Abstract Submitted
for the MAR10 Meeting of
The American Physical Society

Strategies for optimal design for electrostatic energy storage in quantum multiwell heterostructures ILYA GRIGORENKO, Pennsylvania State University, HERSCHEL RABITZ, Princeton University — The physical principles are studied for the optimal design of a quantum multiwell heterostructure working as an electrostatic energy storage device. We performed the search for an optimal multiwell trapping potential for electrons that results in the maximum static polarizability of the system. The response of the heterostructure is modeled quantum mechanically using nonlocal linear response theory. Three main design strategies are identified, which lead to the maximization of the stored energy. We found that the efficiency of each strategy crucially depends on the temperature and the broadening of electron levels. The energy density for optimized heterostructures can exceed the nonoptimized value by a factor more than 400. These findings provide a basis for the development of new nanoscale capacitors with high energy density storage capabilities.

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Date submitted: 20 Nov 2009 Electronic form version 1.4