

MAR11-2010-000393

Abstract for an Invited Paper
for the MAR11 Meeting of
the American Physical Society

Spin-orbit qubit in a semiconductor nanowire

SERGEY FROLOV, Kavli Institute of Nanoscience, Delft University of Technology

Spin-orbit interaction in InAs nanowires is so strong that spin and motion cannot be separated. The eigenstates of a single electron confined to a quantum dot become a spin-orbital doublet. We perform coherent manipulation of spin-orbit states of a single electron, thereby demonstrating a spin-orbit qubit. Fast and universal qubit control is achieved using gigahertz electric fields, which couple to the orbital part of the wavefunction. Qubits in adjacent quantum dots are addressed separately due to a gate-tunable difference in g-factors. Dephasing due to interaction with nuclear spins is studied in a Ramsey experiment. Coherence is extended using Hahn echo as well as Carr-Purcell-Meiboom-Gill dynamical decoupling pulse sequences. The next step is the demonstration of entanglement between neighbor qubits which can be achieved using exchange interaction.