Speaker: Edward Flagg, West Virginia University
Title: “Quantum Dots and Quantum Optics”
Abstract: Semiconductor quantum dots (QDs) are often called artificial atoms because charge carriers trapped within them have discrete energy levels in the fashion of atoms. They absorb and emit light at discrete wavelengths corresponding to those energy levels. Because of this, in many ways QDs behave like the canonical two-level quantum system, which makes them suitable for experiments involving the quantum nature of light, which is called quantum optics. Milestones achieved using solid-state quantum emitters include photon anti-bunching, coupling to a photonic cavity, spin-manipulation of a single trapped electron, and entangled photon-pair generation.

I will present in detail an experimental technique developed to allow direct, resonant excitation of the lowest energy excitonic state in a QD. Previously, such excitation was thought impossible because the magnitude of scattered laser light would vastly overpower the meager emission of a single QD. The effects of resonant excitation include the Mollow triplet emission from dressed states, and oscillations in the photon emission statistics. I will also discuss related work investigating the indistinguishability of photons emitted by different QDs. Indistinguishable single photons will be useful in quantum information processing, or in quantum repeaters which would distribute entanglement along optical networks.