UCSD physicist awarded Hellman Fellowship

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Dimitri Basov, an assistant professor of physics at the University of California, San Diego, has been awarded a $20,000 Hellman Faculty Fellowship.

The award, effective for one year beginning July 1, 1997, is intended to support Basov's research and creative activities.

Basov, who joined the UCSD faculty last January from the Brookhaven National Laboratory in New York, is conducting experiments on electron transport in novel materials, including exotic conductors and superconductors.

Among other things, he is using infrared and optical spectroscopy to study high- temperature superconductor materials, which are capable of conducting electricity without resistance.

The discovery in 1986 of the high-temperature superconductors in a novel of class ceramic materials took researchers by surprise. Then, a team of scientists at the IBM Corp. Laboratory in Zurich, Switzerland announced they had observed the phenomenon at a temperature of about -425 degrees F., some 30 degrees warmer than scientists thought possible in these materials. Further work on ceramics of slightly different composition resulted in superconductivity at even higher temperatures.

Before long, people were talking about room-temperature superconductivity, ushering in a new era of superconducting supercomputers, levitating passenger trains, and saving millions of dollars wasted by ordinary conductors like copper, using low-cost, high-power transmission wires made of the new materials.

Though improvements have been steady, and several products have resulted, the initial rush of excitement has cooled somewhat in recent years.

To be sure, over the past decade scientists have pushed the maximum temperature of superconductors up to 134 degrees K., and discovered more than 100 compounds with this property. Such achievements are considered remarkable for such a young technology. But researchers hope that by pinpointing the mechanism responsible for high-temperature superconductivity, they may tailor new materials to specific purposes, and conceivably push superconducting transition temperatures significantly higher than those presently achieved.

In his laboratory, Basov is studying different types of high-temperature superconductors, focusing on structurally simpler compounds than those pushing the upper temperature ranges.

"We hope that these simple materials will help us to better understand properties of this class of superconductors because it's still the same physics under which high-temperature superconductivity operate," he said.

"These are in a sense model systems to tackle the same exciting problems also found in their high-temperature brothers."

While the primary goal of Basov's work is aimed at unraveling the fundamental physics behind the mechanism of high-temperature superconductivity, the "byproduct" of this experimental program is directly related to applications of these materials in satellite communications and other areas.

As part of his studies, Basov has designed and built devices to probe optical properties of tiny grains of superconducting material. The goal of these spectroscopic studies is to get an insight into the physical processes that govern interactions in the electronic system of the high- temperature superconductors. Researchers believe that if they can better understand the fundamental laws of the electronic transport in these materials, they can overcome the intellectual barriers that have stymied progress in the field.

"Crystals of high-temperature superconductors do not grow very large," Basov said. "Technically, they're quite difficult to study. So we needed to build instrumentation here to do that."

Funds from the Hellman fellowship will go toward the construction of an even more sophisticated instrument to study superconductors and other novel materials in previously unexplored frequency and temperature ranges.

Basov also is collaborating with researchers at Brookhaven, developing experimental spectroscopic techniques using synchrotron light sources.

Basov received his Ph.D. in physics in 1991 from the Lebedev Physics Institute, Academy of Sciences of Russia. Earlier this year, he was awarded a Sloan Research Fellowship, which honors young scientists in the early stages of their careers on the basis of their exceptional promise to contribute to the advancement of knowledge.

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