High-efficiency solid-state lighting and superconductor research receives funding

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Energy sciences flourish under DOE grant award

Los Alamos, New Mexico, August 26, 2009—Lower-cost, higher-efficiency lighting and better superconducting materials could result from a pair of grants awarded to Los Alamos National Laboratory researchers.The U.S. Department of Energy's Office of Science, Basic Energy Sciences, recently announced its commitment to fund two Single Investigator and Small Group Research projects at Los Alamos. Each project will be funded for up to three years.The first project, led by Jennifer Hollingsworth and Han Htoon, will focus on "Giant Nanocrystal Quantum Dots: Controlling Charge Recombination Processes for High-Efficiency Solid-State Lighting." This scientific

effort exploits novel nanomaterials—particles hundreds of times smaller than a grain of sand—that have the potential to convert electrical energy to light with 100 percent efficiency.Although researchers have used nanocrystal quantum dots for light-emitting diodes (LEDs) in other efforts, the materials have serious drawbacks, such as blinking or flickering due to complex physical properties inherent to the materials. Due to the inherent flaws of conventional nanocrystal quantum dots, LEDs made from them have been limited to external quantum efficiencies (EQEs) of only about 2 percent.Hollingsworth and Htoon have found a way to cover giant nanocrystal quantum dots with a shell of inorganic material that mitigates the inherent flaws of conventional nanocrystal quantum dots. Further development of the technology could result in significantly improved LED lighting systems that are highly efficient, reliable, and cost effective.The other project, “Towards a Universal Description of Vortex Matter in Superconductors,” focuses on understanding vortex physics in superconducting materials. This understanding could enhance the current-carrying capacity of superconductors, which are materials with the ability to conduct electrical current without resistance, generally at extremely cold temperatures.Principal researcher Leonardo Civale is examining how nanosized imhomogeneities—tiny deviations from uniformity—in the lattice structure of superconducting materials can behave as “pinning centers,” trapping current vortices and precluding motions that would dissipate energy and reduce the current-carrying capacity of the superconducting material. By exploring these phenomena in different materials across a broad spectrum of properties, Civale and colleagues expect to develop a unified picture of vortex matter that is valid for all superconductors.“Both of these Los Alamos National Laboratory research projects illustrate how the Laboratory is using cutting-edge science to address problems of significant importance to the nation,” said Terry Wallace, principal associate director for Science, Technology, and Engineering at Los Alamos.

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