Optics Center to Build New Laser Lab

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A $510,500 grant from the M.J. Murdock Charitable Trust will help scientists at the University of Oregon's Center for Optics (OCO) jump to a new level in the quest to manipulate light and matter at the atomic level.

The grant, coupled with a $600,000 investment by the university, will build and equip a research lab quiet enough and clean enough to allow researchers to probe and control the behavior of atoms, semiconductors and nanometer-thin metal films.

The university's new Laboratory for Quantum Control, the first of its kind in Oregon, will enable the UO group to carry out original experiments at an internationally competitive level, says physics professor Michael Raymer. He and Andrew Marcus, associate professor of chemistry, are the new lab's principal investigators.

"It's absolutely clear that basic discovery now leads directly to new technologies in the future," Raymer says. "The cutting-edge science that is going on now will lead to inventions that we can't even imagine."

Raymer says quantum control is essential if the semiconductor industry is to keep up with the demand for increased capacity. According to Moore's Law, the capacity of chips to hold information doubles every 18 months.

"We're already down to the level where quantum effects are in play," Raymer says. "Within three to five years, the size of each circuit element

is going to be on the nanometer scale, where quantum effects begin to be important."

The theory of quantum mechanics describes systems that don't fit into our every day experience as defined by Newtonian physics.

"Electrons don't exist in the same way that our intuition tells us that they ought to, and their behavior doesn't map onto space and time the way that an apple falls from a tree," Marcus explains. "All the rules change as we enter the quantum level. We're discovering whole new ways to think about information."

The new Laboratory for Quantum Control will be a part of the university's Oregon Center for Optics, which contributes to ONAMI, the Oregon Nanoscience and Microtechnologies Institute, a collaboration involving the University of Oregon, Oregon State University, Portland State University, the Pacific Northwest National Laboratory, the state of Oregon and private industry.

The new temperature-controlled laboratory will be equipped with two state-of-the-art laser systems allowing the UO scientists to probe into the structure and dynamics of matter and light. Using new insights from these studies, they hope to conduct research that leads to increased computer capability, improved optical-fiber communications, control of chemical reactions and new forms of electronics.

Leading-edge research in this area involves controlling atoms and molecules by using ultrashort light pulses with durations comparable to the shortest light pulses available--as short as 10-14 seconds (one-hundredth of a millionth of a millionth of a second). These can be provided by recently developed laser technology, which will form the centerpiece of the laboratory.

When complete in early 2005, the new lab in Klamath Hall will house the custom-built laser systems as well as all of the lasers currently used in Marcus' labs.

Raymer, a founding member of the Oregon Center for Optics, specializes in quantum and classical optical phenomena. Marcus specializes in single molecule and ultrafast laser spectroscopy. Other faculty members who also will participate in the new facility include Tom Dyke, a chemistry professor; Miriam Deutsch, assistant professor of physics; Stephen Gregory, associate professor of physics; and Hailin Wang, associate professor of physics. The M.J. Murdock Charitable Trust was created by the will of the late Melvin J. (Jack) Murdock, a co-founder of Tektronix, Inc., of Beaverton, Ore.

"This latest award reflects the Murdock Charitable Trust's commitment to helping the University of Oregon create world-class scientific instrumentation facilities," says Richard Linton, UO vice president for research and graduate studies. "We expect the investment in this new laboratory to cement the UO's position as a leading research center in this branch of nanoscience for years to come."

Source: University of Oregon

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