

Physics & Astronomy

WESTERN WASHINGTON UNIVERSITY

Winter 2020

From the Chair



Greetings Alumni and Friends of the WWU Physics & Astronomy Department, and welcome to our 2020 Winter newsletter. You may be wondering what happened to Dr. Riemann, but don't worry! He finished his term as Chair this past spring, and is now happily focused on being a regular faculty member again. I am grateful for the opportunity to take the reins from such a capable leader and am hopeful that I will be similarly able to keep the department from falling apart over the next four years!

There's quite a bit to be excited about as the department continues to grow and thrive. First, I would like to highlight the accomplishments of our class of 2019. Last year's student award winners included MacKenzie Jewell (Outstanding Graduate '19), who is currently pursuing a PhD in Ocean, Earth, and Atmospheric Sciences at Oregon State University, and Valerie Beale (Outstanding Student Service Award '19) who is pursuing a PhD in Physics at the University of Oregon. Congratulations and best of luck to both of these fantastic grads! I'd also like to direct your attention to the cutting-edge research opportunities that our faculty continue to provide to undergraduate students in condensed matter/materials physics, physics education research, and astronomy/planetary sciences. Learn more about these on page 3!

This year, we're hoping to add new faces to our department. Our long standing Technical Services Manager, Max Knittel, retired recently and we've just hired alumnus Geordon Brewer to take up the position (see more about Max's retirement on page 2). We're also busy recruiting new faculty in the areas of experimental physics and planetary geoscience. Hopefully we'll have many new faces in next year's newsletter!

Enjoy our newsletter, and please keep in touch!

Equity, Inclusion, and Diversity

Our department is excited to be playing an active role in Equity, Inclusion, and Diversity in the College of Science and Engineering by participating in the Community Ambassador (CA) program. The primary purpose of CAs is to improve support for marginalized students, staff, and faculty. Dimitri Dounas-Frazier and Melissa Rice have been selected as faculty Community Ambassadors for the Physics & Astronomy and Geology departments respectively, and Jess Mollerup is our first Student Ambassador.

APS Sectional Meeting



Congratulations to Nate Chapman and Mackenzie Jewell who both received best poster awards at the APS meeting!

The American Physical Society Sectional meeting that was hosted by WWU Physics and Astronomy in May 2019 was, by all accounts, a great success. Eight states or provinces were represented with a total of 112 attendees including 28 graduate students and 27 undergraduates. Our department contributed the banquet talk (Melissa Rice), a plenary talk (Andrew Boudreaux), two invited talks (Brandon Peden and Armin Rahmani), and 14 student talks or posters.

Our Seniors 2018-2019

As always, our seniors had a wide range of post-WWU plans including graduate programs, jobs in industry, and travel.



Left to right, Back: Collin Head, Mason Starr, Ethan Cohen, Lucas Browning, AJ Calder, Megan McAndie, Grace Baker, Corbit Sampson, Middle: Scott Gershon, Jacob Curtis, Luke Westbrook, Hunter Goff, Erick Powell, Kyle Young, Chris Babcock, MacKenzie Jewell, Valerie Beale, Reuben Szabo, Front: Abu Naimzadeh, Nick Earl, Josh Spradlin, Sarah Richardson, Karissa Langevin, Joseph Happold, Nate Chapman

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New faces in the Department

Department Manager Sara Lavender



In April, we welcomed a new Department Manager, Sara Lavender, to our team! She received her undergraduate degree from Portland State University where she majored in Applied Linguistics and Spanish and is currently enrolled in a Master's program in Educational Leadership & Policy. She is a dedicated administrative professional who thrives on solving the puzzles of bureaucracy

so that faculty and students can focus on doing what they do best: Physics and Astronomy! In her spare time she enjoys reading comics, fantasy and sci-fi, watching cartoons, playing board games, walking in the rain and learning to tie knots with the eventual goal of learning how to sail.

Instructor Nick Underwood



Dr. Nicolas Underwood received his PhD from Clemson University in 2019, where he also taught to support his research. Prior to this, he earned a postgraduate certificate in education and taught secondary school physics in London, UK. He holds two masters degrees in theoretical physics. One each from Imperial College London and the University of York. Nick's research concerns fundamental issues in quantum physics. His thesis asks the simple question: Could the quantum probability distribution $|\Psi|^2$ have arisen thermodynamically from an underlying quantum dynamics that is now hidden from view? He has publications considering both what is required for this to be the case, and also observable consequences were it so.

Max Retires!

Max Knittel, who has been the technical backbone of the Department of Physics and Astronomy for 44 years, retired in November of 2019. Over the years we estimate that Max touched the lives of some 30,000 undergraduate students and over 50 faculty through his work with teaching demonstrations and laboratories.

Max graduated from WWU Physics in 1971, worked as a technician physicist in a civilian Naval lab in San Diego, and as a senior engineer at Boeing, and then returned to the Physics & Astronomy Department to work as the department technician in 1975.

Max took on an ever-growing list of activities during the ensuing years: machinist and builder of demonstrations, chief plumber and electrician when new research equipment was installed, writer of operating procedures for virtually every single piece of apparatus in the department, emergency electronics repairman, laboratory teaching assistant and work-study student supervisor, building safety officer, the creator and instructor of a popular course entitled *Physics of High Fidelity*, liaison with facilities management, electronics, and machine shop personnel, New Building (2002-2004) liaison with architects and administration and supervisor of the move to the new building once it was completed, and budgetary accountant for all things laboratory-related. Max has been the one who shepherded the Physics & Astronomy department through an endless succession of computer platforms over the years: mainframes, DOS machines, early Apples, countless Windows and Macintosh operating systems, and Linux. In the early 2000s Max was instrumental in obtaining a number of internal Student Technology Grants that allowed the department to modernize the Junior Lab with experiments like High Tc superconductors, Nuclear Magnetic Resonance, Diode Laser Spectroscopy, Scanning Tunneling microscopes, Optical Pumping, Raman Spectroscopy, and LabVIEW hardware and software. And once all this new equipment arrived Max was the one who helped students and faculty get it working for the first time. Despite his busy schedule, virtually all of us faculty have had the experience of Max happily dropping everything and instantly coming to the rescue when a demo didn't work or lab apparatus broke down.

Amazingly enough, Max managed to do all of the above while also showing up on the hour, every hour, to set up classroom demonstrations for faculty! To most of us, Max's job probably sounds stressful. And yet Max always remained in good cheer and modestly described his job as "Christmas at the hobby shop".

The Max Knittel Scholarship

The department is excited to announce that we are establishing a scholarship for students interested in experimental physics in Max Knittel's name. Faculty have donated enough money to cover the scholarship for two years. We're now taking the fundraising effort to the next level, where we hope to raise enough money to endow the scholarship permanently! There are two easy ways to contribute to the Max Knittel scholarship:

Online: www.wwu.edu/give and click "My support area isn't listed" and then type in Max Knittel Scholarship.

By Check: make payable to the WWU Foundation, with Max Knittel Scholarship written in the memo line and send to: WWU Foundation, 516 High Street, Old Main 430, Bellingham, WA 98225

Student Research in the Department

Undergraduate student involvement in faculty research continues to be a hallmark of the WWU program in Physics and Astronomy. This past summer saw numerous students working on research projects with faculty. Many of these projects were funded thanks to the generosity of alumni and other friends of the department who contributed to our **Undergraduate Summer Research Funding Campaign**. Please read about the campaign on the Viking Funder website (<https://www.vikingfunder.com/project/8248>).

Here are descriptions of a few faculty mentored projects to give you a flavor of what our students are involved in:

Andrew Boudreaux

During Summer 2019, junior **Alex Peelle**, working with Andrew Boudreaux, developed a set of supplemental online HW assignments for introductory physics to promote fluency in mathematical reasoning. This intervention, designed on the basis of cognitive science principles, is being pilot tested this year in PHYS 161.

Marina Kounkel & Kevin Covey

Marina recently led a paper identifying families of stars in our Galactic neighborhood that are physically clustered and/or co-moving, significantly expanding the census of such stellar populations. This work received a major international press release, and was featured in the *Sky & Telescope* magazine. **Aidan McBride** had a first author publication with Marina, searching for runaway stars from the Orion Nebula. **Matt Scoggins & Erin Howard** contributed to a collaborative project Kevin & Marina developed with Brian Hutchinson (CS faculty) to use machine learning techniques to better understand the properties of stars with spectral data from the SDSS-IV/APOGEE survey. **Matt Scoggins** also published a AAS Research Note demonstrating how multi-year datasets from NASA's *Kepler* and *TESS* satellites constrain the timescales of stellar magnetic activity cycles with Kevin & former WWU postdoc **James Davenport** (now a research scientist at UW's DIRAC Institute). **Chase Boggio & Annaliese Miller** are demonstrating the ability to measure the masses and radii of eclipsing binary stars from sparse, but uniform, datasets constructed by combining radial velocity measurements from the SDSS-IV/APOGEE survey with numerous brightness measurements from the All Sky Automated SuperNova survey.

Dimitri Dounas-Frazer

Kimme Johnson and **Soojin Park** studied students' beliefs about the nature of experimental physics practice. They worked collaboratively to analyze transcripts from interviews with over 30 students who had recently completed a project-based upper-division physics lab course. **Kimme** and **Soojin** found that interviewees' ideas were consistent with the belief that there are many valid approaches to experimentation. Moreover, interviewees justified their views by drawing upon their own experiences working on projects as well as their observations of their peers' projects. This suggests that comparison between personal and vicarious experiences in project-based lab courses is an important mechanism that influences students' beliefs about the plural nature of experimental physics. **Kimme** and **Soojin** presented their work at the 2019 Physics Education Research Conference in Provo, Utah. Soojin was funded by the WA NASA Space Grant Consortium.

Janelle Leger

It was a busy summer in the Leger lab! **Ariel Garcia** continued her work understanding the electrochemistry of conjugated polymers oxidized using polymerizable ionic liquids, while **Avalon Hayes** and **Haley Holliday** worked to apply these same principles to create chemically-fixed junction photovoltaic (solar) cells. Our group is grateful to the department and to the CSE Jarvis Memorial Student Research Award for supporting the research efforts of **Max Cannella** and **Colin Marquis** this summer, who worked on the development of applications based on guided-wave plasmon polariton modes.

Melissa Rice

We study the geology of Mars using NASA's Mars rovers, orbital spacecraft data, and laboratory investigations of rocks and minerals. We look for clues about how water has interacted with Mars' surface over the past 4.5 billion years, and whether the Red Planet ever had the right conditions to support life. The Mars Lab was established in 2014 at Western Washington University by Dr. Melissa Rice, with the goal of engaging a diverse set of students in active research and operations of NASA missions on the Red Planet. Our group includes undergraduate and graduate (MSc) students from a variety of backgrounds, including geology, geophysics, physics, aerospace engineering, computer science and chemistry. You can follow what the Western Mars Lab is up to on our new webpage (<https://wp.wwu.edu/mars/>).

Andreas Riemann

Julia Thorpe worked during the summer on computational chemistry calculation in Dr. Andreas Riemann's group. She investigated the adsorption behavior of two organic molecules (PTCDA and CuPc) on an insulating single and double-layer of NaCl. The methods included electronic and conformational calculations using DFT and adsorption geometry and energy calculation using molecular mechanics. The results show a very close agreement with experimental STM measurements of the adsorption of these two molecules on a NaCl film. Students in Dr. Riemann's group will continue the study of these and other organic molecules with computational and experimental methods.

Armin Rahmani

Two students, **Sam Shuman** and **Matt Scoggins**, worked in my group this summer. Matt has been productively working on optimal-control-based quantum simulation of strongly correlated models with many-body systems of superconducting qubits for over a year. Sam started a project at the beginning of the summer on the phase diagram of a ladder of interacting Majorana fermions. He has been learning about theoretical techniques for many-body quantum systems, as well as the numerical density-matrix renormalization group method.

Milton From

During the summer of 2019 student **Benny Saack** worked on the preparation and characterization of thin magnetic films related to spintronics applications. These films had thicknesses in the range of 5-20 nanometers and were prepared by sputter deposition. Over the summer Benny did intensive training with in-house characterization techniques including scanning electron microscopy, x-ray reflectivity, magneto-optic Kerr effect, and Brillouin light scattering.

Please join us at upcoming events!

Department seminars: most Thursdays at 4pm.

WWU Scholars week: May 11-15, 2020

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

P&A Undergrad Conference: May 14, 2020

P&A Annual Picnic: June 2020

To contact us for details on these and other events:

phone: (360)650-3818

email: physics@wwu.edu

webpage: cse.wwu.edu/physics



Faculty News

Melissa Rice is the principal investigator on the recently funded NASA proposal: *Interpreting Rock Weathering on Mars Using Spectrogoniometry of Natural Rinds and Coatings*, \$302,509, NASA Solar System Workings Program, (awarded 2019-2021). Other contributors to the grant proposal were Mike Kraft of Scientific Technical Services, and Assistant Professor of Geology Sean Mulcahy.

Armin Rahmani co-organized an international workshop on "Engineering Nonequilibrium Dynamics of Open Quantum Systems" at the Max-Planck Institute for the Physics of Complex Systems in Dresden, Germany.

Regina Barber DeGraaff received a fellowship to attend the The Jackson Wild Media Lab (JWML) in September 2019. JWML is an immersive, cross-disciplinary science film making workshop that brings scientists and media creators together to learn from leaders in the profession and work together to develop effective tools to communicate about science, nature and conservation with diverse audiences across the world's evolving media platforms.

Dimitri Dounas-Frazer was a co-author on an article intitled *Active Learning Isn't Enough* that appeared in the Fall 2019 issue of the Observer (the Newsletter of the Society of Physics Students). The theme of this issue is *Toward a Culture of Inclusion*.

Alumni News

Luke Westbrook (2019), moved to Eugene, OR to start the Applied Physics master's program at the U of O. He attended his first graduate class less than 48 hrs after graduating with his B.S. in Physics from WWU! As part of the program, Luke has just accepted an internship with a Boise, ID company, Fiberguide, to work on developing new types of fiberoptic cables. Congrats Luke!

Joseph Smith (2018) is working on his PhD in physics at the University of Otago in Dunedin, New Zealand in the research group of Dr. Blair Blakie studying the behavior of ultracold dipolar Bose gases.

Jo'Elen Hagler (2017) is working on her PhD in Chemical Engineering at École Polytechnique de Montréal. She is investigating the use of conducting polymer coatings on metal electrodes as a way of improving neural signal recording and stimulation due to their mixed electronic-ionic conduction and biocompatibility.

Mix it Up, sponsored by the College of Science and Technology, was the 7th annual event focused on celebrating science, technology, engineering and math (STEM) at

Western Washington University. Each year has a new theme with a goal of showing the world that anyone can enjoy STEM and the people who are part of the STEM community are diverse and multifaceted. This year's event was on November 14 and was attended by over 200 students!



"Working to dismantle the scientist stereotype"