Semiconductor Optical Refrigeration: Could a LED Ever Become a Cooler?

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Abstract: I will first introduce the newly established Center for Nanophotonics at the Arizona Institute of Nanoelectronics and some of the research highlights of my group in optoelectronics at Arizona State University. Then I will present our latest research work on semiconductor optical refrigeration.

Solid state optical refrigeration is a relatively new field although the idea was first proposed almost 80 years ago. It was first experimentally confirmed in doped glasses in 1995. Our effort mainly focuses on the study of the possibility of optical refrigeration in semiconductor light emitting devices, which is much more challenging than that in glasses as semiconductors have much greater refractive indexes and non-radiative recombination rates. In order to fully understand the cooling processes in semiconductors, the transport and optical properties in heterostructures, such as Peltier effect and photon recycling, need to be taken into account. I will discuss the theoretical limits to these processes and some preliminary experimental results.

Brief Bio: Professor Zhang received his BS and MS in China and PhD in Physics from the Max Planck Institute for Solid States and University of Stuttgart in 1991. He then worked as an Assistant Research Engineer at UCSB before he joined Hughes Research Labs in 1993. In 1996, he became an Associate Professor in the Department of Electrical Engineering at ASU. He was promoted to full professor in 2000. He is the founding director of the Center for Nanophotonics at the newly established Arizona Institute for Nanoelectronics and the director of a MURI program on semiconductor optical

refrigeration. His areas of research interest include MBE growth, optical properties of semiconductor quantum structures, optoelectronic devices, and their applications. He has published more than 120 refereed papers and book chapters, edited several conference proceedings, 3 issued US patents, and given numerous invited presentations at various national and international scientific conferences. He is a senior member of IEEE and a member of several other professional associations.

Prof. Zhang will give a talk at 3:00 p.m. Jan. 9, 2007 in the meeting room 408 of physics building. Please ask your students to join us.