Abstract Submitted
for the MAR06 Meeting of
The American Physical Society

Multi-valued analog information storage using self-assembled nanoparticle films. AL-AMIN DHIRANI, YOSHINORI SUGANUMA, Department of Chemistry, University of Toronto — Digital computers use binary states, typically represented by 0 and 5 V, to store and process information at all stages of a calculation. If more states (ideally a continuum) were available in between, density of information could be dramatically increased. Here we show that self-assembled nanoparticle films can feature such continuous state or analog information storage. Nanoparticle films were prepared on gate oxides by alternate immersion in solutions of gold nanoparticle and dithiol linker molecules. These films afford microlithography-free fabrication bridging nanometer to micrometer length scales as well as a layer-by-layer assembly yielding three-dimensional functional structures. Information provided by an arbitrary gate voltage was 'written' by trapping charges in local, gate-modified potentials when films were cooled below 175 K. The information was 'read' using the film's built-in ability to sense charge via Coulomb blockade. Application of a time-dependent, multi-step writing gate voltage generates conductance maps corresponding to multi-valued analog information. As a proof of concept, we exploited this technique to store 'UT' in Morse code.

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Date submitted: 30 Nov 2005 Electronic form version 1.4