UC SANTA BARBARA

THE Current

October 15, 2019
Andrew Masuda and Sonia Fernandez

Leaders in their Fields

One professor specializes in understanding the microscopic forces present in living systems, while another searches for evidence of the highly elusive dark matter. A third is pushing the boundaries of polymer-based semiconductors, and still another is exploring the world of self-assembling and active biopolymer systems. And a fifth pioneering scientist has developed instrumentation to understand the complex interactions of biomolecules.

All of them — Megan Valentine, Harry Nelson, Michael Chabinyc, Zvonimir Dogic and Omar Saleh, respectively — are faculty members conducting their high-impact research at UC Santa Barbara. And they all are also the newest fellows of the American Physical Society (APS).

Recognized by their peers for their “exceptional contributions to the physics enterprise in physics research, important applications of physics, leadership in or service to physics, or significant contributions to physics education,” they join 163 fellow scientists and engineers “selected and recognized for their contributions to science.”

The Physics of Life

“The American Physical Society is the premier society for biological and biomaterial physics, and being selected as a fellow includes me among the leaders in the field, which is truly inspiring,” said Megan Valentine, a professor of mechanical engineering and associate director of the California NanoSystems Institute. “It is

both an honor and a goal I set at the beginning of my career. The fact that I was elected one year after attaining full professorship at UC Santa Barbara demonstrates the impact of my work. This honor further motivates me to continue pushing boundaries, pursuing interdisciplinary collaborations and taking risks."

Valentine's research focuses on understanding how forces are generated and transmitted in living materials and how they control cellular outcomes. She also examines how to capture and mimic, in manmade materials, the extraordinary features of living systems, including the ability to respond, move and heal. Her work to advance the understanding of fundamental biological processes could enable better disease diagnostics and treatments, and inspire the creation of high-performance materials used in coatings, packaging and robotics.

Selected by APS's Division of Biological Physics, Valentine was cited for her "pioneering research in the development of microrheology and the applications of biomechanics at multiple length scales to diverse biological systems."

The Mystery of Dark Matter

The nature of dark matter is one of the most pressing scientific questions of our time, according to high energy experimental physicist Harry Nelson. Indeed, the vast majority of matter in the universe is thought to be made up of this mysterious substance which, Nelson said, "neither emits nor absorbs substantial quantities of light and exceeds in energy density the usual matter that we are made up of by a factor of six."

Because of this apparent noninteraction with observable light, dark matter, though ubiquitous, is also extremely elusive. But Nelson is hot on its trail, with detectors built to seek out particles which could comprise dark matter. Nominated by the Division of Particles and Fields, Nelson was recognized by APS "for contributions to the experimental campaign to discover weakly interactive massive particles."

"I'm honored to be elected an American Physical Society Fellow for my work to detect the signals that might arise from the direct interaction of Weakly Interacting Massive Particles (WIMPs) in the detectors I have helped design, deploy, operate and analyze data from," Nelson said. "These detectors can detect dark matter particles which participate in the weak interaction, which is the interaction that powers the Sun. I've been very fortunate to have the enthusiastic support of UC Santa Barbara,

my many colleagues, engineers and students in the UCSB High Energy group, and the Department of Energy for three decades."

Next-Generation Electronics

Michael Chabinyc, chair of UC Santa Barbara's Materials Department, studies how to make electronic devices from polymers that conduct electricity. These materials can be printed from solvents, like an ink, to produce flexible transistors and solar cells. By using X-rays and electron microscopy to study how these polymers pack together at the nanoscale, Chabinyc develops new rules for structural design of these functional materials.

He was recognized by the Division of Polymer Physics and cited for "contributions to the understanding of relationships between structure and electronic properties of conjugated polymers, and the translation of these relationships to functional devices such as transistors and solar cells."

"I am honored to be selected," said Chabinyc, who was named a Materials Research Society Fellow earlier this year. "I believe the selection of multiple faculty who study synthetic polymers and biopolymers recognizes the strength of UC Santa Barbara in soft materials."

Active Matters

How do active matter systems — materials that consist of individual components that consume energy and thus exert their own motions — behave? How do these individual components move, self-assemble into larger systems, interact with each other, orient, sense and transition between phases? How can their properties and behaviors be harnessed into the next generation of "smart" materials?

Finding out the basic principles, as well as future applications of this relatively new field in soft matter research is at the heart of physicist Zvonimir Dogic's work, and what led to his election as a fellow. Nominated by its Topical Group on Soft Matter, the APS cited his "experiments on equilibrium self-assembled systems and active liquid crystals, and for the bottom-up engineering of biomimetic systems with life-like properties."

"APS fellow election is a recognition of scientific accomplishments by one's colleagues and peers," Dogic said. "I am an experimentalist and the

accomplishments described in the citation are really those of numerous undergraduates, graduate students, postdoctoral fellows and other collaborators that I have had the great fortune to work with over the past dozen years."

Life in the Micro-Scale

Omar Saleh, a professor of materials and of biomolecular science and engineering, was honored by the Division of Biological Physics for "outstanding contributions to single-molecule biophysics, including development of magnetic tweezer instrumentation and its use in elucidating electrostatic and self-avoidance contributions to biopolymer structure, as well as mechanics of motion of ring-shaped ATPases along DNA."

"There is special significance for me to be elected as a fellow," said Saleh. "As a young graduate student in 1999, I attended the centennial APS meeting and was blown away by the range of ideas on display. It was that meeting that really confirmed for me that I should pursue a career in science. So, it is extra meaningful to now be honored by the same society that had such a profound effect on me."

Saleh's research group studies the physical principles governing the behavior of soft, biological molecules and materials. Biomolecules take part in a wide array of complex interactions and behaviors, so untangling them will lead to new insights into what it means to be alive, as well as generate ideas and opportunities for new applications.

About UC Santa Barbara

The University of California, Santa Barbara is a leading research institution that also provides a comprehensive liberal arts learning experience. Our academic community of faculty, students, and staff is characterized by a culture of interdisciplinary collaboration that is responsive to the needs of our multicultural and global society. All of this takes place within a living and learning environment like no other, as we draw inspiration from the beauty and resources of our extraordinary location at the edge of the Pacific Ocean.