Abstract Submitted
for the MAR11 Meeting of
The American Physical Society

Spin-dependent Tunneling through a Potential Barrier on a Nanotube YONATAN ABRANYOS, GODFREY GUMBS, Hunter College at the City University of New York, PAULA FEKETE, United States Military Academy, West Point, New York — The electron spin effects on the surface of a nanotube have been considered through the spin-orbit interaction (SOI), arising from the electron confinement on the surface of the nanotube. This is of the same nature as the Rashba-Bychkov SOI at a semiconductor heterojunction. We estimate the effect of disorder within a potential barrier on the transmission probability. Using a continuum model, we obtained analytic expressions for the spin-split energy bands for electrons on the surface of nanotubes in the presence of SOI. First we calculate analytically the scattering amplitudes from a potential barrier located around the axis of the nanotube into spin-dependent states. The effect of disorder on the scattering process is included phenomenologically and induces a reduction in the transition probability. We analyzed the relative role of SOI and disorder on the transmission probability which depends on the angular and linear momentum of the incoming particle, and its spin orientation. We demonstrated that in the presence of disorder perfect transmission may not be achieved for finite barrier heights.

Yonatan Abranyos
Hunter College at the City University of New York

Date submitted: 14 Nov 2010 Electronic form version 1.4