

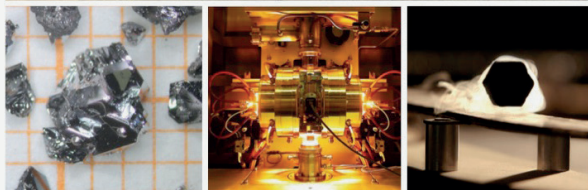
The Moore Foundation's Emergent Phenomena in Quantum Systems Initiative

In May 2013, the Gordon and Betty Moore Foundation launched the Emergent Phenomena in Quantum Systems funding initiative (EPIQS), which aims to stimulate breakthroughs in the science of quantum materials and to advance understanding of the basic organizing principles of complex quantum matter. The program was approved for an initial six-year term and a budget of \$90 million.

Solid materials, comprised of many billions of interacting particles, present boundless opportunities for discovery of emergent phenomena – cooperative behaviors that cannot be predicted from the properties of constituent particles. Materials also create the basis of modern technology; continued advances in materials research and processing have enabled the unparalleled growth of the electronics industry, making it possible for Moore's law to remain valid for more than 50 years.

Recent years have witnessed exciting progress in investigations of a new generation of electronic materials – often termed “quantum materials” – that are characterized by many new types of emergent electronic behavior and quantum properties that are observable on the macroscopic scale. The decision to launch EPIQS was motivated by the recognition that quantum materials are important to basic science and society and by a belief that the field is approaching a critical juncture at which a strategic investment can propel it to new heights. This decision was consistent with our founders' intent to “tackle large, important issues at a scale where [our foundation] can achieve significant and measurable impacts.”

EPIQS is an integrated research program that incorporates materials synthesis, experiment and theory, and that crosses the boundaries separating physics, chemistry and materials science. The key principle of our approach is a focus on people instead of a narrowly defined scientific agenda. For the most part, the research agenda is established, and continually being shaped, by the community of researchers we support. They study a broad swath of physical systems and problems. We see this breadth as an advantage, because in this rapidly evolving field it is currently uncertain which particular



Faces and facets of the EPIQS Initiative

TOP: COURTESY OF DUSAN PEJAKOVIC, MOORE FOUNDATION. BOTTOM LEFT: COURTESY OF RONGWEI HU, RUTGERS UNIVERSITY. BOTTOM MIDDLE: COURTESY OF CURTIS BOLES, OAK RIDGE NATIONAL LABORATORY. BOTTOM RIGHT: COURTESY OF ANDREA DAMASCELLI, QUANTUM MATTER INSTITUTE, UNIVERSITY OF BRITISH COLUMBIA - WWW.QMLAB.UBC.CA

materials or technical approaches will lead to the next major advance. Moreover, supporting a diverse scientific community offers opportunities for cross-fertilization of ideas generated by researchers with complementary expertise, which would be impossible within a program focused on a small number of research themes.

EPIQS supports blue-sky science and provides scientists with the resources and freedom to explore highly uncertain research directions. The program dedicates substantial resources to materials synthesis and development of new experimental techniques, because materials discovery and new probes are major drivers of scientific progress yet are often difficult to support through traditional funding sources.

The EPIQS strategic approach is implemented through the following types of support:

- Moore Investigators in Quantum Materials - these awards currently support 31 leading experimental and synthesis experts. The five-year grants aim to take full advantage of the researchers' creativity through largely unconstrained support, in which risk-taking and innovation are strongly encouraged.
- Moore Fellows in Materials Synthesis - this portfolio supports new faculty whose primary expertise is materials synthesis. The goal of these awards is to strengthen synthesis efforts at leading U.S. academic institutions and help

secure the future for a new generation of synthesis experts.

- Theory Centers - this portfolio supports theory programs at six leading U.S. universities by funding primarily prestigious postdoctoral fellowships. The Moore Theory Postdoctoral Scholars have the freedom to work with any faculty member at the host universities and to pursue their individual research interests, which enables them to acquire broad knowledge needed for future intellectual leadership in the field.

- Equipment Grants - they are intended to enhance experimental capabilities at leading research institutions. The funds can be used to acquire expensive, state-of-the-art equipment or to support the development of first-of-a-kind instrumentation.

- Rapid-Response Grants - they drive innovation by supporting timely projects with high potential to make breakthroughs. These projects may include experimental tests of novel theoretical concepts and highly innovative research endeavors that are unlikely to be supported through traditional funding channels due to their high-risk nature.

- Community Building - these funding efforts aim to galvanize the quantum materials research community, promote the exchange of ideas and facilitate collaborations. The supported activities include investigator symposia, workshops, “Big Ideas” meetings, a scientist exchange program, and strategic partnerships with organizations sharing our purpose of fostering research and collaboration in this field.

Through EPIQS, the Moore Foundation strives to unleash the creative potential of a community of outstanding researchers and push the entire field of quantum materials forward. We hope that one of the outcomes of this initiative will be to stimulate a broader support for discovery-driven science in the U.S. and internationally.

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