Abstract Submitted
for the MAR09 Meeting of
The American Physical Society

Bistable tunneling current through a quantum dot array junction
YIA-CHUNG CHANG, Research Center for Applied Sciences, Academia Sinica, Taiwan and University of Illinois, Urbana-Champaign, DAVID M.T. KUO, National Central University, Taiwan — We investigate the tunneling current through a six-fold degenerate p –like states of a one- dimensional (1D) or two-dimensional (2D) quantum dot (QD) array in the x-y plane. Due to the coupling ofp_x and $p_y$orbitals at neighboring QDs, a 1D or 2D conduction band (ε_p) is formed, whereas the p_z orbitals remain localized due to their weak in-plane coupling. The on-site repulsive Coulomb interaction in the p_z levels (U) and that between the p_z level and p_x/p_y level (U_{dc}) are taken into account in an extended Anderson model, which is used to investigate the tunneling characteristics of the system. Tunneling current through localized p_z state is calculated in the framework of the Green function technique. Due to the effect of U_{dc}, the 1D/2D conduction band states are shifted by a self-energy term $2NU_{dc}$. We find that bistable current can be observed for this system in the Coulomb blockade regime, which makes the system a valid candidate for ultra high-density memory device.

Yia-Chung Chang
RCAS, Academia Sinica, Taiwan

Date submitted: 23 Nov 2008 Electronic form version 1.4