**Electron Spin Relaxation in a Moving Quantum Dot**
*Peihao Huang, Xuedong Hu*
*arXiv:1208.1284*
We study spin relaxation of an electron in a moving quantum dot due to spin-orbit interaction and an environmental random electric potential. We find that at the lowest order, the magnetic fluctuations experienced by the spin have only components transverse to the total magnetic field, so that the motion induced spin decoherence is a pure relaxation channel. The spin relaxation rate is linearly proportional to the dot velocity. Our calculated spin relaxation time ranges from as fast as sub$\mu$s in GaAs to above ms in Si. Our results also give clear indications on how to reduce the decoherence effect of electron motion.

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**Quantum synchronization and transresistance quantization in superconducting devices**
*Alina Hriscu, Yuli V. Nazarov*
*arXiv:1208.1038*
We show theoretically the possibility of quantum synchronization of Josephson and Bloch oscillations in a superconducting device. One needs an $LC$ oscillator to achieve exponentially small rate of synchronization errors. The synchronization leads to quantization of transresistance similar to that in (Fractional) Quantum Hall Effect.

**Topological liquid nucleation induced by vortex-vortex interactions in Kitaev's honeycomb model**
*Ville Lahtinen, Andreas W. W. Ludwig, Jiannis K. Pachos, Simon Trebst*
*PRB **86**, 075115 (2012)*
We provide a comprehensive microscopic understanding of the nucleation of topological quantum liquids, a general mechanism where interactions between non-Abelian anyons cause a transition to another topological phase, which we study in the context of Kitaev's honeycomb lattice model. For non-Abelian vortex excitations arranged on superlattices, we observe the nucleation of several distinct Abelian topological phases whose character is found to depend on microscopic parameters, such as the superlattice spacing or the spin-exchange couplings. By reformulating the interacting vortex superlattice in terms of an effective model of Majorana fermion zero modes, we show that the nature of the collective many-anyon state can be fully traced back to the microscopic pairwise vortex interactions. Due to Ruderman-Kittel-Kasuya-Yosida-type sign oscillations in the interactions, we find that longer-range interactions beyond the nearest neighbor can influence the collective state and, thus, need to be included for a comprehensive picture. The omnipresence of such interactions implies that corresponding results should hold for vortices forming an Abrikosov lattice in a p-wave superconductor, quasiholes forming a Wigner crystal in non-Abelian quantum Hall states, or topological nanowires arranged in regular arrays.

**Dirac Electrons on a Sharply Edged Surface of Topological Insulators**
*Yositake Takane, Ken-Ichiro Imura*
*arXiv:1208.1571*
An unpaired gapless Dirac electron emergent at the surface of a strong topological insulator (STI) is protected by the bulk-surface correspondence and believed to be immune to backward scattering. It is less obvious, however, and yet to be verified explicitly whether such a gapless Dirac state is smoothly extended over the entire surface when the surface is composed of more than a single facet with different orientations in contact with one another at sharp corner edges (typically forming a steplike structure). In the realistic situation that we consider, the anisotropy of the sample leads to different group velocities in each of such facets. Here, we propose that much insight on this issue can be obtained by studying the electronic states on a hyperbolic surface of an STI. By explicitly constructing the surface effective Hamiltonian, we demonstrate that no backward scattering takes place at a concave 90° step edge. A strong renormalization of the velocity in the close vicinity of the

step edge is also suggested.

**Absorption of Heat into a Superconductor–Normal Metal–Superconductor Junction from a Fluctuating Environment**
*J. Voutilainen, P. Virtanen, T. T. Heikkilä*
*PRL **109**, 067002 (2012)*
We study a diffusive superconductor-normal–metal-superconductor junction in an environment with intrinsic incoherent fluctuations which couple to the junction through an electromagnetic field. When the temperature of the junction differs from that of the environment, this coupling leads to an energy transfer between the two systems, taking the junction out of equilibrium. We describe this effect in the linear response regime and show that the change in the supercurrent induced by this coupling leads to qualitative changes in the current-phase relation and, for a certain range of parameters, an increase in the critical current of the junction. In addition to normal metals, similar effects can be expected also in other conducting weak links.

**Electron-phonon scattering in a 2DEG with spin-orbit interaction**
*Tutul Biswas, Tarun Kanti Ghosh*
*arXiv:1208.2151*
We study the interaction between electron and acoustic phonon in a Rashba spin-orbit coupled two dimensional electron gas. Both deformation potential and piezoelectric scattering mechanisms are considered. Temperature dependence of resistivity at high and low temperature regimes has been explored. Dependence of the transport properties on the the Rashba spin-orbit interaction has also been discussed.

**Spin transfer torque with spin diffusion in magnetic tunnel junctions**
*A. Manchon, R. Matsumoto, H. Jaffres, and J. Grollier*
*PRB **86**, 060404 (2012)*
Spin transport in magnetic tunnel junctions in the presence of spin diffusion is considered theoretically. Combining ballistic tunneling across the barrier and diffusive transport in the electrodes, we solve the spin dynamics equation in the metallic layers. We show that spin diffusion mixes the transverse spin current components and dramatically modifies the bias dependence of the effective spin transfer torque. This leads to a significant linear bias dependence of the out-of-plane torque, as well as a nonconventional thickness dependence of both spin torque components.

**Composite Majorana fermion wave functions in nanowires**
*Jelena Klinovaja, Daniel Loss*
*PRB **86**, 085408 (2012)*

**Decoherence of Majorana qubits by noisy gates**
*Manuel J. Schmidt, Diego Rainis, Daniel Loss*
*PRB **86**, 085414 (2012)*

**Magnetic texture-induced thermal Hall effects**
*Kevin A. van Hoogdalem, Yaroslav Tserkovnyak, Daniel Loss*
*arXiv:1208.1646*

**Superfluid drag of two-species Bose-Einstein condensates in optical lattices**
*Patrick P. Hofer, Christoph Bruder, Vladimir M. Stojanovic*
*arXiv:1208.1659*

**Helical States in Curved Bilayer Graphene**
*Jelena Klinovaja, Gerson J. Ferreira, Daniel Loss*
*arXiv:1208.2601*