Department of Physics and Electrical Engineering
2017-2018 Alumni Newsletter

Featured Alumna

About **Kathleen Baker**

Kathleen Baker is a program manager for advanced technology and a member of the Principal Professional Staff at the Johns Hopkins University Applied Physics Laboratory (APL) in Laurel, Maryland. She has more than 20 years of experience in leadership of electro-optical and infrared systems, including system design, development, and test. Prior to joining APL, Kathleen served four years as a government contractor at Arnold Air Force Base, Tennessee; and 10 years in industry with Northrop Grumman and Bell Helicopter. Since joining APL, her various management and leadership assignments have included program management, staff supervision, and Lab-wide program creation and execution. Kathleen received a B.S. in Physics from the University of Scranton, and an M.S. in Physics from the University of Tennessee Space Institute. She lives in Sykesville, Maryland, with her husband, and enjoys bicycling and reading in her spare time.

Johns Hopkins University Applied Physics Laboratory (APL)

At the Johns Hopkins University Applied Physics Laboratory, they solve complex research, engineering, and analytical problems that present critical challenges to our nation. APL, the nation's largest university affiliated research center, provides U.S. government agencies with deep expertise in specialized fields to support national priorities and technology development programs. They also serve as independent trusted

(continued on next page)

ABET Accreditation

The Electrical Engineering (EE) and Computer Engineering (CE) programs, after a comprehensive review by an ABET Team during their visit on campus in September 2017, have been successfully **accredited by ABET for another six years**. The next ABET visit will occur in the Fall of 2023.

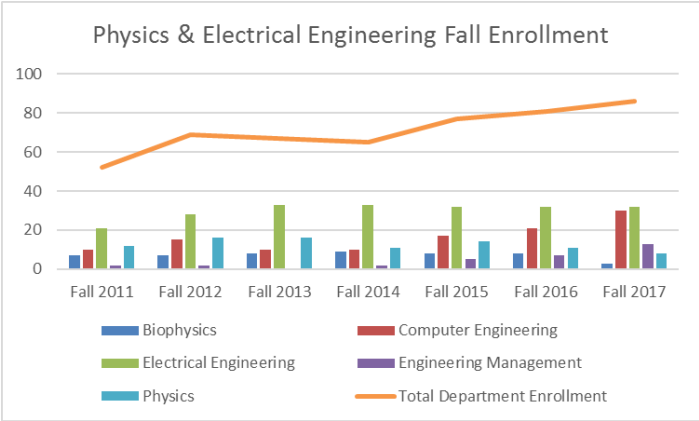


Figure: Growth of our department since 2011

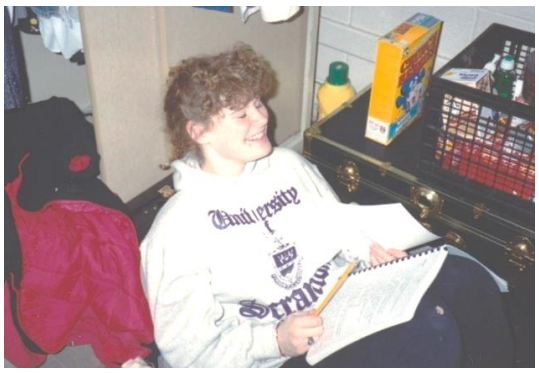
ABET Self-Study reports were submitted on June 30, 2017 to the Engineering Accreditation Commission (EAC) of ABET. They were the result of several years of program assessment, reviews and continuous improvement. Each Self-Study contains detailed information on the institution, departmental faculty qualifications, student profiles, curriculum, program educational objectives, student outcomes, program assessment results, alumni surveys, Industrial Advisory Board (IAB) recommendations, and program improvements implemented over the past six years. **Thank you to everyone who attended IAB dinners in recent years and thank you to everyone who made the accreditation process run smoothly**!

Program Evaluators completed our on-site visit during September 16 – 18, 2017. The Program Evaluators reviewed our program by studying examples of student work and transcripts, and inspection of facilities and equipment while also meeting with administrators, faculty, students, alumni, and Industrial Advisory Board members.

Featured Alumna (continued)

technical agents to the government, providing continuity for highly complex, multigenerational technology development systems. You can read more about them at www.jhuapl.edu.

Kathleen's Scranton Perspective



How Kathleen spent most of her time at Scranton – in this picture probably doing physics lab homework!

Kathleen remembers her time at Scranton: "When I came to Scranton, I brought a strong passion to question and learn. Every interaction with professors, staff, and other students encouraged and fostered that curiosity and desire to grow. The welcoming environment I experienced at Scranton, where everyone is valued for who they are, gave me the confidence to become who I am today. Although I didn't know it when I was in school, I now know that begging your hardware or software to explain why it worked fine yesterday, but won't work today is a totally normal part of research and engineering!"

In the News!

The Parker Solar Probe, which just launched from Cape Canaveral, FL was designed, built, and managed for NASA by APL!
http://parkersolarprobe.jhuapl.edu/News-Center/Show-Article.php?articleID=94

Illustration of NASA's Parker Solar Probe approaching the Sun. Image credit: NASA/Johns Hopkins APL/Steve Gribben

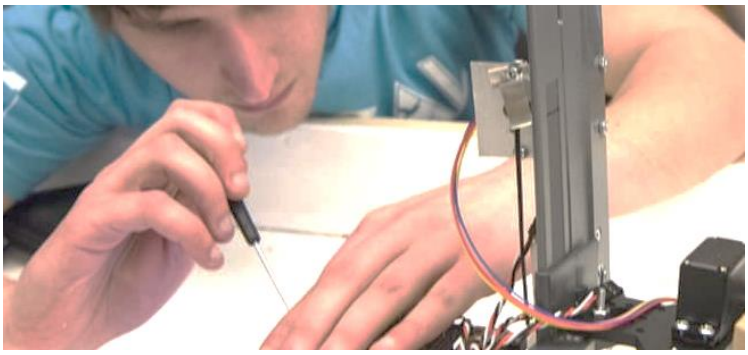
EE/CE Senior Capstone Projects

*Highlights – **Dr. Robert Spalletta**'s Capstone Course*

Automated "Catan"

Senior Students: Zachary Black, John Bowers, Nicholas Chaump, Nicholas DePierro, and Brian Kohler

The purpose of this project is to create an automated version of the board game "Settlers of Catan". Throughout the game, there is a constant process of gathering resource cards every time the dice are rolled. These resource cards will be dispensed to each player dependent upon their placement on the board and the number that is rolled. The goal of this project is to automate the entire dispensing process while keeping track of each player's points. This project involves the disciplines of EE, CE, and Education.



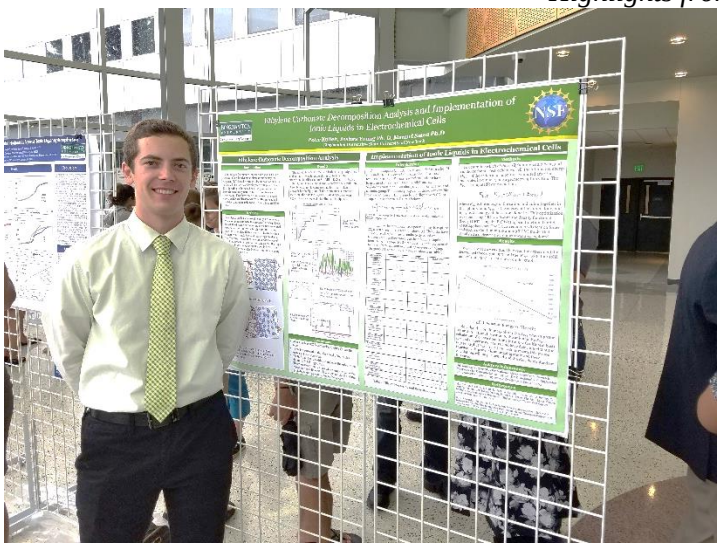
Microbit Exploitation Hockey Playing Robot

Senior Students: Tara Hambrose, Wilson Ortiz, George Ebeid

This project means to demonstrate the features of the BBC Microbit microcontroller. This microcontroller is intended for use by primary and secondary school students in STEM courses and embedded systems IoT. The Microbit has 19 multipurpose I/O pins, built in radio, Bluetooth and Wi-Fi, a magnetometer, a three-axis gyroscope, a three axis accelerometer, light sensors, a temperature sensor, a 5 x 5 LED graphical display, 3 ten bit A/D converters, a timer subsystem and an ARM Cortex dual core processor. Included with this project is a 3D printed low cost tracked multi-purpose robot designed to provide the physical capabilities this project requires. This project is to inspire potential STEM students to build inexpensive autonomous robots using the Microbit. This project involves the disciplines of EE, CE, and Education.

Students Complete REU Experiences in the Summer of 2018

Highlights from two experiences

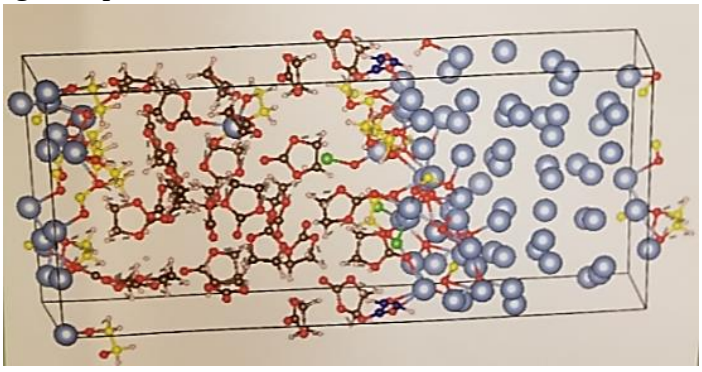


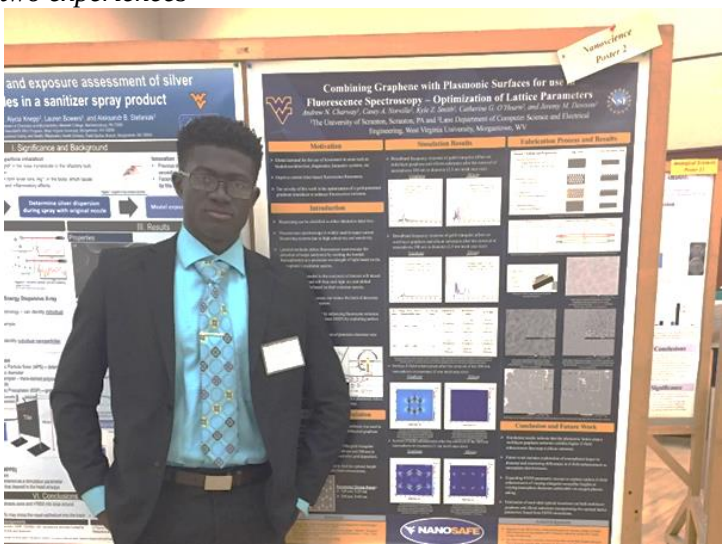
Binghamton University
State University of New York REU

Research Team: Dr. Manuel Smeu, Ph.D and Dr. Joshua Young, Ph.D

Title: *Ethylene Carbonate Decomposition Analysis and Implementation of Ionic Liquids in Electrochemical Cells*

Summary: Peter worked in a computational physics lab analyzing battery chemistry on the molecular level. He wrote Python scripts to analyze and process data generated by battery simulations. This primarily focused on the decomposition of the electrolyte with different battery materials. In addition to that, he started a second project, which involved looking into different electrolytes called ionic liquids that can potentially stop batteries from overheating due to loss of conductivity at high temperatures.





West Virginia University
National Science Foundation REU

Research Team: Casey A. Norville, Kyle Z. Smith, Catherine G. O'Hearn, who are graduate students, and Dr. Jeremy Dawson, Associate Professor.

Title: *Combining graphene with plasmonic surfaces for use in fluorescence spectroscopy*.

Summary: Recent growth in the biosensor market can be attributed to an increase in fluorescence spectroscopy research geared toward highly sensitive and cost-effective sub-micron optical biosensors capable of reducing the limit of detection (LOD). The goal of my research was to explore graphene as a passive substrate for improved labeled fluorescence enhancement biosensors. Finite Difference Time Domain (FDTD) software was utilized in the research in conjunction with the development of an optimized device fabrication process.

IEEE club student members shown above practicing for the "Ethics" Presentation Competition

Scranton Students Continue to Excel at the 2018 IEEE Region 2 Student Activities Conference

Held at the University of Pittsburgh

April 6th-8th, 2018

The student branch of IEEE at the University of Scranton is a program providing students with the opportunity to participate in a campus wide event in the form of an IEEE seminar series (presentations by distinguished scientists, community business leaders, as well as our alumni and various employers/prospective job companies). The IEEE club also fosters professional development and networking. **Dr. Andrew Berger** has been the IEEE club mentor since 1991.

Twenty-six University of Scranton students competed at the annual Region 2 IEEE Student Activities Conference held at the University of Pittsburgh in April. Preparation for this competition began in the fall of 2017 with students competing in class competitions to earn the privilege to represent Scranton at the competition. IEEE Region 2 encompasses a region of the United States including Pennsylvania, Ohio, West Virginia, Maryland, Washington DC, Delaware, southern New Jersey and parts of Kentucky. Students from Scranton competed in every competition ranging from robotics competitions to an ethics presentation competition. Scranton placed in 4 of 9 competitions including:

First Place in the Micromouse Competition:
Wilson Ortiz '18, John Bowers '18, Ben Arbizo '19, Luke Cullen '19

Second Place in the Ethics Competition:
Alex Pinnaretta '18, Eileen McNulty '20, Peter Petsas '21

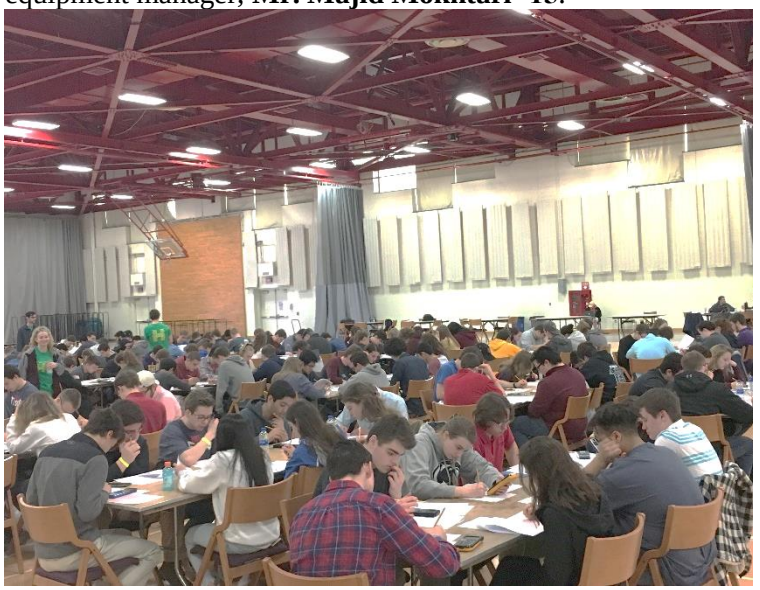
Second Place in the Paper Competition:
Joshua Zadoyko '18

Third Place in the Sumo Robot Kit:
Jesse Kemmerling '19, Andrew Charway '19

2018 Hayes Competition

April 10th, 2018

This year's theme was **Divide and Conquer**. High School student teams needed to break down their teams to three smaller teams to finish each of the day events. Because of the generosity of **Ed '61 and Margaret Hayes**, the department's High School competition will now be funded yearly. The Hayes Family also provides funding for the annual Kane Scholarship to keep the "Kane" name alive in the competition. The competition is administered by **Prof. Nicholas Truncale '06** with the engineering expertise of our lab equipment manager, **Mr. Majid Mokhtari '15**.



A team from **Wallenpaupack Area High School** took first place in the 2018 Kane Competition and took home the perpetual trophy. The team was coached by Mr. Ryan Neenan. First Place in the Jeopardy Competition was Charles Kulick '22, who entered the university as a Computer Science Major in the fall of 2018.

Student Internships and REUs

Summer 2018 Highlights

Matthew Acquadro '19 EM – Marketing Intern, WeLivv, Manhattan, NY

Salvatore Aiello '20 EM – Intern, C&S Companies, Syracuse NY and San Diego, CA

Joseph Brancato '20 EM – Intern, Sysca Hennessy, Manhattan NY

Nicholas Hook '20 EM – Intern, Pfizer, Collegeville PA

Andrew Buttner '20, CENG – Computer Engineering Intern, Syracuse Research Corporation, East Syracuse NY

Vincent Oliverio '20 CENG – Cybersecurity Intern, Campus Door, Carlisle PA

Stephanie DeBarros '20 EE – IT Tech/Admin, IT Services LLC, Stamford CT

Mark Pawelski '20 EE – ESTI/Engineering Scientific Technical Intern, PA DoT, Dunmore PA

Charles Cunningham '19 BPHYS – Intern, East Coast Orthotics and Prosthetics, Deer Park NY

Luke Cullen '19 CENG – Marketing Intern, Today's Business, Pine Brook NJ

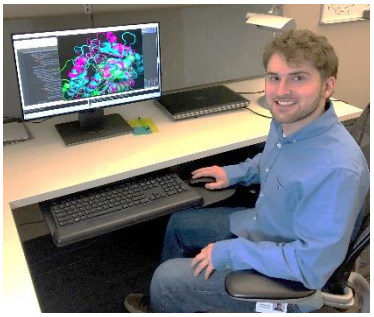
Daniel D'Agostini '19 EE – Engineering Intern, Pennsylvania Power and Light, Allentown PA

Alex Ranieri '19 EE – Internship, MG Engineering D.P.C

Summer Spotlight

Sophomore , **Joshua Toth '20, PHYS**

I work with Dr. William McLaughlin in the computational biology lab at the Geisinger Commonwealth School of Medicine. Our project entails the estimation of the quality of protein structural models. Protein models have important applications in life science research for tasks such as drug design and the study of molecular interactions. To evaluate model accuracy, we are developing a novel and objective analysis pipeline that assesses the degree to which these models have the same predicted molecular functions as the corresponding experimentally determined protein structure. Our collaborators at the University of Basel have built a federated web resource called Continuous Automated Model Evaluation (CAMEO). For me, a typical day of research in the laboratory involves plenty of computer programming in the Python language and using statistical methods to analyze large volumes of data. This past summer I had the exciting opportunity to present my work at the International Society for Computational Biology's 26th Intelligent Systems for Molecular Biology conference in Chicago, Illinois. The entire research experience has been simply fantastic and is a very meaningful part of my education. I enjoy and appreciate every minute working on this project.



Senior Highlights

All twenty-seven students who attended and competed in competitions at the 2018 IEEE Region 2 Student Activities Conference held at the University of Pittsburgh, pictured with Jacob Culleny, IEEE R2 Student representative (kneeling). This photo was taken at the competition banquet after the awards were announced. The University of Scranton placed in four of the nine competitions.

Nicholas DePierro – Electrical Engineering, Class of '18
BAE Systems, Wayne New Jersey
Systems Engineer

Zachary Black – Electrical Engineering, Class of '18
Lockheed Martin, Owego New York
Test Engineer in the ELDP Program

Noel Saharig – Biophysics and Chemistry, Class of '18
University of Scranton, Scranton Pennsylvania
MS Chemistry Program in Chemistry Department with Graduate Teaching Assistantship

Joshua Zadoyko – Physics, Class of '18
SDG Group, Princeton New Jersey
Business Intelligence Consultant

Sean Nonnemacher – Computer Engineering, Class of '18
Northeastern University, Boston
MS Program in Electrical and Computer (E/CE) Engineering

Nicholas Chaump – Electrical Engineering, Class of '18
Johns Hopkins Applied Physics Laboratory – The Discovery Program, Laurel Maryland
Associate Professional Staff in Electrical Engineering

Undergraduate Research Projects

Honors Thesis

Medical Devices: Methods and Applications

Nicholas Chaump'18 – Advisor: **Dr. Christine Zakzewski**

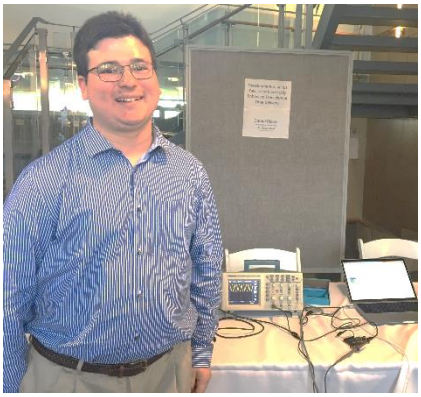
In a world where technology is exponentially growing, advancements in medical technology are making drug delivery more robust and efficient. Drugs may be administered across the skin either passively or non-passively depending on the chemical structure of the molecule. Traditionally, drugs like insulin cannot be administered passively through the skin due to the size of the insulin molecules themselves, making the most accessible method of insulin delivery injection by needle. This has lead researchers to investigate less invasive forms of drug delivery for drugs like insulin. This paper will investigate the applications of alternating current (AC) transdermal iontophoresis, a non-invasive delivery method of ionic compounds through the skin by the application of an external electric field.

Faculty Student Research Program

Medical Devices: Methods and Applications

Daniel Ricker '19 – Advisor: **Dr. Christine Zakzewski**

The goal of this project was to create an Internet of Things (IoT)-based microcontroller for use in electrically enhanced transdermal drug delivery. IoT technology allows users to control a device wirelessly via the internet. The project goal was to make a user-friendly system that could be used in future studies to investigate how the waveform effects transdermal delivery of a drug. Using an Esquillo Air microcontroller, the system was programmed using HTLM and Bootstrap to allow users to specify and control the output waveforms through a web interface. Several custom waveforms were then programmed using JavaScript and Squirrel languages. The system is capable of producing ten customizable waveforms of frequencies between 10 Hz – 50 kHz.

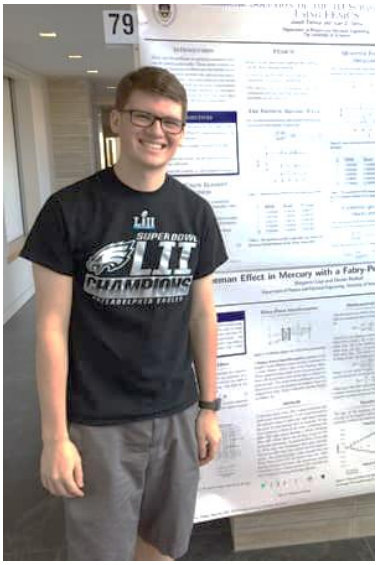


Undergraduate Physics Research

Numerical Solution of the 1D Schrödinger Equation Using FeniCS

Joseph Delmar '19 – Advisor: **Dr. Juan Serna**

There are few problems in quantum mechanics that can be solved analytically. These model systems include: the harmonic oscillator and the infinite square well. These provide reliable test systems for numerical approximations. One such method is the Finite Element Method, which can be used to approximate solutions to the Schrödinger equation. In this paper, we use FEniCS to numerically solve the wave equation and approximate the energy eigenvalues.



Undergraduate Physics Research

Classical Analogs for Electromagnetically Induced Transparency

Joshua Zadoyko '18 – Advisor: **Dr. Juan Serna**

Electromagnetically induced transparency (EIT) is a quantum nonlinear effect observed when two sources of highly coherent light (laser beams) interact with an atomic medium consisting of three-level atoms and making it transparent to a narrow region of frequencies around a spectral absorption line. This project explores the foundational concepts of EIT to develop a classical analog that facilitates the study and comprehension of this quantum phenomenon. We show that the interference resulting from the competition of frequencies in oscillatory systems such as the mass-spring (mechanical) and the RLC circuit (electrical), closely reproduce those observed in the quantum EIT counterpart. In the mass-spring analog, we model the coherent source of light by an external driving force and the coupling field by a linking spring. In the RLC analog, we model light by an AC voltage source and the coupling field by a capacitor.

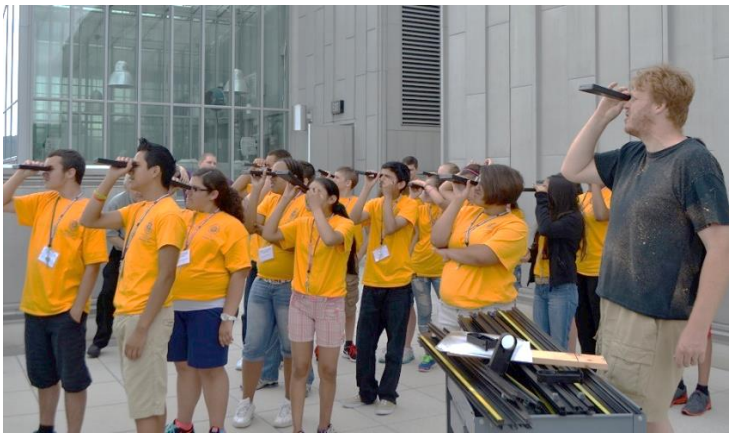
The Physics/EE Department live streamed the solar eclipse to the campus on August 21st, 2017

Academic Support STEM National Science Foundation Grant

Dr. Declan Mulhall was co-PI on a $645,000 National Science Foundation (NSF) grant that will fund scholarships and provide additional academic support to 25 undergraduate students majoring in science, technology, engineering and mathematics (STEM) fields over the next five years. The Royal Scholars Program provides scholarships to University students who have demonstrated academic achievement and a need for financial assistance. The grant also supports student and faculty mentorships, internship and research opportunities for the students, as well as additional enrichment programs such as a weeklong summer workshop. The scholars will also participate in a common first-year seminar on science and society and in common sections of STEM introductory classes for those in same major.

Biophysics graduate, Matthew Reynolds '17, working in a laboratory in the Loyola Science Center.

MAGIS Honors Program



Dr. Mulhall working with students in the University of Success Program during a summer workshop on light.

Dr. Declan Mulhall is co-developer of a new science honors program, which was piloted in the academic year 2017-2018. The Magis Honors Program in STEM provides a community of inquiry and personal development for students in the STEM disciplines. The main objective of the program is to provide undergraduate students with a more intensive and longer-term research experience than they might ordinarily have at the University. The faculty and other students provide the interdisciplinary, collaborative atmosphere that students might encounter in a research institution while maintaining the cura personalis nature of the Scranton undergraduate experience. In the context of the Magis Honors Program, the physics department has established a service relationship with McNichols Plaza elementary school, located in the city of Scranton, to help their science teachers enrich their offerings. Students in the program routinely meet in seminar courses and learn the necessary skills to become a scientist in a STEM field and work with their peers.

Thank you for reading our 2017-2018 Physics/EE newsletter! Feel free to contact any of us at any time!

Dr. W. Andrew Berger

Department Chair

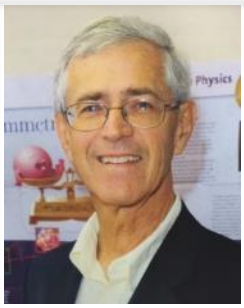
wandrew.berger@scranton.edu

NEW FACULTY MEMBER

Dr. Mohammad Maktoomi was born in Muzaffarpur, India. He received a B.Tech. Degree in Electronics Engineering from the Aligarh Muslim University, India, in 2009, the M.Tech. and Ph.D. degrees in Electronics & Communication Engineering from Indraprastha Institute of Information Technology, Delhi (IIIT Delhi), India, in 2016.

Most recently, he was a postdoctoral scholar at the University of Calgary, Canada. His research interests cover the design and analysis of radio-frequency/microwave circuits and systems for wireless communications and Internet-of-Things applications.

Dr. Maktoomi is an IEEE member, reviewer for several IEEE transactions and journals, and an academic editor of PLOS ONE journal. He received the University of Calgary Eyes High postdoctoral fellowship, the best student paper award at IEEE MWSCAS 2016, DST Science and Engineering Research Board (SERB) travel grant, and was a winner at the microstrip bandpass filter design competition held during the IEEE IMaRC 2015.



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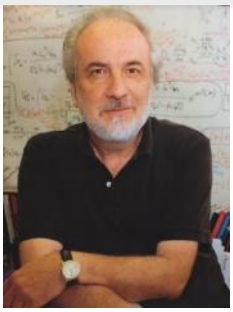

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