



THE CAMPUS BEAUTIFUL – PHOTO BY DR. LEVENTE BORVAK

# University of Dallas Physics News

## Fall 2016

### IN THIS ISSUE

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Dear Alumni, Parents, and Friends,

The Department of Physics faculty and staff extend our warmest wishes as we move into the Christmas season. We are truly blessed to educate a very talented, respectful, and highly motivated group of students. Whether these are your children, your relative's or friend's children, or even if they are simply later, modified versions of our students of the past, we thought you might be interested in learning about the research our current students completed during the summer of 2016.

This group of students has a variety of aspirations, including becoming scientists, engineers, teachers, and active and productive members of our scientifically educated workforce.

To serve these students, the department was able to hire a third tenure-track faculty member, Dr. Jacob Moldenhauer, in 2015 and a new laboratory director, Dr. Levente Borvak, in 2015. These new faces join Dr. Richard Olenick, Mr. Arthur Sweeney, and me as the Physics faculty.

Our recent graduates have been very successful carrying on the tradition of excellence that you started. Since 2005, we have had three Fulbright, two NSF Fellowship, and one Goldwater honorable mention recipients. We have alumni in prestigious physics and engineering graduate programs across the nation and our undergraduates are frequently the recipients of REUs at these same universities.

With support from the UD administration and generous gifts from alumni, we are working to offer new experiments and in-house research opportunities for students in both our physics and Core classes.

Sincerely,

Sally Hicks, Professor and Chair of Physics



### Students discuss their summer research and internships

Fourteen physics majors were busy during the summer of 2016 completing Research Experiences for Undergraduates (REUs), investigating the stars, cosmological models, head trauma, or nuclear physics with UD professors, while others had internships at companies.

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### Faculty updates

Und-ergraduate research continues to be an important component of the undergraduate physics program at the University of Dallas.

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# Research Opportunities and Internships from the Students' Perspective



Alessandra Marchi is a junior dual-degree electrical engineering/physics major from Napa, California.

"I worked at James Loudspeaker Corporation in Napa, California. I aided in the production of loudspeakers, both custom and standard models. I built crossovers which allowed me to see the electrical engineering aspects of speaker design. This included learning about the sound quality produced by different circuit and mechanical designs. I also used sound testing equipment to graph frequency and impedance values, learning more the physics behind sound."

"This summer I performed small-angle neutron scattering measurements at Oak Ridge National Laboratory with my REU research group from the University of Notre Dame. In September, I traveled to the Institut Laue-Langevin (ILL) in Grenoble, France with the same group to complete more precise measurements. The results from these experiments are used in determining the mechanism behind type-II superconductors which could potentially lead to more high-temperature superconductors."



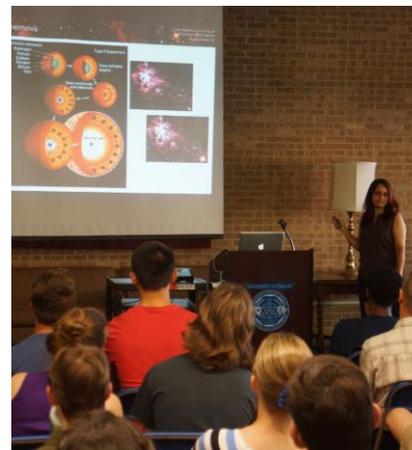
Joseph Archer is a senior physics major from St. Louis, Missouri.



Steven Block is a junior physics major from Manassas, Virginia .

"I did research with Dr. Hicks this summer searching for detector voltage stability in neutron scintillation detectors. I did this by writing a code that plots the recoil spectra of backup files and analyzes the peak neutron energy versus channel number over the course of several-day experiments in order to see if voltage drifts occur. My hope was to create a program that eliminated the need to place known radiation sources in the main detector for a long period of time to monitor detector stability to save experimental time."

## Physics Department Events



**Sep. 8-9, 2016:** Clare Boothe Luce Speaker Dr. Rebecca Surman from the University of Notre Dame spent two days with UD students talking about her research and opportunities in physics.



**Oct. 11, 2016:** Clare Boothe Luce Stem Panel. Students learned about opportunities in STEM from UD alumni Kara Earle, Joe Costantino, Anne Hoelscher, and Dominic Hilario, from UTA Assistant Dean Carter Tierman and from current UD students Alessandra Marchi and MacKenzie Warrens.



**Nov. 15, 2016:** Joint Physics/Chemistry Seminar with speaker Dr. Julie Chan from the University of Texas at Dallas.

"This summer, I worked at the Baylor University Research & Innovation Collaborative Laboratory, where I calibrated a Piezoelectric Dust Detector (PDD). This sensor will be used to detect hypervelocity dust particles orbiting the Earth. In the lab, I simulated impacts similar to what might be encountered in space. Utilizing a light gas-gun particle accelerator, I shot BB's made of Aluminum, Teflon, & Stainless Steel at velocities between 100-220 m/s at the PDD plates. It was a lot of fun performing experimental research, but by the end of the summer I had determined that there was more calibration required before the PDD could be shot into space."



Matt Fournier is a senior physics major from Scottsdale, Arizona.



Ted Morin is a sophomore physics and mathematics major from Irving, TX.

"I built a database of 50 functions to calculate patients' medical risks at Duke Clinical Research Institute. An Application Programmer Interface was designed to turn patient data into risks scores based on published models. This database and interface may be useful for making comparisons between different models and testing the models' performance on new patient groups. Risk factors and outcomes were defined according to the National Cancer Institute Meta-thesaurus."

"Over the summer I worked on star observations with Mr. (Arthur) Sweeney and Dr. Olenick. In order to collect data we set up a telescope with an attached CCD camera just north of Gainesville, Texas, in a small UNT remote observation center that we borrowed space from UNT astronomy and physics. Each night I would set up and monitor the data collection remotely and make alignment corrections if the telescope were to lose its location in the sky due to clouds or other weather conditions."



Mark Rodriguez is a senior physics major from Richardson, Texas.

"This summer, I worked on an aeromechanical one-way array at The College of Wooster in Ohio, as part of my REU project under the supervision of Dr. John Lindner. The array, when placed under a fan, allowed for solitons, which are waves moving in only one direction, to chase one another around the array. I worked on making the array work at lower speeds by designing new 3D pieces, collecting clearer data at the lower speeds, and showing the effect of noise on the array."



Tessa Rosenberger is a sophomore physics major from Lakewood, Ohio.

## Physics Department Events



Nov. 30, 2015: Student's enjoy food and fellowship at the Physics Department Christmas Party.



Feb. 11, 2016: Clare Boothe Luce Speaker Dr. Jodi Cooley-Sekula discussed her experiments searching for Dark Matter.



Apr. 6, 2016: Sigma Pi Sigma physics honor society induction. 2016 seniors Daniel Jackson and Alex Jagrowski conduct the induction ceremony.

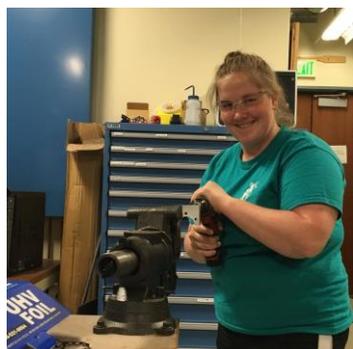
"This summer, I researched alongside Alvaro Hu and under Dr. Moldenhauer here at the University of Dallas. My research was focused on java coding to graphically represent aspects of modified gravity models, where I worked on the Modified Polytropic Cardassian, Interacting Dark Energy, and General Chaplygin Gas models - with those aspects being supernova events, gamma-ray bursts, calculating the Hubble constant, baryon acoustic oscillations, the Alcock-Paczynski test, and mapping expansion. It was a really good experience, and I liked that I was able to research with one of my classmates, and do my research over the summer so that my other school work did not interfere with the progress of my research and field-specific learning."



Blake Palmer is a senior physics major from Coppell, TX.



**April 30, 2016:** Students and faculty gathered for a little relaxation and a lot of food right before final examinations at the Physics Department spring picnic.



MacKenzie Warrens is a senior physics major from Parkville, Missouri.

This summer, I did experimental atomic physics research at UCLA. I worked with two other undergrads to build a linear Paul trap that has the electrodes placed outside the vacuum chamber, which we termed the ex vacuo ion trap. Our goal was to trap barium ions and see them fluoresce before the summer ended. My part of the project was building a vacuum chamber that reaches pressures on the order of  $10^{-9}$  torr, if not lower pressure, as well as making the barium ion source. I successfully completed my portion of the project, but we were unable to trap barium ions before the summer ended.

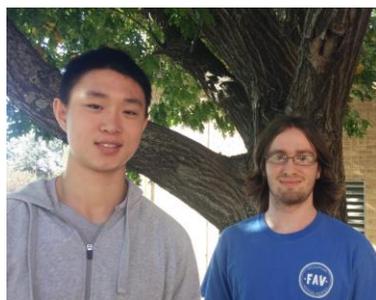


**May 15, 2016:** Alex Henderson, Ramses Gonzalez, Alex Jagrowski, Daniel Jackson, Liam O'Toole, Samantha Richardson, Mary Zischkau, and ThienAn Nguyen graduated on a beautiful spring day in Texas. Drs. Moldenhauer and Hicks joined the seniors for one last celebration together.

"This summer I did research in cosmology at the University of Dallas under Dr. Moldenhauer. I used data recorded from several research teams and ran different combinations of the data through the TACC supercomputer cluster to obtain better constraints on several cosmological parameters. Some that I mainly focused on were Dark Energy, trying to determine if it is a cosmological constant, and the Curvature of the universe."



Alvaro Hu is a senior physics major from Hayward, California.



Andrew Chang and James Frisby are sophomore physics majors from Tempe, Arizona and Lebanon, Indiana, respectively.

"James Frisby and Andrew Chang worked together on research with Dr. Moldenhauer and biologist Dr. Slaughter investigating the physics of concussions, specifically measuring differences in acceleration between the inside and outside of the head. The experimental setup consisted of launching a soccer ball to collide with a model head that contained an inertial measurement unit. This device collected the acceleration data from within the model brain. During the summer we improved on the design of the model head and brain, improved the consistency of the collisions, and collected data from several locations inside and outside the head."



Women in mathematics, physics, electrical engineering and computer science join Clare Boothe Luce speaker Dr. Rebecca Surman for dinner.



The Society of Physics Students had fun on the mall with the water balloon launch activities.

"Last summer, I had the opportunity to work with experimental nuclear physicists at the University of Kentucky accelerator lab where we used a Van de Graaff ion accelerator to create a source of fast neutrons. Using this neutron source, we measured neutron scattering cross sections of Carbon 12, which are of practical importance in the on-going development of fourth generation fission reactors. Working in the lab was interesting, and I really enjoyed learning about the rigorous processes involved in making such precise experimental measurements."



Tommy Byrd is a senior physics major from Grand Prairie, TX



# University of Dallas Physics News

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