Abstract Submitted
for the MAR05 Meeting of
The American Physical Society

Theory of quantum nanodevices induced by charged metallic nanowires in a Si(1-x)Ge(x)/Si heterostructure. ZINOVI GRIBNIKOV, Institute of Quantum Sciences, Michigan State University, GEORGE HADDAD, Department of EECS, University of Michigan, MI — Modern nanoelectronics has giving birth to new quantum devices: QDs, QWrs, DQDs, QPCs, etc. As a rule, such devices are realized on the basis of modulation doped $Al_xGa_{1-x}As/GaAs$ or $Si_{1-x}Ge_x/Si$ heterostructures controlled by negatively charged *depleting* gates. Such a method of controlling is not obligatory for Si-based structures where the more effective *accumulating* gates can be used. In this case, the modulation doping is eliminated and the gates move up from the structure surface to one of the levels in the multi-layered covering barrier. All the active devices are induced by the positively charged gates-nanowires (NWrs) parallel to the surface and placed on several levels in the barrier. Electrons from the peripheral n^+-contacts are delivered across the intermediate 2DEGs induced by the flat gates. The NWrs (parallel to each other or crossing) induce in the Si-QW parallel or crossing QWrs. The negatively charged NWrs in the barriers separate the induced 2DEGs and QWrs into different parts by gate-controlled tunnel barriers. QDs are induced under the intersection points of two positively charged NWrs or can be separated from the induced QWr by negative transverse NWrs. We calculate quantum states in the closed induced quantum elements (QD, DQD, Q ring) and estimate conductivities of the induced current-conducting devices: QWrs, DQWrs, QPCs, etc.

Zinovi Gribnikov
Institute of Quantum Sciences, Michigan State University

Date submitted: 27 Nov 2004 Electronic form version 1.4