"Quantum Photonics Faculty Candidate Seminar"

February 11th, 2015 @ 3:30pm
BRK, ROOM 2001

Dr. Jeff Thompson

Title: Nanoscale quantum systems with single atoms and photons

Bio: Jeff Thompson received his PhD from Harvard University in 2014 under the supervision of Mikhail Lukin. His thesis work was the development of a new experimental platform for quantum optics, consisting of single laser cooled atoms coupled to nano-optical cavities. He is currently a posdoc with a joint appointment between Harvard and MIT, working with Lukin at Harvard and Vladan Vuletic at MIT on many-body physics and quantum optics with ultracold Rydberg atoms.

Abstract: Strong interactions between light and atoms at the single-quantum level are an important ingredient for quantum technologies, and for studies of complex many-particle quantum systems. In this talk, I will describe the development of a novel experimental platform that allows for trapping a single rubidium atom in the evanescent mode of a nano-fabricated optical cavity with sub-wavelength dimensions. By virtue of their small size, these cavities provide extremely large atom-photon coupling strengths and good prospects for scalability and integration into complex quantum optical circuits. Positioning the atom near the nano-structure is accomplished using a scanning optical tweezer dipole trap. As a first application, we have demonstrated a coherent optical switch, where a single gate photon controls the propagation of many subsequent signal photons, with the interaction mediated by the atom and cavity. We have also shown that the optical response of the combined atom-cavity system is nonlinear at the level of one or two photons. I will close by discussing prospects for extensions with many atoms to realize large-scale quantum networks and create complex entangled states.