Arbel Haim, Erez Berg, Felix von Oppen and Yuval Oreg
Current Correlations in a Majorana Beam Splitter
arXiv:1504.05950
We study the current correlation in a T-junction composed of a grounded topological supercon- ductor and of two normal-metal leads which are biased at a voltage V . We show that the existence of an isolated Majorana zero mode in the junction dictates a universal behavior for the cross corre- lation of the currents through the two normal-metal leads of the junction. The cross correlation is negative and approaches zero at high bias voltages as 1/V . This behavior survives the presence of disorder and multiple transverse channels, and persists at finite temperatures. We employ numerical transport simulations to corroborate our conclusions.

J C Martinez and M B A Jalil
Topological dynamics and current-induced motion a skyrmion lattice
arXiv: 1509.00591
We study the Thiele equation for current-induced motion in a skyrmion lattice through two soluble models of the pinning potential. Comprised by a Magnus term, a dissipative term and a pinning force, Thiele's equation resembles Newton's law but in virtue of the topological character to the first two, it differs significantly from Newtonian mechanics and because the Magnus force is dominant, unlike its mechanical counterpart –the Coriolis force– skyrmion trajectories do not necessarily have mechanical counterparts. This is important if we are to understand skyrmion dynamics and tap into its potential for datastorage technology. We identify a pinning threshold velocity for the one-dimensional pinning potential and for a two-dimensional potential we find a pinning point and the skyrmion trajectories toward that point are spirals whose frequency (compare Kepler's second law) and amplitude-decay depend only on the Gilbert constant and potential at the pinning point.

Lars Elster, Manuel Houzet, and Julia S. Meyer
Magnetic resonance in a singlet-triplet Josephson junction
arXiv:1509.00287
We study a singlet-triplet Josephson junction between a conventional s-wave superconductor and an unconventional px-wave superconductor. The Andreev spectrum of the junction yields a spontaneous magnetization in equilibrium. This allows manipulating the occupation of the Andreev levels using an ac Zeeman field. The induced Rabi oscillations manifest themselves as a resonance in the current-phase relation. For a circularly polarized magnetic field, we find a spin selection rule, yielding Rabi oscillations only in a certain interval of the superconducting phase difference.

Keita Hamamoto, Motohiko Ezawa, Naoto Nagaosa
Chirality and spin transformation of fully polarized triplet Cooper pairs on interaction with singlet condensate in superconductor-ferromagnet structures
arXiv:1508.07905
We show that the fully polarized triplet s-wave component is characterized not only by the spin direction, but also by chirality. Interaction of a polarized triplet component and a singlet one results in creation of triplet Cooper pairs with opposite spin direction and of different chiralities. Such injection of spin leads to interesting effects in magnetic Josephson junctions. We calculate the dc Josephson current IJ in a multiterminal

Josephson contact of the Sm/n/S′ m type with "magnetic" superconductors Sm that generate fully polarized triplet components. The superconductors Sm are composed by an S/F bilayer and magnetic insulators (filters) which pass electrons only with a fixed spin direction. If the filter axes are oriented antiparallel to each other, the Josephson current is zero. But if a singlet superconductor S with a phase χ, is attached to
the normal n wire, the current IJ appears, that shows an unusual phase dependence on the phases χL/R of superconductors Sm, IJ = Ic sin(χR +χL −2χ), i.e., it does not depend on the difference, χR −χL, between the phases of the right and left triplet superconductors Sm. We discuss possibilities of experimental observation of the effect.

Aline Ramires, and Piers Coleman
Supersymmetric approach to heavy fermion systems
arXiv: 1508.07861
We propose a generalization of the supersymmetric representation of spins with symplectic symmetry, generalizing the rotation group of the spin from SU(2) to SP(N). As a test application of this new representation, we consider two toy models involving a competition of the Kondo effect and antiferromagnetism: a two-impurity model and a frustrated three-impurity model. Exploring an ensemble of L-shaped representations with a fixed number of boxes in their respective Young tableaux, we allow the system to choose which representation is energetically more favorable in each region in parameter space. We discuss how the features of these preliminary applications can generalize to Kondo lattice models.

Se Kwon Kim, So Takei, and Yaroslav Tserkovnyak
Thermally-Activated Phase Slips in Superfluid Spin Transport in Magnetic Wires
arXiv: 1509.00904
We theoretically study thermally-activated phase slips in superfluid spin transport in easy-plane magnetic wires within the stochastic Landau-Lifshitz-Gilbert phenomenology, which runs parallel to the Langer-Ambegaokar-McCumber-Halperin theory for thermal resistances in superconducting wires. To that end, we start by obtaining the exact solutions for free-energy minima and saddle points. We provide an analytical expression for the phase-slip rate in the zero spin-current limit, which involves detailed analysis of spin fluctuations at extrema of the free energy. An experimental setup for a magnetoeletric circuit is proposed, in which thermal phase slips can be inferred by measuring nonlocal magnetoresistance.

Maximilian Russ and Guido Burkard
Long distance coupling of resonant exchange qubits
arXiv: 1508.07122
We investigate the effectiveness of a microwave cavity as a mediator of interactions between two resonant exchange (RX) qubits in semiconductor quantum dots (QDs) over long distances, limited only by the extension of the cavity. Our interaction model includes the orthonormalized Wannier orbitals constructed from Fock-Darwin states under the assumption of a harmonic QD confinement potential. We calculate the qubit-cavity coupling strength gr in a Jaynes Cummings Hamiltonian, and find that dipole transitions between two states with an asymmetric charge configuration constitute the relevant RX qubit-cavity coupling mechanism. The effective coupling between two RX qubits in a shared cavity yields a universal two-qubit iswap-gate with gate times on the order of nanoseconds over distances on the order of up to a millimeter.