Applied Physics & OSA

Optics Seminar

Sensing nanomechanical motion with a resonant microwave interferometer

Prof. Konrad Lehnert

Associate Fellow of JILA and Assistant Professor of Physics (Adjoint) NIST and The University of Colorado

Abstract:

Detection of nanomechanical motion near the quantum limit opens the possibility of sensing the recoil force of individual microwave photons. It provides a method to test schemes of backaction evading measurements and to cool the motion of the beam close to its mechanical ground state. To pursue these ideas, we have embedded a nanomechanical resonator in a microwave cavity. By detecting the phase shift of microwave signals as they pass through the cavity, we observe the Brownian motion of the beam at millikelvin temperatures and detect the radiation pressure of microwave signals. We achieve a force sensitivity of 3 aN/Hz^{1/2} and displacement sensitivity 30 times worse than the standard quantum limit. I'll discuss prospects for sensing displacement at the quantum limit, and for cooling the beam to its motional ground state, with this technique.

Brief Biography:

Konrad Lehnert graduated in 1993, with a B.S. in physics (honors), from Harvey Mudd College. Before attending graduate school, he worked as a microwave design engineer for Pacific Communications Sciences Inc. As a physics graduate student at the University of California at Santa Barbara, he studied electron coherence in superconductor-semiconductor-superconductor Josehpson junctions, working with S. James Allen and Herbert Kroemer. After receiving his Ph.D. in 1999, he worked as post-doctoral scientist at Yale University with Robert Schoelkopf. There his work focused on the use of ultra-small Josephson junction circuits as Qubits and as fast, sensitive electrometers. His publications from that period include the first charge measurements to use a radio-frequency single electron transistor. In 2003 he joined JILA, as an Associate Fellow, and the Physics Department at the University of Colorado, as an assistant professor. In 2007 he became a Fellow of JILA. He conducts research in quantum electronics, mesoscopics, and nanomechanics.

Wednesday, February 27, 2008.

4:00pm-5:00pm.

Watson 104

Refreshments will be available in the Watson Lobby at 3:45pm.