UC SANTA BARBARA

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Unleashing the Atom

Scientists have known for a long time that nature is quantum, following physical principles — at the atomic and molecular levels — that to the naked eye would seem counterintuitive and downright surreal.

According to UC Santa Barbara theoretical physicist Leon Balents, these quantum behaviors can be harnessed to produce materials and technologies with properties we've only dreamed of, as well as applications we haven't even thought of yet.

"Quantum materials are materials — solid substances — whose electrons act together to produce surprising properties relying on the quantum laws of nature," said Balents, who holds the Joe Yzurdiaga Chair in Theoretical Physics at UC Santa Barbara's Kavli Institute for Theoretical Physics (KITP). "Quantum materials can provide new means to convert waste heat into usable energy, to build exquisitely accurate sensors, and to transmit power with ultra-low loss."

And now, as a new co-director of CIFAR's Quantum Materials program, Balents is poised to contribute his expertise in correlated electron systems, quantum magnetism and complex materials, and his leadership to the Canadian educational research center's efforts to accelerate science and research in the burgeoning field.

"I'm honored to take on this leadership role in CIFAR's longest-running program, which has played a seminal role in its area of quantum physics," he said. "The Quantum Materials program led the world to advances in high-temperature superconductivity, and has since broadened to embrace and in fact define the field

of quantum materials.”

Balents joins a cohort of international, top-caliber researchers from diverse fields to conduct research that addresses science and humanity’s most important questions. CIFAR’s new portfolio of 13 research programs explore themes including life and health; individuals and society, Earth and space; and information and matter. The selection of its research programs and the fellows chosen to pursue them comes after a rigorous and meticulous 16-month call for ideas.

“For almost 40 years, CIFAR has supported fundamental research and innovation across borders and disciplines,” said Alan Bernstein, president and CEO of CIFAR. The portfolio of research the nonprofit organization intends to pursue will, according to him, “change conversation across disciplines and result in the scientific, technological and scholarly advances of tomorrow.”

In the field of quantum materials, these advances may be closer than we think, as quantum scientists everywhere endeavor to investigate, characterize and even build materials that will revolutionize fields from chemistry to cybersecurity, engineering to computing.

“Quantum materials are the logical successors of the semiconductor materials which underlie today’s electronics, and will be used to create the quantum computers of tomorrow,” Balents said. “As a new CIFAR co-director, I aim to advance this field by convening the best minds and most creative scientists in the field for intense brainstorming, collaboration and training for young scientists in this dynamic field. I hope that I can both help the program to engage internationally while supporting the Canadian community from which it springs.”

CIFAR is a Canada-based, global charitable organization that convenes extraordinary minds to address science and humanity’s most important questions. By supporting long-term interdisciplinary collaboration, CIFAR provides researchers with an unparalleled environment of trust, transparency and knowledge-sharing. CIFAR’s community of fellows include 19 Nobel laureates and more than 400 researchers from 22 countries.

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.