



# Quantum Times

Department of Physics Newsletter



## A Message To Our Alumni

Alumni support is essential to having a strong, vibrant department. We hope that reading this newsletter will inspire you to help the Department of Physics with a tax-deductible donation. Please see page 2 for more details.

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### Visit our webpage!

physics.nmsu.edu for more information about our programs and how to donate.

**GIVE NOW!**

Dear Alumni and Friends,

I have had the pleasure to serve as the Interim Department Head for the past year. Our permanent Department Head, Dr. Stefan Zollner, is currently on a one-year sabbatical leave, performing research at the Air Force Research Laboratory (AFRL), Albuquerque, and Extreme Light Infrastructure (ELI) Beamlines Laser Facility near Prague (Czech Republic).

This has been a very exciting year for the department. Both of our BS programs, the BS in Engineering Physics and the BS in Physics, sought separate program accreditations through the Accreditation Board for Engineering and Technology (ABET). Indications are that both programs will be officially accredited in summer of 2019. It should be noted that the BS in Physics program would be the first fundamental physics program in the US accredited by ABET! Our faculty continues to compete at the highest level of research, as evidenced by high-impact research publications and successful grant submissions. This Newsletter contains some examples of the accomplishments in research for our faculty.

Most important, however, is the educational mission of the department, and all faculty members are invested in achieving the educational objectives of our various programs, undergraduate and graduate. We find that our graduating students are very competitive in their chosen careers. The achievements of individual students and our student societies, Society of Physics Students (SPS) and Society for Engineering Physics (SEPh) students, have been recognized through college-wide awards; see just a few examples in this Newsletter.

For many of our students, academic success relies on the availability of departmental scholarships, which allows them to concentrate on their studies rather than needing to also work to afford college tuition and living costs. At this point, I would like to thank the many (sometimes very generous) donors who have contributed in the past. Thank you! No matter how large or small, your support helped to make a difference for individual students, and we hope that you will continue your support. If you haven't contributed in the past, please consider to also contribute to departmental scholarship and/or current-use funds.

Thanks in advance for your support.

Heinz Nakotte

Interim Department Head, Physics



To give a donation please visit [physics.nmsu.edu/giving.html](http://physics.nmsu.edu/giving.html) and follow the instructions written there. You can also look up the fund that you would like to donate to.

Provided on the website is a list of all the scholarships and funds that can be donated to.

If you have any questions, feel free to contact Marisela Chavez at [marisech@nmsu.edu](mailto:marisech@nmsu.edu) or (575)646-3831.

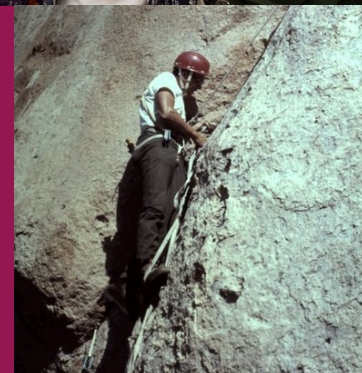
On April 27, 2018 the Department of Physics dedicated a room to Mr. Gale Harvey. Mr. Gale Harvey graduated from NMSU in 1962 with a Bachelor's Degree in Physics and went on to get a Master's in Physics at Virginia Polytechnic Institute and State University. He worked with meteor astronomy and directed the NMSU Meteor Spectra Patrol in the 1970s. Mr. Harvey had a 42-year career with NASA Langley Research Center in Hampton, Virginia where he worked on intercontinental ballistic missile reentries, atmospheric research lasers, and the space shuttle thermal protection system. Since retiring, Mr. Harvey has applied his science background in new ways, becoming a full-time beekeeper. He uses thermal analysis to alleviate heat stress on the bees. Mr. Harvey had established an endowed scholarship for physics students in 2007 and continues to support students through his scholarships. The lecture room where many physics students have their classes in was named the Gale A. Harvey Physics Classroom. *Pictured in the photo above from left to right: Arts & Sciences Dean Enrico Pontelli, Mr. Gale Harvey, and Physics Department Head Dr. Stefan Zollner.*



On April 4, Dr. George Goedecke and Mrs. Barbara Goedecke were presented with a room dedication of the Physics Conference Room. Dr. and Mrs. Goedecke have done a lot for the department even after Dr. Goedecke retired. They have created a scholarship for the most outstanding graduate student. The scholarship is named the George and Barbara Physics Excellence Fund. This year the award was given to graduate student Rigo Carrasco who had been nominated by the faculty.

Dr. Goedecke worked as a faculty member at NMSU since 1961 and served as department head from 1988-1995. He received his PhD from Rensselaer Polytechnic Institute. Dr. Goedecke has a distinguished record in the fields of electrodynamics, optics, acoustics, statistical physics, and atmospheric physics. Dr. Goedecke has also advised around a dozen graduate students in pursuing their degrees. Dr. Goedecke helped map out many of the hiking trails for the Organ Mountains and was often the first to rock climb to the top of many sites around Las Cruces. Aside from academics and outdoor activities, Dr. Goedecke also enjoyed music. He masterfully played the clarinet in a Dixieland Band and was a permanent fixture at the departmental Spring Physics Gala until recently.

Barbara Goedecke earned a M.S. in Biology from NMSU and worked for the Communicable Disease Center in Atlanta and a Veterinary Research Lab in Montana. She was a very active member in the Las Cruces Community serving as an officer for the League of Women Voters of Greater Las Cruces.





**Dr. Robert Cooper** has been an assistant professor at NMSU since Fall 2015 and also works at Los Alamos National Laboratory. He received his PhD from the University of Michigan in 2008. Currently, Dr. Cooper is teaching Intermediate Electricity and Magnetism II for the physics undergraduates and Engineering Physics II. Dr. Cooper also serves as the advisor for the Society of Physics Students where he works with the students to do outreach and recruitment for the Department of Physics. Dr. Cooper’s research interests include neutron interactions in neutrino, dark matter, and rare-search experiments.

Dr. Cooper has 4 undergraduates and 1 graduate student working with him on the CAPTAIN-Mills experiment. CAPTAIN-Mills is an effort to use coherent elastic neutrino-nucleus scattering to search for sterile neutrino oscillations and sub-GeV dark matter. It will be the first experiment to perform a neutrino disappearance measurement at the same energies as LSND. The current plan is to run in a near and far location in order to map the neutrino oscillation “wave.” It uses 10-tons of liquid argon at the Lujan Center which is part of the Los Alamos Neutron Science Center. Dr. Cooper is a founding member whose initial calculations validated the viability of the experiment. CAPTAIN-Mills is currently assembling the light collection units and neutron shielding for 2-month engineering run starting in November. Full production running will commence next year for at least 3 years. CAPTAIN-Mills includes world-leading institutions in neutrino physics such as LANL, Fermilab, MIT, U. Michigan, Indiana U., U. Pennsylvania, and NMSU.

Dr. Cooper has recently published a paper regarding his research on MiniBooNE where he served as analysis coordinator from 2013-2017. MiniBooNE is a  $\nu_\mu \rightarrow \nu_e$  neutrino appearance, oscillation search that ran in a beam off-target mode in 2014 to search for a low-mass dark sector particle. MiniBooNE is an 800-ton mineral oil Cherenkov tracking detector that has been running for over 15 years, and as a result is extraordinarily well understood. Currently, it is collecting more neutrino oscillation events and has doubled its neutrino mode data set to improve the search for sterile neutrinos.

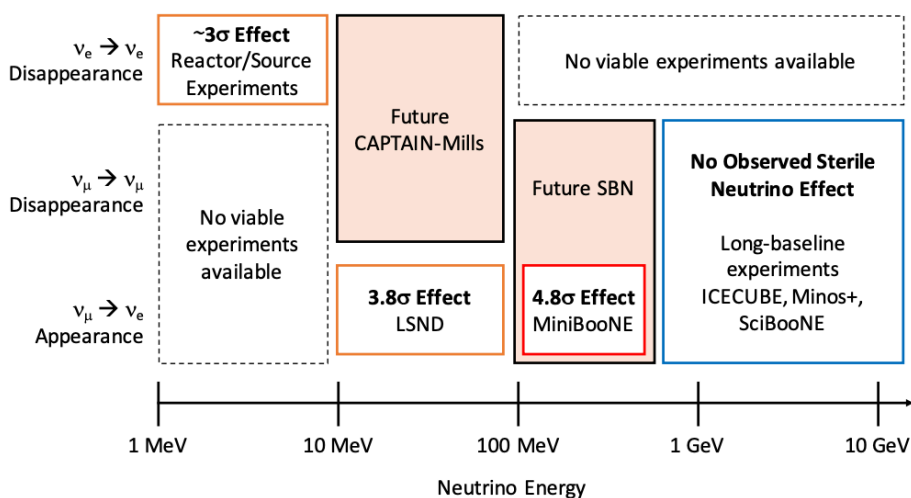


Figure 1: The current landscape for sterile neutrino searches. There are 3 rows which represent the type of neutrino oscillation measurement, and many experiments are sensitive to multiple types. The solid boxes are color coded to represent the significance of these results in sterile neutrino searches, blue/red for low/high significance. The shaded black boxes are future efforts on CAPTAIN-Mills and SBN which will make crucial first measurements that may corroborate longstanding anomalies.

## Department Highlights

- Dr. Papavassiliou and Dr. Pate were presented with an award that recognizes their research accomplishments at NMSU. The Department of Energy has renewed a \$1.26 million grant that funds Physics faculty, students, and post-doctoral students.
- Dr. Lauren Waszek published a paper titled "Global observations of reflectors in the mid-mantle with implications for mantle structure and dynamics" in Jan 2018 that was featured in Nature.
- The B.S. in Physics program applied for program accreditation through ABET's Applied Natural Sciences Accreditation Commission (ANSAC) as the first fundamental physics program in the nation! Preliminary findings indicate that the BS in Physics will be accredited by ABET-ANSAC.
- The B.S. in Engineering Physics program has its regular 6-year re-accreditation visit by ABET's Engineering Accreditation Commission (EAC) from Sept 29-Oct 1, 2018. Preliminary finds indicate that the B.S. in EP will be re-accredited by ABET-EAC in summer 2019.
- Dr. Burkardt and Dr. Engelhardt were granted a new grant from the Department of Energy for \$510,000 to help fund their research on quark gluon structure of hadrons in QCD.
- Jorge Garcia, a graduating senior, acquired an internship at Los Alamos National Laboratory. Mr. Garcia will be working on the Matter Radiation Interactions in Extremes project (MaRIE) to incorporate machine learning methods and develop predictive modeling systems to assist in the data analysis of the project.
- The Physics Summer Camp will be held during the week of July 15th-19th. SPS Secretary Mariana Aldavaz and Dr. Jacob Urquidi will be planning the event. They are hopeful of getting around 25 students to come to the camp and learn about physics and have some fun!



Dr. Mary Hockaday is a NMSU alumni where she acquired her M.S. (in 1984) and PhD (in 1986) in Physics. Currently Dr. Hockaday is working at Los Alamos National Laboratory where she is the Division Leader of Nuclear Engineering and Nonproliferation (NEN). NEN Division develops nuclear safeguards concepts and instruments used to monitor and measure nuclear materials, operates the Nation's only capability for nuclear criticality experiments, and develops unique nuclear reactor concepts. Dr. Hockaday has served in many positions over her 38 year career at LANL. Dr. Hockaday is an Association for the Advancement of Science Fellow and a Distinguished Alumni Awardee from the New Mexico State University Alumni Association. Dr. Hockaday also serves on the Physics Department Advisory Board and on the Board of Directors for the Girl Scouts of New

Mexico Trails. Dr. Hockaday recently visited the department to give a colloquium on her research on April 5th, 2019. Dr. Hockaday is held in high regard and respected by many in the Department of Physics.



**Dr. Marc Schlegel** is the newest addition to the faculty of the Department of Physics. Dr. Schlegel completed his PhD at Ruhr University Bochum in Germany in 2006. Afterwards he held a post-doctoral position at the Thomas Jefferson National Accelerator Facility from 2007-2009 and then a long term post-doctoral position at the University of Tübingen in Germany from 2010-2017. Dr. Schlegel decided to come to NMSU since he knew some of the faculty and knew that there is a strong nuclear physics group here. Dr. Schlegel does theoretical nuclear and particle physics where he uses the formalism of perturbative quantum chromodynamics to understand the data that is gathered at particle accelerators around the world. He is particularly interested in the structure of the nucleon and the properties of the nucleon that emerges from quarks and gluons.

From a recent publication, Dr. Schlegel shows a Feynman diagram for the process of two colliding protons where a pair of  $J/\psi$ 's are created. A  $J/\psi$  particle is a bound state of a charm-anticharm quark. By measuring this final state one could learn about the linear polarization of gluons in the nucleon. Since starting at NMSU, Dr. Schlegel has taught Graduate level Quantum Field Theory and Quantum Mechanics. Dr. Schlegel has been the advisor for the Society of Physics Students for two semesters. He currently has one graduate student doing research with him, Weeam Albaltan, who started doing research with Dr. Schlegel last fall. Dr. Schlegel has two children (aged 5 and 1) and likes to go hiking and camping with his family. They also enjoying doing road trips to explore the Southwest.

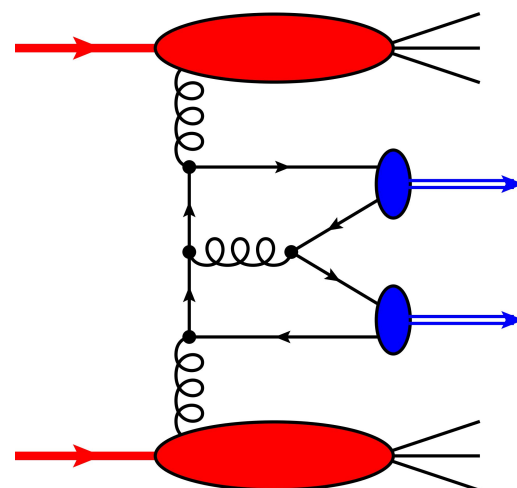


Figure 1: Feynman Diagram for  $pp \rightarrow J/\psi - J/\psi$

**PHYSICS GALA 2019** was held on April 12, 2019 at the Ramada hotel. Dr. Pate served as the host, presenting students with their awards. Both undergraduates and graduate students were honored at the event. 5 students were inducted into the Sigma Pi Sigma honor society. The awards given at the ceremony included: H. Bartel & Doris Williams Memorial, Gale Harvey Endowed, Albert & Mabel Burris, George & Barbara Goedecke, M. Miller & C. McClellan Memorial, Radziemski, Gilbert & Dolores Cano, and the Dr. Stephen & Brigitta Hanzely award.

*Pictured in the top right photo are the Gale Harvey Endowed Scholarship recipients. From left to right: Dominique Madrid, Jorge Garcia, Sarah Garner, Domunick Gonzales, Wade Kloppenburg, Joshua Morales, Devon Thompson, Esther Thompson, and Cesy Zamarripa.*





**Chase Brooks** is a graduating senior majoring in Physics with minors in Mathematics and Astronomy. Mr. Brooks graduated from Las Cruces High School in 2015 before deciding to come to NMSU. Originally, Mr. Brooks wanted to go into law school after acquiring his Bachelors but changed his mind because he fell in love with everything that Physics had to offer. Mr. Brooks will be attending the University of Colorado at Boulder to pursue a PhD in Physics. He has also done undergraduate research with Dr. Matthias Burkardt running theoretical quantum simulations in order to measure the magnetic polarizability of mesons in 2D. Mr. Brooks also participated in the JICS REU at the University of Tennessee in the summer of 2018. He did research in theoretical chemical physics, doing molecular dynamics simulations of largely cross-linked polymers and doing measurements of their bulk physical properties. Mr. Brooks has worked as a peer learning assistant and tutor for the Department of Physics. He has been a President's Associates Excellence Scholarship recipient since Fall 2015 and has received numerous awards from the Department of Physics. In his free time, he likes to play tennis, racquetball, and go swimming. Chase Brooks was also chosen as the Department of Physics Outstanding Senior for the Spring of 2019.



**Scott (Mason) Walls** is a graduating senior majoring in Engineering Physics with a concentration in Mechanical Engineering. Mr. Walls is the vice president of the Society for Engineering and Physics (SEPh) and is also a peer learning assistant and tutor for the Department of Physics. Mr. Walls is the Engineering Physics Outstanding Senior for Spring 2019. He is a College of Engineering Ambassador and has worked on some outreach events in the public. Mr. Walls has been an Ambassador for 2 years and has gained the reputation of being one of the most effective representatives when it comes to outreach and recruitment activities. He has received an award for Outstanding Student Teaching Assistant from the American Association of Physics Teachers. Mr. Walls is currently working with Dr. Charles Bruce as a research assistant doing research in fiber optics. He has also worked under Dr. Jessica Houston of the Chemical Engineering department doing research in flow cytometry and development. Mr. Walls has also done a summer internship at the Los Alamos National Laboratory doing code development for neutron shielding and another internship with the Four Corners Power Plant in Farmington, NM doing work on plumb column verification. After graduating, Mr. Walls will work for NavAir or White Sands Missile Range and plans to attend graduate school in a few years to pursue degrees in Nuclear Engineering and Business Administration. Mr. Walls is a dog lover and has two dogs of his own, one being a rescue who is deaf.



**Rigo Carrasco** is a second year graduate student, on track to a PhD. He started his college career at San Joaquin Delta Community College before transferring to UC Berkeley and graduating with a BA in Physics in 2017. While at UC Berkeley, he did research in the bioengineering department. Mr. Carrasco is currently the president of the Physics Graduate Student Organization and is organizing Physics Fun Day which is to be held on April 9th, 2019. He is working under Dr. Stefan Zollner and does research in characterizing the crystalline structure, quality and optical properties of semiconductor alloys through high resolution x-ray diffraction and spectroscopic ellipsometry. Mr. Carrasco's current research topic is about optical properties and band structure calculations of strained tin-germanium

alloys grown by molecular beam epitaxy. He is co-author on four publication with two listing Mr. Carrasco as first author. Mr. Carrasco has also been involved with the Air Force Research Lab Summer Faculty Fellowship Program during the summer of 2018. Mr. Carrasco worked along side his advisor at the Wright-Patterson Air Force Research Lab in Ohio. This research was to characterize the optical response of gray Tin and SnGe alloys as a function of alloy composition, temperature and strain state. After acquiring his PhD, he would like to work in a government research lab or in the private sector. In his free time, he likes to watch Netflix, go to the gym and hang out with his fellow classmates.



**Elijah Schold** is a first year graduate student that is pursuing a PhD with plans to complete a masters thesis in the fall. Mr. Schold is originally from Albuquerque and completed his undergrad here at NMSU. He decided to come to NMSU because he wanted to move away from home and decided to stay for his masters because he liked the research group he ended up in. At the end of his senior year, Mr. Schold got involved with Dr. Edwin Fochtung's research group. Mr. Schold is currently researching experimental x-ray/neutron physics and material science that focuses on nano-enabled mechanisms and functional defects. One technique that is used is called BCDI which enables them to look inside of nanoparticles and watch them change

under external perturbations. Mr. Schold does help out in community outreach and recruiting with the Society of Physics Students and has said that it is the best feeling to get students excited about science. Mr. Schold has traveled to the synchrotron in Chicago to collect data on the BCDI experiment which made him fall in love with experimentation. He has also traveled to the UK for another experiment and is expected to travel to Sweden this coming May. After graduating, he wants to pursue a post-doctoral position at a national lab or university.





**Rashni Anandawansha** is a second year graduate student, on track to a PhD. Ms. Anandawansha started her college career at the University of Colombo and is originally from Sri Lanka. During her undergrad, she was in the rowing and athletics team and was also involved in research during her final year. Ms. Anandawansha is currently working with Dr. Lauren Waszek and is studying properties of the inner core with an emphasis on inner core anisotropy, by looking at travel time differences for wave phases that interact with the inner core boundary. The inner core is not well understood and Rashni's studies will provide information on seismic wave speeds as they travel through

Earth and how these speeds differ based on the direction of their ray paths. Inner core anisotropy plays a role in discussions of how the inner core formed, a topic which is still up for debate. During the summer of 2018, she participated in the CIDER summer program at UCSB and recently won best graduate poster award at the APS Four Corners meeting last fall. Once Ms. Anandawansha finishes her degree she wants to get a job in a national lab or the private sector.



**Andrew Dotson** is a first year graduate student, on track to a PhD. Mr. Dotson graduated with a Bachelor's in Physics and a minor in mathematics from Old Dominion University. Mr. Dotson has found success in the world of physics education and entertainment through the use of his YouTube channel. He started his channel in order to inform potential physics students about his experience in his classes and his journey to graduate school. Mr. Dotson was inspired to make a youtube channel after seeing Simon Clark speak about his experiences at Oxford and wanted to do the same. He currently has 47,000 subscribers and has seen a large rise in numbers after posting a video called "Physics Professors Be Like" which has over 650,000 views. Mr. Dotson generally makes three types of videos a week: a heavy math/physics video over advanced topics, a comedy

based video, and a weekly vlog that focuses around the Physics Department. Mr. Dotson has been recording a series of videos where his subscribers ask the graduate students within the department questions and has previously done a tour of the Department of Physics. Last year, Mr. Dotson was approached by the Discovery Channel to film some scenes for their show "What on Earth." He filmed with the show for about 10 hours regarding several stories which have been released in episodes that will continue into this year. Mr. Dotson didn't enjoy the television aspect as much because it seemed a lot less personal and he didn't have a say in the editorial process like he does with his YouTube channel. He is now using his videos as a means of supporting himself which was never a goal since he started the channel as a hobby 3 years ago.

The **Society of Physics Students** has had an eventful year. SPS hosted the Boys Scouts of America in order for them to gain their Nuclear Science Badge. The scouts built an electroscope, visited a nuclear science lab, built models of isotopes, and learned about radiation. SPS has also visited multiple elementary schools and participated in STEMfest which was held by the Department of Education here at NMSU.



SPS has also began recruiting at local high schools, visiting Las Cruces High and Gadsden High School. SPS will host the yearly Physics Summer Camp during July 15-19th, 2019 where students will go over three days of physics, one day of chemistry, and one day of astronomy.

This year, the SPS officers were: President Sean Tierney, Vice President Jorge Garcia, Secretary Mariana Aldavaz, Treasurer Emily Medeles, and Media Representative Joel Cannon.

You can keep up with SPS at their website [sps.nmsu.edu](http://sps.nmsu.edu) where they upload photos of the events that they participate in!



The **Society of Engineering and Physics students (SEPh)** was created to cater engineering physics students as well as engineers and physicists. The group is mostly made up of undergraduate students but it is also open for graduate students.

This academic year, members were involved in several groups and organizations on campus to help the Engineering Physics program become known on campus. Members participated in Engineering Council, several engineering clubs, ASNMSU, and much more.

During Fall 2018, SEPh helped the E-council host a week long event of science and engineering activities. SEPh helped build homecoming floats, provided demos for middle and high school students, and volunteered to help the Girl Scouts of America through Virgin Galactic.

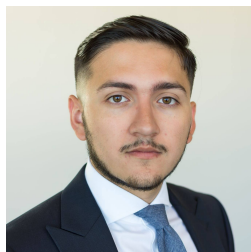
SEPh members have been working on projects to help solidify their understanding of physics and engineering. They have worked on projects like 3D-printing/maintenance, rocket building, building and testing a Tesla coil, rebuilding the Foucault pendulum, and engineering new box designs for the pendulum.

SEPh's biggest accomplishment was finalizing paperwork in order to create a SEPh national organization! Several universities have already pledged to participate and create their own SEPh organization.

This year, the officers were: President Juan Treto, Vice President Scott Walls, Secretary Zoe Burns, Treasurer Rebecca Holguin, Communication Officer Jorge Enriquez, and Engineering Representative Alexandro Solis.



Exit Interviews were conducted for the graduating class of the department but many chose not to comment about their future plans. Below are the students who were able to respond.



Jorge Garcia will continue at NMSU in order to acquire his Master's in Physics through the Accelerated Program. Mr. Garcia is graduating with a B.S. in Physics and a concentration in computational physics. He also acquired a minor in Astronomy.



Fatma Aslan will be graduating with her doctoral degree focusing on nuclear theory. Her advisor is Dr. Matthias Burkardt and she will continue to do research with him. She also works with Dr. Schlegel and Dr. Engelhardt.



Oscar Jaramillo Perez will be graduating with a B.A. in Physics and a supplemental major in Mathematics. He will attend Cornell University to pursue a PhD in Applied Physics.



Aimee Hatfield is graduating from the Physics Engineering Program with a concentration in Electrical Engineering. After graduation, Aimee has a job lined up working as an Electrical Engineer at Raytheon.



Patrick Miller will continue at NMSU in order to pursue a Master's in Electrical Engineering. His interests are optics, photonics, and signal processing. Mr. Miller will be graduating with B.S. in Physics and a concentration in optics.



Jeongsu Bok is graduating with his PhD that focused in particle physics. Dr. Papavassiliou and Dr. Pate were his main advisors. Bok will now pursue a post-doc position in South Korea.

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## College of Arts and Sciences Student Awards

Chase Brooks was nominated by Dr. Stephen Pate for the Dean's Undergraduate Award for Excellence which is the highest award for undergraduate students. Mr. Brooks received the award for his accomplishments over the years at NMSU. Mr. Brooks was previously mentioned in this newsletter and has also received the Department of Physics Outstanding Senior award. During his time at NMSU, Mr. Brooks acquired a 4.0 GPA while working as a supplementary instructor and as a tutor.

Mariana Aldavaz was nominated by Dr. Heinz Nakotte for the Arts and Sciences Outstanding Student Service Award that recognizes students who excel in service to the betterment of the university community. Ms. Aldavaz is graduating with her Chemistry degree and is pursuing a Master's in Secondary Education. Dr. Nakotte nominated Ms. Aldavaz for her commitment to the Society of Physics Students as Secretary and as a student assistant to the Department.

Both Chase Brooks and Mariana Aldavaz will be honored and presented with their awards on May 10, 2019 where their nominators will present them to the guests.



**Spring 2018**

**Fall 2018**

**Spring 2019**

**Bachelors**

Corey Boehm  
 Ryan Hall  
 Michael Kaemingk  
 Rogelio Ochoa  
 Rachel Ridgeway  
 Alejandro Salas Chavira  
 Elijah Schold  
 Taylor Uselman  
 Nathaniel Williams

**Bachelors**

Kimberly Zapata Limas

**PhD**

Pavan Chaturvedi  
 Gregory McPherson  
 Katherine Woodruff  
 Chen Xu

**Bachelors**

Carlos Armenta  
 Chase Brooks  
 Jorge Garcia  
 Aimee Hatfield  
 Oscar Jaramillo Perez  
 Dominique Madrid  
 Patrick Miller  
 Scott Walls

**Masters**

Mitra Subedi

**PhD**

Fatma Aslan  
 Sayedayat Ghazisaeed  
 Jeongsu Bok

**Masters**

Meera Mohana Varier  
 Hannah Rich

**PhD**

Joshua Amburgey  
 Richard Mbatang

Graduate Coordinator

Dr. Vassili Papavassiliou  
 pvs@nmsu.edu  
 (575) 646 - 1310

Undergraduate Coordinator

Dr. Stephen Pate  
 pate@nmsu.edu  
 (575) 646 - 2135

**CONGRATULATIONS TO ALL OF OUR GRADUATES!**