

# Single Electron Control in n-type Semiconductor Quantum Dots using non-Abelian Holonomies Generated by Spin Orbit Coupling

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We propose that n-type semiconductor quantum dots with the Rashba and Dresselhaus spin orbit interactions may be used for single electron manipulation through adiabatic transformations between degenerate states. All the energy levels are discrete in quantum dots and possess a double degeneracy due to time reversal symmetry in the presence of the Rashba and/or Dresselhaus spin orbit coupling terms. We find that the presence of double degeneracy does not necessarily give rise to a finite non-Abelian matrix Berry phase. We show that a distorted two-dimensional harmonic potential may give rise to non-Abelian Berry phases. The presence of the non-Abelian Berry phase may be tested experimentally by measuring the optical dipole transitions.

keywords : single electron control, quantum dot, Berry phase