1- Phys. Rev. B 92, 081107(R) (2015)

Title: **Quantized topological magnetoelectric effect of the zero-plateau quantum anomalous Hall state**

Authors: Jing Wang, Biao Lian, Xiao-Liang Qi, and Shou-Cheng Zhang

Abstract: The topological magnetoelectric effect in a three-dimensional topological insulator is a novel phenomenon, where an electric field induces a magnetic field in the same direction, with a universal coefficient of proportionality quantized in units of e2/2h. Here, we propose that the topological magnetoelectric effect can be realized in the zero-plateau quantum anomalous Hall state of magnetic topological insulators or a ferromagnet-topological insulator heterostructure. The finite-size effect is also studied numerically, where the magnetoelectric coefficient is shown to converge to a quantized value when the thickness of the topological insulator film increases. We further propose a device setup to eliminate nontopological contributions from the side surface.

2- Phys. Rev. B 92, 060501(R) (2015)

Title: **Inverse proximity effect at superconductor-ferromagnet interfaces: Evidence for induced triplet pairing in the superconductor**

Authors: Y. Kalcheim, O. Millo, A. Di Bernardo, A. Pal, and J. W. A. Robinson

Abstract: Considerable evidence for proximity-induced triplet superconductivity on the ferromagnetic side of a superconductor-ferromagnet (S-F) interface now exists; however, the corresponding effect on the superconductor side has hardly been addressed. We have performed scanning tunneling spectroscopy measurements on NbN superconducting thin films proximity coupled to the half-metallic ferromagnet La2/3Ca1/3MnO3 (LCMO) as a function of magnetic field. We have found that at zero and low applied magnetic fields the tunneling spectra on NbN typically show an anomalous gap structure with suppressed coherence peaks and, in some cases, a zero-bias conductance peak. As the field increases to the magnetic saturation of LCMO where the magnetization is homogeneous, the spectra become more BCS-like and the critical temperature of the NbN increases, implying a reduced proximity effect. Our results therefore suggest that triplet-pairing correlations are also induced in the S side of an S-F bilayer.

3- Nature 524, 325–329 (20 August 2015)

Title: **Measurement-based control of a mechanical oscillator at its thermal decoherence rate**

Authors: D. J. Wilson, V. Sudhir, N. Piro, R. Schilling, A. Ghadimi and T. J. Kippenberg

Abstract: In real-time quantum feedback protocols[1,2], the record of a continuous measurement is used to stabilize a desired quantum state. Recent years have seen successful applications of these protocols in a variety of well-isolated micro-systems, including microwave photons[3] and superconducting qubits[4]. However, stabilizing the quantum state of a tangibly massive object, such as a mechanical oscillator, remains very challenging: the main obstacle is environmental decoherence, which places stringent requirements on the timescale in which the state must be measured. Here we describe a position sensor that is capable of resolving the zero-point motion of a solid-state, 4.3-megahertz nanomechanical oscillator in the timescale of its thermal decoherence, a basic requirement for real-time (Markovian) quantum feedback control tasks, such as ground-state preparation. The sensor is based on evanescent optomechanical coupling to a high-*Q* microcavity[5], and achieves an imprecision four orders of magnitude below that at the standard quantum limit for a weak continuous position measurement[6]—a 100-fold improvement over previous reports[7,8,9]—while maintaining an imprecision–back-action product that is within a factor of five of the Heisenberg uncertainty limit. As a demonstration of its utility, we use the measurement as an error signal with which to feedback cool the oscillator. Using radiation pressure as an actuator, the oscillator is cold damped[10] with high efficiency: from a cryogenic-bath temperature of 4.4 kelvin to an effective value of 1.1 ± 0.1 millikelvin, corresponding to a mean phonon number of 5.3 ± 0.6 (that is, a ground-state probability of 16 per cent). Our results set a new benchmark for the performance of a linear position sensor, and signal the emergence of mechanical oscillators as practical subjects for measurement-based quantum control.

4- Phys. Rev. B 91, 235424 (2015)

Title: **Spin-resolved Andreev transport through double-quantum-dot Cooper pair splitters**

Authors: Piotr Trocha, Ireneusz Weymann

Abstract: We investigate the Andreev transport through double-quantum-dot Cooper pair splitters with ferromagnetic leads. The analysis is performed with the aid of the real-time diagrammatic technique in the sequential tunneling regime. We study the dependence of the Andreev current, the differential conductance, and the tunnel magnetoresistance on various parameters of the model in both the linear and nonlinear response regimes. In particular, we analyze the spin-resolved transport in the crossed Andreev reflection regime, where a blockade of the current occurs due to enhanced occupation of the triplet state. We show that in the triplet blockade, finite intradot correlations can lead to considerable leakage current due to direct Andreev reflection processes. Furthermore, we find additional regimes of current suppression resulting from enhanced occupation of singlet states, which decreases the rate of crossed Andreev reflection.We also study how the splitting of Andreev bound states, triggered by either dot level detuning, finite hopping between the dots, or finite magnetic field, affects the Andreev current. While in the first two cases the number of Andreev bound states is doubled, whereas transport properties are qualitatively similar, in the case of finite magnetic field further level splitting occurs, leading to a nontrivial behavior of spin-resolved transport characteristics, and especially that of tunneling magnetoresistance. Finally, we discuss the entanglement fidelity between split Cooper pair electrons and show that by tuning the device parameters, fidelity can reach unity.

5- Phys. Rev. B 92, 075131 (2015)

Title: **Topological phase diagram and saddle point singularity in a tunable topological crystalline insulator**

Authors: M. Neupane et al

Abstract: We report the evolution of the surface electronic structure and surface material properties of a topological crystalline insulator (TCI) Pb1-xSnxSe as a function of various material parameters including composition x, temperature T and crystal structure. Our spectroscopic data demonstrate the electronic groundstate condition for the saddle point singularity, the tunability of surface chemical potential, and the surface states' response to circularly polarized light. Our results show that each material parameter can tune the system between trivial and topological phase in a distinct way unlike as seen in Bi2Se3 and related compounds, leading to a rich and unique topological phase diagram. Our systematic studies of the TCI Pb1-xSnxSe are valuable materials guide to realize new topological phenomena.

6- arXiv:1508.05295

Title: **Inhomogeneous nuclear spin polarization induced by helicity-modulated optical excitation of fluorine-bound electron spins in ZnSe**

Authors: F. Heisterkamp, A. Greilich, E. A. Zhukov, E. Kirstein, T. Kazimierczuk, V. L. Korenev, I. A. Yugova, D. R. Yakovlev, A. Pawlis, M. Bayer

Abstract: Optically-induced nuclear spin polarization in a fluorine-doped ZnSe epilayer is studied by time-resolved Kerr rotation using resonant excitation of donor-bound excitons. Excitation with helicity-modulated laser pulses results in a transverse nuclear spin polarization, which is detected as a change of the Larmor precession frequency of the donor-bound electron spins. The frequency shift in dependence on the transverse magnetic field exhibits a pronounced dispersion-like shape with resonances at the fields of nuclear magnetic resonance of the constituent zinc and selenium isotopes. It is studied as a function of external parameters, particularly of constant and radio frequency external magnetic fields. The width of the resonance and its shape indicate a strong spatial inhomogeneity of the nuclear spin polarization in the vicinity of a fluorine donor. A mechanism of optically-induced nuclear spin polarization is suggested based on the concept of resonant nuclear spin cooling driven by the inhomogeneous Knight field of the donor-bound electron.