Abstract Submitted
for the DAMOP14 Meeting of
The American Physical Society

Wavelength sensitive detector based on ICD in two coupled quantum wells TAMAR GOLDZAK, Schulich Faculty of Chemistry and Russell-Berrie Nanotechnology Institute, Technion-Israel Institute of Technology, IDO GILARY, Schulich Faculty of Chemistry, Technion-Israel Institute of Technology, NIMROD MOISEYEV, Schulich Faculty of Chemistry, Russell-Berrie Nanotechnology Institute, and Department of Physics, Technion-Israel Institute of Technology — We design a wavelength sensitive detector based on inter coulombic decay (ICD) mechanism in a two-quantum well nano-structure. The two coupled quantum wells are designed to satisfy the specific conditions which allow the ICD to occur. In this setup, by absorbing light an electron in one well is excited. Its relaxation back to the ground state is a non-radiative process which transfers the excess energy to the ionization of the electron in the neighboring well into the continuum. Only radiation with a specific wavelength will be absorbed, when the wavelength matches the excitation energy in the quantum well. By applying a weak bias a current is obtained even when light with a very low intensity is absorbed. For the ICD to be dominant decay mechanism it must prevail over all other possible competitive decay processes. We have found that the lifetime of the ICD is on the timescale of picoseconds. Control over the ICD lifetime can be achieved by variation of different parameters in the two quantum well nano-structure. The most useful parameter is the distance between the two quantum wells. We show that as the distance decreases the decay rate of the ICD increases. Furthermore the distance can be tuned such that the emitted electron would be in a metastable state in the continuum (a resonance state); this causes the life time of the ICD to be an order of magnitude smaller, and improves the efficiency of the ICD.

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Date submitted: 11 Mar 2014 Electronic form version 1.4