Abstract Submitted
for the MAR13 Meeting of
The American Physical Society

Temperature Dependence of the Single-Photon Sensitivity of a Quantum Dot, Optically Gated, Field-Effect Transistor ANDREW PRUDHOM, ERIC GANSEN, Physics Department, University of Wisconsin-La Crosse, MARY ROWE, Optoelectronics Division, National Institute of Standards and Technology, Boulder, SEAN HARRINGTON, JOHN NEHLS, Physics Department, University of Wisconsin-La Crosse, SHELLEY ETZEL, SAE WOO NAM, RICHARD MIRIN, Optoelectronics Division, National Institute of Standards and Technology, Boulder — The potential advantages that quantum communications and computing have over their conventional counterparts have seeded a growing interest in transmitting and processing information with individual photons. However, if these technologies are ever to reach their full potential, improved single-photon detectors will have to be developed. Here, I present a systematic study of the temperature dependence of the electrical noise in a quantum dot, optically gated, field-effect transistor (QDOGFET) and detail how the noise influences the sensitivity of this novel single-photon detector. Previous studies have shown that when cooled to 4K, QDOGFET's exhibit single-photon sensitivity and photon-number resolving capabilities; however, there has been no systematic study of how operating temperature affects their performance. Here, we measure the noise spectra of a device for a range of sample temperatures between 7K and 60K. We use the noise data to determine the signal-to-noise ratio of the optical response of the device for various temperatures and detection rates. Our analysis indicates that QDOGFET's can operate over a broad range of temperatures, where increased operating temperature can be traded for decreased sensitivity.

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Date submitted: 07 Nov 2012 Electronic form version 1.4