NMSU

QUANTUM TIMES

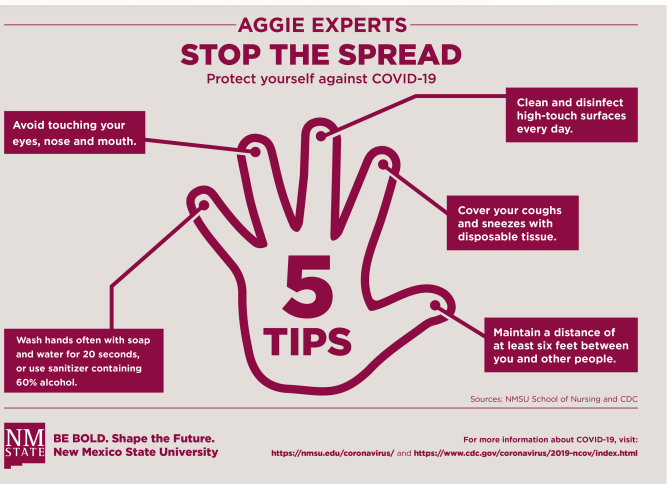
PHYSICS NEWSLETTER

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 tax deductible donations.

Reminder of COVID 19

More info about our response on page 5



A Message from the Department Head Dr. Zollner

Dear alumni and friends:

After spending one year on a wonderful and productive sabbatical in Dayton, OH, Albuquerque, NM, (both Air Force Research Lab) and Prague, Czech Republic (Institute of Physics, Czech Academy of Sciences), I have returned to NMSU as the Physics Department Head. I am very grateful to Dr. Heinz Nakotte for leading the Department while I was on sabbatical.

There is plenty of good news about the Department described in this newsletter. Most of all, our BS in Engineering Physics program was reaccredited by the Engineering Accreditation Commission of ABET, Inc. For the first time, our BS in Physics program also received accreditation from the Applied and Natural Sciences Accreditation Commission of ABET, Inc. Dr. Nakotte and Dr. Pate, along with others, led this effort. Accreditation has two primary benefits: First, our graduates can take jobs with the US government labs or other employers that require a degree from an accredited program. The second less tangible benefit is that accreditation proves to our students that a BS degree from our department is a worthwhile investment of their time and tuition money.

Since I was recently appointed to the APS Committee on Education, I had an opportunity to compare our undergraduate physics program with similar programs at the other 180 or so Ph.D. granting physics departments in the US. First of all, we are in the top 10% for awarding undergraduate degrees to underrepresented minorities. A large portion of our degrees are awarded to women (29%), significantly higher than the national average (19%). Our NMSU physics program makes up only 0.65% of NMSU undergraduate degrees, but again that is larger than the national average (0.56%). In other words, the NMSU Physics program is large compared to the size of our institution, and highly successful. Finally, we awarded 51 undergraduate physics degrees from 2015 to 2017, more than many of our peers.

To achieve such graduation statistics, everyone in the department works hard on recruiting and retention. A particularly beneficial retention strategy is to hire undergraduate students in the physics department, for outreach (such as a physics summer camp), undergraduate research, or as peer learning assistants or tutors.

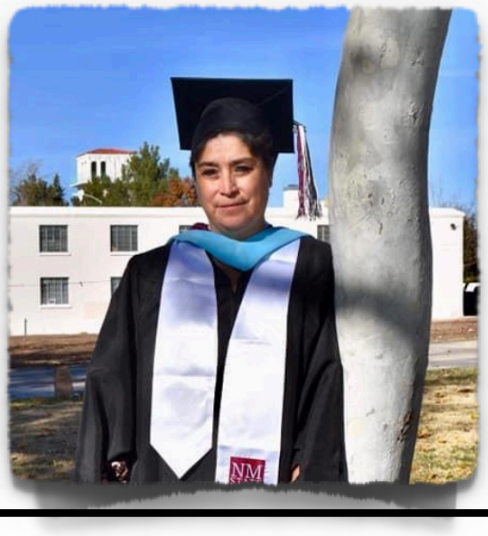
I am therefore asking you to donate to our Physics Department current use fund (102382). This will allow us to hire students in the department and pay for other student services, such as student organizations or travel to conferences. (Read elsewhere about a group of NMSU women who attended the APS Conference for Undergraduate Women in Physics.) Making a donation is easy on our department's web site (http://physics.nmsu.edu/giving.html).

As always, thank you very, very much for your support.

Best wishes to all of you!

Stefan Zollner

Rosa Urioste, Fiscal Assistant



Rosa Urioste started working at NMSU in 1995 and has worked at various departments on campus. Mrs. Urioste has been working at the Physics Department since July 2011.

Rosa Urioste graduated in 2009 with a Bachelor's degree in Business Administration from NMSU. In 2019 she returned to her studies and graduated with Master's degree in Educational Leadership and Administration from NMSU. In August 2019, Rosa Urioste got married and moved to Florida in June 2020, but continues to work with the Physics Department.

Esther Thompson

As a result of **Esther's** position as the secretary of the SPS (Society of Physics Students) and her academic progress and maintenance of a 3.5 or higher GPA, she was invited to be an ambassador for the APS (American Physical Society) and given the opportunity to talk with Congress and the Senate about relevant issues in physics important to the APS. Esther Thompson has also received many scholarships through the Department of Physics including the Gale Harvey Scholarship, the Leon & Barbara Radziemski Scholarship, and the Bezdek Scholarship, as well as the A&S General Scholarship from the College of Arts and Sciences. She is also doing research and working in the office at the Physics Department which she says has opened various opportunities for her to be more actively involved in events associated with the Department. She has attended the Conference for Undergraduate Women in Physics in College Station, TX this past January as well as the APS Leadership Meeting in Washington DC. Esther Thompson is majoring in Physics and minoring in Math. She is expecting to graduate in the Spring of 2021.

Graduate Spotlight

Andrew Eagon

Andrew Eagon was a graduate student working on his masters on investigating applications of template matching in time-series data to identify repeated signals such as reverberative seismic phases. Andrew Eagon attended the University of Wisconsin – Whitewater for his bachelor's in Physics. During his time at NMSU Andrew has been awarded the New Mexico Space Grant scholarship for two consecutive years and the Graduate Tuition Fellowship for three consecutive years. Andrew has graduated from NMSU in Spring 2020 and has since looked for jobs in either education or industry.

Galen Helms

Galen Helms was a graduate student in the Department of Physics. Galen's primary research was in evaluating applications of 3D printing technologies. He's developed software to sync the motion system of a 3D printer with digital sensors. With these modifications, he was able to measure magnetic fields of bar magnets, with possible applications as demo experiments in undergraduate E&M courses. He has also measured the infill dependence of Young's Modulus in 3D printed ABS plastics in collaboration with Mechanical Engineers, and worked with Civil Engineers on developing 3D printed filters for particulate removal as the first step in water purification. He has since graduated from NMSU Fall 2020.

Michael Engelhardt

"I am a theoretical physicist - I use the theory governing the behavior of quarks and gluons, quantum chromodynamics (QCD), to make predictions about the properties of protons and neutrons. Such predictions can be confronted with corresponding experimental data in order to refine our understanding of quark and gluon physics. The methods I utilize involve large-scale numerical computations carried out at leading supercomputing centers located, for example, at Brookhaven, Lawrence Berkeley, and Argonne National Laboratories, as well as in Juelich, Germany. Together with my collaborators at MIT, SUNY Stony Brook, University of Arizona, CERN in Switzerland, and Jefferson Lab, I annually apply for computer time at these facilities.

A typical question addressed in these calculations is how the spin angular momentum of protons and neutrons is composed of the spin and orbital angular momenta of the quarks and gluons. To this end, quark and gluon fields are placed on a space-time grid such as to form protons or neutrons according to the dynamics described by QCD; a large part of the computational cost lies in applying the equations of QCD such that protons and neutrons emerge. Secondly, one extracts from the quark and gluon data answers to the specific questions at hand, e.g., the spin angular momentum of each quark in the proton or neutron. This requires additional computational effort, at the end of which the data analysis can be condensed into a concise answer.

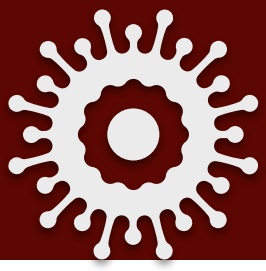
My work is supported by the U.S. Department of Energy (DOE) through a grant which I have held together with my colleague M. Burkardt since 2004. In addition, in 2016, we joined a multi-institutional DOE Topical Collaboration focused on the quark-gluon substructure of protons and neutrons, coordinating and buttressing the funding for such investigations. This underscores the importance accorded by the DOE to this field of study, not least motivated by the recently approved construction of a new Electron-Ion Collider (EIC) facility. Our theoretical investigations serve to guide and support the experimental program envisioned at the EIC."

COVID 19 Response

During this pandemic, I think that my main responsibility is to collect and distribute information and to make sure that all of us follow the path the university has chosen. Most of the faculty, given their many years of experience, were able to transform their teaching in a way that best met the learning outcomes of their course, their teaching style, and the needs of their students. On the other hand, I worked closely with graduate teaching assistants responsible for a course (especially instructional laboratories) who had less experience and wanted more coaching. The department also contacted (or tried to contact) all of our undergraduates to learn about their experience with the transition to online teaching. I personally interacted with all the freshmen in the second-semester PHYS 214 lab. Since registration for the fall semester has started, our focus is now to make sure that all our students get advised and select courses for the next semester. I will also start calling prospective students who want to start as freshmen in the next fall semester. I am glad to say that the transition to online teaching has worked better than most people expected. My Ph.D. students all work from home and analyze data taken previously. All students in PHYS 214L have good internet connections and are able to participate in our Zoom meetings. Much instruction has moved to an asynchronous mode, to accommodate students whose internet connection is unstable.

-Dr. Stefan Zollner

Remember to Wear a Mask



Research in the Physics Department Applied Physics Group

Team members: ("permanent") Dr. Charles Bruce, Michael Granado, Dr. Sharhabeel Alyones, Dr. Al Jelinek; (others at present) Mason Scott Walls

Personnel

Charles W. Bruce is College Research Professor at the Physics Dept., New Mexico State University. He received a B.A. in Physics from Union College, Schenectady in 1959 and both Masters and Ph.D. degrees in Physics from New Mexico State University (1968 and 1970). His initial research was in laser induced plasmas and development of pulsed laser instrumentation at Kirtland AF Base in the early 1960s. From 1971 to 1995 he was employed at the US Army Atmospheric Sciences Laboratory. From 1984 to the present he also has been a College Research Professor at the Physics Dept. at NMSU (initially through the Intergovernmental Personnel Act (IPA)). Other research areas have been; radio frequency excited low density plasmas, air contamination research on both sides of the USA-Mexico border and molecular and particulate spectroscopy with current emphasis on electromagnetic interactions with specific particulate morphologies and materials across the spectrum. Each of these efforts have produced publications. A number of new techniques are described in publications and patents.

Awards

U.S. Army Research and Development Achievement Award, 1979

Michael C. Granado is a Senior Research Associate in the Physics Dept. at New Mexico State University. He received a B.S. in Electrical and Computer Engineering Technology and a Master's in Business Administration from New Mexico State University (2007 and 2010). Began work as an engineer for this Applied Optical Group at NMSU while attending graduate school collaborating on several tech reports and studies in physics and engineering. Upon receiving his Master's degree he began full time employment as a research assistant and has continued work on aerosol analyses, other technical studies and reports as well as publications.

Dr. Al V. Jelinek

Thirty five years experience in the research and measurement of aerosols. Measured and developed measurement techniques and systems to characterize aerosols. Developed software for realtime data acquisition and display for various research efforts over the years (field and lab measurements). Developed software for data reduction and analysis. Performed and/or participated in scientific studies on obscurant aerosols resulting in refereed publications.

Ph.D. Texas A & M University, 1970. Major: Physics, M.S. Texas A & M University, 1966. Major: Physics, B.A. St. Thomas University, 1960. Majors: Physics & Math

Dr. Sharhabeel Alyones

At Hashemite University/Jordan, Dr. Alyones has been involved in teaching undergraduate and graduate Physics courses in the Physics department, Theoretical research activities were performed with collaboration with Prof. Charles Bruce/New Mexico State University in the area of electromagnetic scattering and absorption by small particles.

At New Mexico State University, Dr. Alyones has been and still being involved in research concerning small particle obscurants and Metamaterial filters, Also Dr. Alyones taught two undergraduate physics courses in the physics department/New Mexico State University.

Research Associate Professor, Physics Optics Group, NMSU Physics dept., Bachelor, Masters of Physics at Yarmouk University, Jordan, Master of Electrical Engineering at New Mexico State University, Doctorate of Physics at New Mexico State University.

Continue...

Research

Summary

This group is involved in several forms of optical research: we might classify these as… discretionary, supportive of specific government interests and measurements and analyses for numerous firms throughout the country. Basically we work for the government in their interest(s) in knowing precisely what effect atmospheric aerosols have on radiation at virtually every wavelength of the EM spectrum. While this does include gases, our tasks no longer include separate molecules (earlier papers and patents did apply to those media). It does include aerosols which intentionally affect radiation; they want to understand how EM radiation can be blocked as well as how the atmosphere treats it. It is a basic premise of our work that to understand how to effect the latter purpose, we must be able to predict for all cases. This means that, if we don't have computational ability, we have to create it. Our major contribution here has been in the area of one-dimensional particles. To support the efforts of others, we electronically supply them with codes.

Discretionary

Here we apply our imaginations and if thorough literature searches indicate we have a unique and potentially useful idea we forge forward. Our purpose is to assure that the government is not blindsided by new developments that they have not anticipated and to produce results which show the promise of our initiative. Current primary interests are: comparing the measured and computed visible through infrared optical properties of fractal metal nanoparticles of quasi-linear morphology. Tailoring the optical properties of metallic nanotubes with length as a parameter. We discovered (presentation in 2016, paper 2019) through computations that nanofibers/tubes slow light down dramatically strongly affecting the spectrum. We have developed exotic metaparticles at microwave wavelengths (relatively cheaply, published) and plan to attempt to do so in the infrared (expensive).

Measurements and analyses for commercial firms (SBIRs etc.)

Small Business Independent Research grants are one way the government can invest in development of new ideas. It has so developed that frequently these firms involved with aerosols choose to incorporate our group into their contracts to analyze their results and often for us to provide advice regarding recommendations as to direction of the developments. There have been some 40 or so firms involved with our group..sometimes for several different efforts. Currently we have 4 of these efforts plus the contract that supports our more general effort and there are 14 more contracts pending of which only a few may be funded.

NMSU's **Society of Physics Students (SPS)** actively promotes the study and understanding of science, technology, engineering, and mathematics (STEM), with a focus on physics topics and concepts. SPS regularly conducts outreach events throughout the local community, where members demonstrate and explain a variety of physics concepts and experiments. Though physics isn't an easy subject to learn, SPS members effectively communicate its fundamental principles through explanations and demonstrations. During presentations, members also convey their passion for physics and the wonder and excitement of discovery.

Stay updated with SPS on their website sps.nmsu.edu

Physics Fun Day 2019

Department of Physics Faculty

Professor: Drs. Stefan Zollner, Matthias Burkardt, Michael Engelhardt, Boris Kiefer, Heinrich Nakotte, Vassili Papavassiliou, Stephen Pate, Igor Vasiliev.

Associate Professor: Drs. Thomas Hearn, and Jacob Urquidi

Assistant Professors: Drs. Michael Paolone, Matthew Sievert, and Lauren Waszek

College Professor: Drs. Charles Bruce, Michaela Burkardt, Michael DeAntonio

Staff: Marisela Chavez, Francisco Carreto-Parra, and Rosa Urioste

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