

Tribuvan Prasad Pareek

Research Summary:

We have continued studying spin transport in nanosystems. In particular we studied spin-orbit induced torque and its relation on magnetization reversal and quantum computation. A theoretical frame work of spin density scattering matrix developed by us has been used towards this end. We have shown that spin-orbit (SO) interaction can induce a torque for the collinear configuration of spin valve structure (F1/2DEG/F2). Further, it is argued that this SO-induced torque can induce magnetization reversal even in collinear spin valves. The theoretical estimates of this effect that are made are well within the reach of present day experimental observations. In addition, it is shown that the same mechanism allows one to increase the purity of the outgoing current and produces entangled spin states essential for quantum computation. A scattering theory for the spin-density matrix is developed. Using this theory, the SO-induced torque and the associated von Neumann entropy are studied quantitatively.

Generation and detection of spin currents in non-magnetic systems in absence of magnetic field has also been studied. This is an important problem and our analysis shows that in two terminal systems one can generate and detect spin currents via conductance measurement.

Publications:

1. T. P. Pareek, *Spin-orbit-induced torque in a collinear spin valve: A possible route to design fast magnetic memory*, PRB 75, 115308, (2007)
2. T. P. Pareek, . *Measuring Spin Hall conductance and Rashba spin orbit interaction via electrical measurement in Y shape conductor.* , To appear in IJMPB **volume-number**, page number, (2007)

Preprints:

1. T. P. Pareek and A. M. Jayannavar, *Generation and Measurement of Non Equilibrium Spin Currents in Two Terminal Systems*, eprint number,if any
2. Authors and co-authors name, *Title of the paper*, write (in preparation) if it does not have any preprint number

Conference/Workshops Attended:

1. *National Conference on Recent Advances in Material Science*, ,Kurukshetra University India, September 27-29, 2006
2. *Physics of Mesoscopic and Disordered Materials (MESODIS - 06)* , I.I.T Kanpur India, December 2006.
3. *K. S. Krishnan Discussion Meeting on Frontiers In Quantum Science* , IMSC Chennai India, December 2006.

Visits to other Institutes:

1. Institute of Physics, Bhubaneswar, India, April, 2007

Invited Lectures/Seminars:

1. *Materials for Spintronics: Diluted Magnetic Semiconductor*, , National Conference on Recent Advances in Material Science, Kurukshetra University , Kurukshetra , September 2006.
2. *Transport Spin Currents and Its Measurement* , International Workshop on Physics of Mesoscopic and Disordered Materials (MESODIS - 06), I. I. T, Kanpur, Kanpur, December 2006.
3. *Spintronics: From two dimensional electrons gas to Carbon nanotubes.* , K. S. Krishnan Discussion Meeting on Frontiers In Quantum Science , IMSC, Chennai, Chennai, December 2006.

Other Activities:

1. I have taught a full semester course on condensed matter physics from Aug 2006 - Dec. 2006
2. 7 visiting students have worked with me during the academic year.