Science Café: Participant list

ATOMIC, MOLECULAR, OPTICAL (AMO) PHYSICS

Lou DiMauro
Professor, Department of Physics, The Ohio State University

Prof. DiMauro is one of the leads of the OSU Ultra-fast Atomic Physics Research Group. They explore physics at attosecond and femtosecond time scales, allowing for spatio-temporal imaging of molecular processes, and pursuing research into single atom response to an ultra-fast burst of electromagnetic radiation that will not only provide basic tests of scaling laws and theory but also initiate some novel experimental investigations in strong field physics.

Daniel Gauthier
Professor, Department of Physics, The Ohio State University

Prof. Gauthier's laboratory is involved in a diverse set of research projects in the areas of quantum optics, control and synchronization of chaos in optical and electronic systems, and characterizing and controlling the dynamics of biological systems.

Heidrun Schmitzer
Professor, Department of Physics, Xavier University

Dr. Heidrun Schmitzer received her Doctoral degree from the University in Regensburg in optics and solid state physics. She worked on research projects on fiber and polarization optics for the German Telekom in Frankfurt and also taught two years at a Montessori-School. She was a postdoctoral research associate at the University of Chemnitz from 2000 to 2001 and joined the physics faculty at Xavier in 2002. Dr. Schmitzer´s interests are optics, especially nonlinear optics, polarization optics and quantum optics. Besides her publications she holds 19 patents in this field. Her research is in optomechanics involving the spin of photons. She also likes hands-on physics experiments and physics toys. Reading and sport in small doses round out her recreational activities.

ASTROPHYSICS

John Beacom
Professor, Department of Physics, Director of the Center for Cosmology and Astro-Particle Physics (CCAPP), The Ohio State University

Prof. Beacom's main research interests lie at the intersection of the fields of astrophysics, particle physics, and nuclear physics, concerning mostly neutrinos and the weak interactions. In the past several years, there has been strong growth at this intersection, in part due to new results from the ongoing experiments. With several new and powerful detectors being constructed, much more progress is expected. Much of his work has been focused on providing theoretical input to what can be measured in neutrino experiments and the implications of the results, for both physics and astrophysics.

Amy Connolly
Associate Professor, Department of Physics, The Ohio State University

Prof. Connolly's group works on experiments searching for the highest energy neutrinos produced in the universe. They use a radio technique to search for neutrino interactions in vast volumes of natural media such as Antarctic ice.

Kate Kirby
Chief Executive Officer, the American Physical Society

Dr. Kirby's research interests lie in the area of theoretical atomic and molecular physics, particularly focusing on the calculation of atomic and molecular processes important in astrophysics and atmospheric physics. Recent work has included studies of collision-broadened alkali atom resonance lines (seen in the atmospheres of brown dwarf stars), electron impact excitation of highly-charged ions (to understand astrophysical x-ray spectra), molecular line opacities in cool stellar atmospheres, and formation and destruction of small molecules in astrophysical environments. In addition she is working on processes for forming ultracold polar molecules via laser-induced photoassociation and using such systems as a platform for robust quantum computation. See conference booklet for more information.

Laura Lopez
Assistant Professor, Department of Astronomy, The Ohio State University

Prof. Lopez earned her PhD in astronomy & astrophysics in 2011 at the University of California Santa Cruz. Her research focuses on the birth and death of massive stars and how these processes affect the surrounding interstellar medium (ISM). She studies star-forming regions and supernova explosions in the Milky Way and nearby galaxies using data across the electromagnetic spectrum (radio, mm, IR, optical, X-ray, and gamma rays). See conference booklet for more information.

Annika Peter
Assistant Professor, Departments of Physics & Astronomy, The Ohio State University

Prof. Peter is a dark-matter physicist with additional interests in galaxy evolution and cosmic-ray astrophysics. She went to college at the University of Washington and grad school at Princeton University, and postdoc'ed at Caltech and UC Irvine. Although

she is a Pacific Northwest native, she has loved her 2+ years in Columbus! When not pondering the mysteries of the Universe, she likes to eat spicy food, read non-fiction and crime novels, and wander around town with her family.

Maddie Wade
Assistant Professor, Department of Physics, Kenyon College

Maddie is a member of the Laser Interferometer Gravitational-wave Observatory (LIGO) Scientific Collaboration and works as a data analyst on the experiment. She works on both calibration of the LIGO interferometers and searches for gravitational waves from the inspiral and merger of two massive, compact objects, such as neutron stars and black holes. Gravitational waves stretch and compress spacetime by incredibly small amounts. A gravitational wave produced by some of the most dramatic astrophysical events in our universe would cause a change in the distance between us and the nearest star by the width of a human hair. A direct detection of gravitational waves will serve as an excellent test of Einstein's theory of general relativity, and regular direct detections will open a new window onto the universe, surely resulting in new, exciting discoveries.

BIOPHYSICS

R. Sooryakumar
Professor, Department of Physics, The Ohio State University

The Sooryakumar group works in traditional solid state physics, studying the vibrational modes of novel materials with visible light, but also in soft matter physics/microfluidics, developing systems that use microscopic magnets to apply forces to small fluid borne objects, such as DNA, polymer spheres, cells and bacteria. By applying controlled forces to micro- and nano- sized objects, the group works to develop tools and machines that work at the micro-scale, such as pumps and gears that propel tiny volumes of fluid, and also to develop single cell analysis and manipulation techniques for biology, such precise cell sorting.

Gillian Ryan
Assistant Professor, Department of Physics, Kettering University

Prof. Ryan is originally from NS Canada, where she received both her graduate and undergraduate training (PhD Dalhousie University 2010, MSc Dalhousie University 2006, BSc St. Francis Xavier University 2004). She is currently an assistant professor of physics at Kettering University, and has worked here since Fall 2013. Before this she was a postdoc in the physics dept. at Lehigh University from 2010-2013. Her primary area of research is computational biophysics, studying symmetry-breaking and pattern-formation events in eukaryotic cells. She's also interested in nucleation and phase transition events, and collaborate on some research with colleagues on these topics within materials sciences.

Michael Poirier
Associate Professor, Department of Physics, The Ohio State University

Prof. Poirier's lab is focused on understanding the regulation of the structural dynamics of the human genome and how this controls gene expression. Chromosomes contain long chromatin fibers that are a complex assortment of DNA and protein that organizes our DNA into ~20 million nucleosome spools. The fundamental unit of chromatin is a nucleosome, which contains ~147 base pairs of DNA wrapped around an octamer of H2A, H2B, H3, and H4 histone proteins. His lab is applying a cross-disciplinary approach that combines biochemical, biophysical and single molecule techniques to understand the mechanical dynamics of chromatin. They are then working to understand how mechanical dynamics regulates DNA accessibility within chromatin to control transcription.

CONDENSED MATTER PHYSICS

Katherine Aidala
Associate Professor, Department of Physics, Mount Holyoke College

Prof. Aidala studies nanoscale science, through the use of a scanning probe microscope (SPM). A small cantilever and tip (tip radius = 10 nm) is brought close to or in contact with a surface to measure local properties. Topography, magnetism, elasticity, conductivity, and much more can be locally mapped out in this way. There are applications to materials science, device physics, and cell biology, to name just a few. See conference booklet for more information.

Josh Goldberger
Assistant Professor, Department of Chemistry, The Ohio State University

Prof. Goldberger leads a materials chemistry lab at The Ohio State University whose major focus is to design new materials that synergistically unite and organize inorganic and organic chemistry for applications in energy conversion and medicine. His lab is multidisciplinary, combining synthetic organic, inorganic, and solid-state chemistry techniques, with insight and property measurements from the condensed-matter physics, materials science, and biomedical communities.

Jay Gupta
Associate Professor, Department of Physics, The Ohio State University

Prof. Gupta's group is dedicated to exploring the often surprising behaviors that arise when small numbers of atoms and molecules are brought into close proximity. Such small aggregates offer a window into an intermediate state of matter between isolated

atoms and bulk materials. Improved understanding and control of these nanometer-scale structures may contribute to new paradigms for technologies such as molecular circuits, spin-based electronics and quantum computation.

Haiying He
Assistant Professor, Department of Physics, Valparaiso University

Dr. Haiying He is a Physics professor at Valparaiso University. She teaches both lower-division and upper-division physics courses. Her research interests are in the area of computational studies of nanoscale materials, surfaces, and interfaces for energy and human health related applications. She has a passion of mentoring undergraduate students in research and integrating research into higher-education.

Joseph Heremans
Professor, Departments of Physics & Materials Science Engineering, The Ohio State University

Prof. Heremans leads the Thermal Nanomaterials Laboratory, which is primarily engaged in the design, synthesis, and testing of materials for thermoelectric applications, including power generation through solar-thermal or automotive waste heat recovery as well as Peltier cooling. The lab specializes in thermal and electrical measurements of transport properties from 2K to 600K including electrical resistivity, Seebeck, Hall and Nernst coefficients. Thermal conductivity measurements from 2K to 1270K may be measured while X-ray diffraction (XRD), Scanning Electron Microsopy (SEM) and Differential Scanning Caloremitry (DSC) are used for structural characterizations.

Elizabeth Mann
Professor, Department of Physics, Kent State University

Dr. Mann is interested in fluid interfaces, not just between different disciplines, but literally, between different substances. Classical notions such as phase transitions, phase separation, and transport phenomena carry over to within these interfacial regions, but must be carefully reconsidered, taking into account the back-and-forth play between the molecular dimension perpendicular to the interface and macroscopic phenomena parallel to it. In addition, the intrinsic symmetry-breaking of the interface favors pattern formation and self-organization, while purely topological phenomena like connectivity and curvature are not exotic but rather of every-day importance.

Ruth Pachter
Senior Scientist, Air Force Research Laboratory, Wright-Patterson

Dr. Pachter's research interests are centered on computational materials science and engineering methods, with application to optical and electronic materials that address Air Force needs. See conference booklet for more information.

Nayana Shah
Assistant Professor, Department of Physics, University of Cincinnati

Prof. Nayana Shah is a theoretical phycisist and her field of research is Condensed Matter Physics. Using the fundamental laws of physics, her research seeks to understand how different phases and properties of matter emerge in a collection of many particles interacting with each other under different conditions. The quest is also to identify the universalities within the diversity. The main focus of her research is quantum matter and devices and she uses a variety of theoretical approaches depending on the problem at hand, with an emphasis on studying non-equilibrium dynamics and transport.

Carol Thompson
Professor, Department of Physics, Northern Illinois University

Thompson is an experimental materials physicist, studying how surfaces form and evolve during their growth and subsequent processing. She uses these results to further our understanding of the interplay of the microscopic mechanisms involved can be controlled to form desired properties in the complex materials structures. She uses x-ray scattering as a probe to watch how atoms and molecules attach and rearrange themselves onto the surface under the environments used in various vapor phase epitaxy film growth environments. She performs her x-ray experiments using the bright x-ray source of the Advanced Photon Source at Argonne National Laboratory

Nandini Trivedi
Professor, Department of Physics, The Ohio State University

The research in Professor Nandini Trivedi's group focuses on the effects of strong interactions in condensed matter systems and ultracold atoms in optical lattices. The basic idea is to understand how electrons and atoms get organized at very low temperatures and how new phases of matter emerge. For example, they examine quantum phase transitions between superfluids and Mott insulators in optical lattices, and how fermions become entangled into novel spin liquid states. They are also involved in many new avenues of research, including phases in complex oxides, such as high Tc superconductors and double perovskites, emerging from the interplay of charge, spin and orbital degrees of freedom. Their approach is to combine different types of quantum Monte Carlo simulations with analytical methods.

Rolando Valdés Aguilar
Assistant Professor, Department of Physics, The Ohio State University

Prof. Valdés Aguilar obtained his B.S. in Engineering Physics from Monterrey Tech in 2002. He earned his

Ph.D. in Physics from the University of Maryland in 2008. During this time, he made the discovery and collaborated in the explanation of electromagnon excitations in multiferoic materials. In January 2014 he started his position as Assistant Professor in the Department of Physics at The Ohio State University.

Desiré Whitmore
Science Curriculum Developer, Learning Design Group

Desiré is an accomplished scientist in ultrafast optical spectroscopy, attosecond spectroscopy and optical measurements of nanomaterials. She is currently a science curriculum developer for the Learning Design Group, where she is developing a digital science and engineering curriculum for middle school students nationwide. See conference booklet for more information.

HIGH ENERGY PHYSICS

Alysia Marino
Associate Professor, Department of Physics, University of Colorado - Boulder

Prof. Marino's research in experimental particle physics focuses on neutrinos, one of the basic building blocks of the standard model. For her PhD research, she studied solar neutrinos. She is currently active in the T2K long-baseline neutrino experiment in Japan, where a man-made beam of muon neutrinos is sent 295 km through Japan to the Super-Kamiokande detector. She is also a member of the NA61/SHINE experiment at CERN, and she hopes to use measurements from it to better understand neutrino beams. She is also involved in efforts in the US to build a new neutrino beam from Fermilab to be used with the proposed DUNE detector in South Dakota.

NUCLEAR PHYSICS

Mike Lisa
Professor, Department of Physics, The Ohio State University

Prof. Lisa is one of the leads of the OSU Relativistic Heavy Ion Group. The focus of the the group is the study of nuclear matter under the most extreme conditions of pressure, density, and temperature. While the nuclear matter found at the center of atoms is extremely dense (about two hundred billion times as dense as water), matter at the core of neutron stars is compressed up to 10 times more. Similarly, our own universe evolved from a state in which matter densities far exceeded those found at the center of an atomic nucleus. Studying the physics of how nuclear matter behaves under extreme conditions will further our understanding of our universe in fundamental areas beyond traditional nuclear physics.

PHYSICS EDUCATION RESEARCH

Jennifer Blue
Associate Professor, Department of Physics, Miami University

Prof. Blue is interested in how students develop their ideas and abilities. She has studied students' understanding of forces, of astronomy, and of critical thinking. In addition, she is interested in the classroom environment and how we teach. She has projects going about increasing inquiry-based science teaching in high schools, incivility in the college classroom, and her department's conversion to SCALE-UP. And finally, she has a long-standing interest in issues of equity in the classroom, and her collaborators and she has surveyed female science students from elementary school through college.

Renee Michelle Goertzen
Education Programs Manager, the American Physical Society

Dr. Goertzen's research interests are professional development for physics teachers, graduate students, and faculty and developing community among physics learners and instructors, using methodologies such as case studies, video analysis, and interviews. See conference booklet for more information.

Andrew Heckler
Associate Professor, Department of Physics, The Ohio State University

Prof. Heckler's research interests in the area of physics education and cognitive science include: Fundamental origins of student difficulties with scientific concepts, learning and the transfer of learning, implicit vs. explicit processes involved in answering physics questions, abstract and concrete representations, and the evolution and hierarchy of student understanding of physics.

Paula Turner
Professor, Department of Physics, Kenyon College

Astronomy and astrophysics are complementary approaches to understanding the night sky. Astronomers have worked for centuries observing the stars and planets, recording their motions, estimating their brightnesses, and developing explanations for the cycles they follow. The history of astronomy stretches back in time, long before writing, surviving in oral tradition and mythology embedded in the stories we tell of constellations and stars in the night sky. In the 20th century, revolutions in physics (quantum mechanics, relativity, semiconductors) opened up new perspectives on astronomy. Marrying principles and instrumentation derived from physics with the rich observational legacy of astronomy, the new discipline of astrophysics has produced an explosion of knowledge and understanding about how stars, galaxies, and nebulae work. Professor Turner also directs the CUREA program at Mount Wilson Observatory.