Quantum Mechanics--Looking At the Big Picture

Jack Harris

CURRENT RESEARCH

Observing quantum effects in the behavior of macroscopic objects

Dr. Harris, of the Department of Physics at Yale University, focuses on the possibility of observing exotic quantum effects in the behavior of macroscopic objects.

Quantum mechanics provides us with the basic laws of physics. Although the form of these laws has been known for nearly a century, they describe a universe that is profoundly counterintuitive: objects may appear to be in multiple places at once, they may appear to influence each other without regard for the distance separating them, they may pass through apparently impenetrable barriers, and they may process information much more efficiently than any apparatus obeying the laws of classical mechanics. These phenomena are usually thought of as occurring only at the smallest scales (e.g., with electrons, photons, and atoms). However, the laws of quantum mechanics do not explicitly prohibit macroscopic objects from exhibiting these unusual phenomena.

In the early years of quantum mechanics, Albert Einstein pointed out that the force exerted by a reflecting photon would offer a conceptually simple means for inducing (and observing) quantum behavior in macroscopic objects. Normally, the force exerted by photons is so weak that it is almost unmeasurable. Dr. Harris' team is devising ways to enhance this force to a level well beyond what can be achieved today, with the goal of observing the most dramatic quantum effects in the motion of macroscopic objects. Dr. Harris' team has succeeded in observing simple quantum effects in the motion of a 1-mm-square sheet of glass with a mass of 40 nanograms. The team has recently observed the first optomechanical effects in superfluid liquid helium. Although the effects observed so far are classical, they...

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AFFILIATION

Yale University

EDUCATION

- A.B. in Physics, 1994

Cornell University

- Ph.D. in Physics, 2000

University of California, Santa Barbara

- Postdoc in Center for Ultracold Atoms, 2004

Harvard University

AWARDS

- Arthur Greer Memorial Prize, 2009
- DARPA Young Faculty Award, 2009
- Yale University Junior Faculty Fellowship, 2008
- Sloan Research Fellowship, 2007

RESEARCH AREAS

Technology, Materials Science / Physics, Space

FUNDING REQUEST

Dr. Harris' operations require about $600,000 per year for personnel, equipment, and supplies. With adequate support, Dr. Harris expects that his team's unique experiments will be achievable in the next five years. Your donations will fund this research that pushes the boundaries of science and seeks to take quantum mechanics to the next level.