Colder than Ultracold: A Novel Use for Optical Lattices

Michael Stewart

February 11, 2013

Abstract

The advent of laser cooling and evaporative cooling techniques pushed the experimental temperature limit down to the order of tens of nano-Kelvin (nK). When paired with magnetic or optical trapping techniques, such cooling efforts have allowed researchers to produce the exotic phase of matter known as Bose-Einstein Condensation (BEC) in the laboratory. BECs and other ultracold atom systems allow a detailed study of quantum many-body physics, quantum information and computing studies, and, when combined with optical lattices (standing waves of light which create periodic potentials similar to those of a perfect crystal), condensed matter and crystal physics. Recent research due to Bakr *et al.* has demonstrated a method of cooling utilizing optical lattices that may lower the cooling limit to the researchers' goal of 1 pico-Kelvin (10^{-12} K). This talk will provide a brief introduction to the state of ultracold atomic physics research (including a very brief overview of cooling and trapping methods), explore the novel cooling approach of Bakr *et al.*, and explore the physics of the colder than ultracold.

References:

1. Bakr, W. S. et al. Nature 480, 500503 (2011).