IUPUI Department of Physics Presents:

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Optical refrigeration on CdSe quantum dots

Thursday,
April 26, 2018* 3:30pm,
LD 010
402 N. Blackford Street

Refreshments at 3:00 pm in the Physics Conference Room LD 154B
For additional information call 274-6900

Abstract: In 1929, optical refrigeration (OR) in solids was first proposed by the German physicist Peter Pringsheim. In OR, vibrational energy is removed by spontaneous energy up-conversion photoluminescence (UCPL). Despite of many attempts carried out in different materials, OR in solids was not achieved until 1995, when Epstein and coworkers observed a temperature drop of 0.3 K in Yb³⁺ doped glass. In 2012, Zhang and his coworkers successfully cooled a CdS nanobelt by 40 K. Their work revealed the possibility of realizing OR in semiconducting nanomaterials and greatly encouraged the research in this field. Here, we are proposing OR on quantum dots (QDs) made of cadmium selenide (CdSe) by utilizing a phonon-annihilation-coupled UCPL process. The possible cooling power calculated based on the data from CdSe QDs (zinc-blende crystal structure) conducted with a recent developed method in our lab will be presented, together with a semi-empirical model developed to help us understand the QDs’ PL mechanism and to provide better predictions on the processes involved. Finally, the possibilities and limits of OR in semiconducting quantum dots will be discussed.

*Physics colloquium is scheduled for every Thursday during the academic year, 3:30 PM in LD 010. Changes to the schedule will be posted at www.physics.iupui.edu