Abstract Submitted
for the MAR13 Meeting of
The American Physical Society

Dynamic Hole Trapping Effect in an InAs/AlGaAs quantum dot molecule WEIWEN LIU, University of Delaware, ALLAN BRACKER, DANIEL GAMMON, Naval Research Laboratory, MATTHEW DOTY, University of Delaware — It is well established that the charge and spin configurations of single electrons or holes are promising candidates for next generation computational and logic devices. Quantum Dots Molecules (QDMs) are attractive components for confining and manipulating single charges because the discrete energy levels, charge interactions and spin properties can be tailored with size and composition. The strong confinement QDMs causes overlap of wavefunctions and results in different Coulomb interactions and unique energy levels for different numbers of charges and even for distinct spatial distributions of the same total charge. Quantitative measurements of the Coulomb interactions are important in order to understand charge and spin interactions and design structures for device applications. We present a new phenomenon discovered during optical spectroscopy of a QDM with an AlGaAs barrier between two QDs. AlGaAs barrier allows an extra hole to be trapped in a metastable state of the higher energy QD due to the higher barrier potential. This ?dynamic trapped hole? occurs only under certain electric field conditions and perturbs the Coulomb interactions of the other charges present in the QDM. We propose a model of the kinetic pathways that leads to this dynamic hole trapping effect. We compare the energy of states with and without the extra hole in order to understand many body Coulomb interactions that perturb states energies. We then discuss the challenges and opportunities this effect provides for future devices.

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Date submitted: 17 Jan 2013