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Multi-functional single electron device at room temperature CHIEU NGUYEN, JASON KEE YANG ONG, RAVI F. SARAF, University of Nebraska - Lincoln — Smart designs of sub-wavelength structures enable observation of unusual properties of materials as in metamaterials. Typically, Coulomb blockade is observed in array of conducting particles at cryogenic temperature due to local charging of few particles by a single electron in the percolation path. We will report 1-D network of cemented Au nanoparticles in a multi-functional single electron device exhibiting Coulomb blockade at room temperature. The 1-D array is a self-assembled monolayer network spanning between electrodes 10-100μm apart. It is formed by first bridging the negatively charged 10nm Au NPs with positive ions (Cd2+or Fe3+) followed by cementing with reactive gas to form a robust 2-D network. The network array cemented with CdS and Iron oxide exhibits robust single electron effect at room temperature with electroluminescence (EL) or ferromagnetism, respectively. The nature of EL in this symmetric structure is explained in term of field induced ionization. The EL is specular where the spots are independent of bias magnitude. The magnetic array exhibits "spin-valve" behavior with Barkhausen effect. These unique nano materials, fully self-assembled where, properties can be tailored by varying the cement chemistry, have potential applications in solid state lighting.

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