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An EPiQS Pursuit

UC Santa Barbara condensed matter physicist Andrea Young conducts his work at the boundary of theory and actuality, as he builds instrumentation to probe for signature quantum properties in advanced materials. Using his expertise in the realm of graphene systems, he and his research group also work to coax as-yet hypothetical behaviors from the two-dimensional material's atoms that, if found, could lead to advances in realms such as quantum sensing and topological quantum computing.

Young's experience and expertise have caught the attention of The Gordon and Betty Moore Foundation. And, as a result, he has been selected as one of 20 Experimental Investigators in the Moore Foundation's Emergent Phenomena in Quantum Systems (EPiQS) Initiative, which aims to support U.S. experimental scientists' pursuit of "innovative, risky research with a potential for significant advances in the concepts and methods used to investigate quantum materials."

"The Moore Foundation is doing something really special — giving large grants with true flexibility and freedom," Young said. "I am flattered to have been chosen and excited to make the most of this with some risky projects I've been thinking about for a long time!"

Selected through a national competition with an extensive peer review process, each Experimental Investigator will receive $1.6 million in unrestricted support over the next five years.

“The Experimental Investigator awards are the largest grant portfolio within the EPiQS initiative,” said Amalia Fernandez-Pañella, program officer of the EPiQS Initiative. “We expect that such substantial, stable and flexible support will propel quantum materials research forward and unleash the creativity of the investigators.”

Young’s drive to discover has already led to important advances in his field. He has been credited as one of the pioneers of van der Waals heterostructures — layers of atom-thick materials held together by a weak distance-dependent attraction between the atoms in each layer — which has since influenced how scientists approach 2D systems in general. More recently, he and his research group have reported the discovery of a variety of new quantum phases of electrons, spanning new forms of magnetism, to states harboring non-Abelian anyons — collective excitations that could pave the way toward a logic system for topological quantum computers. Support from the Experimental Investigator award will enable him to range farther into the 2D universe, building tools to probe these phases of matter on nanometer length scales and resolve their dynamics on picosecond timescales.

“The Moore Foundation has recognized the fantastic opportunities at UCSB, where we have seen spectacular growth of multidisciplinary efforts in quantum materials in the last few years,” said Claudio Campagnari, chair of the UC Santa Barbara Department of Physics. “And, of course, we're pleased the foundation will be supporting the development of Andrea's unique instrumentation, which promises to provide radically new windows into the inner workings of correlated electron physics. We look forward to the impacts of the Foundation's support on the whole quantum materials ecosystem at UCSB in the coming years.”

The EPiQS cohort’s research will cover a broad spectrum of research questions, types of materials systems, and complementary experimental approaches. The investigators will advance experimental probes of quantum states in materials; elucidate emergent phenomena observed in systems with strong electron interactions; investigate light-induced states of matter; explore the vast space of two-dimensional layered structures; and illuminate the role of quantum entanglement in exotic systems such as quantum spin liquids. In addition, the investigators will participate in EPiQS community-building activities, which include investigator symposia, topical workshops and the QuantEmX scientist exchange program.

Since 2013, EPiQS has supported an integrated research program that includes materials synthesis, experiment and theory, and that crosses the boundaries between physics, chemistry and materials science. The second phase of the initiative was kicked off earlier this year with the launch of two major grant portfolios: Materials Synthesis Investigators and Theory Centers, including one at UCSB's Kavli Institute for Theoretical Physics. The twenty newly inaugurated Experimental Investigators will join these grantees to form a vibrant, collaborative community that strives to push the entire field towards a new frontier.

"The first cohort of EPiQS Experimental Investigators made advances that changed the landscape of quantum materials, and I expect no less from this second cohort." said Dušan Pejaković, Ph.D., director of the EPiQS Initiative. "Emergent phenomena appear when a large number of constituents interact strongly, whether these constituents are electrons in materials, or the brilliant scientists trying to crack the mysteries of materials."

The Gordon and Betty Moore Foundation fosters path-breaking scientific discovery, environmental conservation, patient care improvements and preservation of the special character of the Bay Area. For more information visit Moore.org or follow @MooreFound.

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.