Topological order in the Kitaev/Majorana chain in the presence of disorder and interactions *Niklas M. Gergs, Lars Fritz, Dirk Schuricht, arXiv:1511.02817*
We study the combined effect of interactions and disorder on topological order in one dimension. To this end we consider a generalized Kitaev chain including fermion-fermion interactions and disorder in the chemical potential. We determine the phase diagram by performing density-matrix renormalization group calculations on the corresponding spin-1/2 chain. We find that moderate disorder or repulsive interactions individually stabilize the topological order, which remains valid for their combined effect. However, both repulsive and attractive interactions lead to a suppression of the topological phase at strong disorder.

Charge and spin density in the helical Luttinger liquid
N. Traverso Ziani, C. Fleckenstein, F. Crepin, B. Trauzettel, arXiv:1511.03157
The weakly interacting helical Luttinger liquid, due to spin momentum locking, is characterized by extremely peculiar local observables: we show that the density-density correlation functions do not exhibit signatures of Friedel and Wigner oscillations, and that spin-spin correlation functions, which are strongly anisotropic, witness the formation of a planar spin wave. Moreover, we demonstrate that the most relevant scattering potentials involving a localized impurity are not able to modify the electron density, while only magnetic impurities can pin the planar spin density wave.

Non-vanishing Berry curvature driven large anomalous Hall effect in non-collinear antiferromagnet Mn3Ge
Ajaya K. Nayak, Julia Fischer, Yan Sun, Binghai Yan, Julie Karel, Alexander Komarek, Chandra Shekhar, Nitesh Kumar, Walter Schnelle, Juergen Kuebler, Stuart S. P. Parkin, Claudia Felser, arXiv:1511.03128
It has been established that the anomalous Hall effect roughly scales with the magnetization of a ferromagnet.Therefore, it should disappear for an antiferromagnet due to its zero net magnetic moment. However, recent theoretical works have predicted that a large anomalous Hall effect can be accomplished in some of the non-collinear antiferromagnets resulting from a non-vanishing Berry-phase curvature. Here we show that the non-collinear antiferromagnet Mn3Ge with practically zero net magnetic moment exhibits a large anomalous Hall effect comparable to that of ferromagnetic metals, the magnitude of the anomalous conductivity is 500 per Ohm per cm at 2 K and about 50 per Ohm per cm at at room temperature. The inverse triangular spin-alignment in Mn3Ge ensures a non-vanishing Berry curvature, leading to the observed effect.

The quantum (non-Abelian) Potts model and its exact solution
Razieh Mohseninia, Vahid Karimipour,arXiv:1511.03636
We generalize the classical one dimensional Potts model to the case where the symmetry group is a non-Abelian finite group. It turns out that this new model has a quantum nature in that its spectrum of energy eigenstates consists of entangled states. We determine the complete energy spectrum, i.e. the ground states and all the excited states with their degeneracy structure. We calculate the partition function by two different algebraic and combinatorial methods. We also determine the entanglement properties of its ground states.

Chiral p±ip superfluid on a sphere *Sergej Moroz, Carlos Hoyos, Leo Radzihovsky, arXiv:1511.03502* We consider a spinless fermionic p±ip superfluid living on a two-dimensional sphere. Using superfluid hydrodynamics we show that the ground state necessarily exhibits topological defects: either a pair of elementary vortices or a domain wall between p±ip phases. In the topologically nontrivial BCS phase we identify the chiral fermion modes localized on the topological defects and compute their low-energy spectrum.

General solution of the Dirac equation for quasi-two-dimensional electrons *A.A. Eremko, L.S. Brizhik, V.M. Loktev, arXiv:1511.04034* The general solution of the Dirac equation for quasi-two-dimensional electrons confined in an asymmetric quantum well, is found. The energy spectrum of such a system is exactly calculated using special unitary transformation and shown to depend on the electron spin polarization. The general solution, being the only one, contains free parameters, whose variation continuously transforms one known particular solution into another. As an example, two different cases are considered in detailL: electron in a deep and in a strongly asymmetric shallow quantum well. The effective mass renormalized by relativistic corrections and Bychkov-Rashba coefficients are analytically obtained for both cases. The general solution allows - independently on the existence of the spin invariants - to establish conditions at which a specific (accompanied or non-accompanied by Rashba splitting) spin state can be realized. In principle, this opens new possibilities of the spin degree of freedom control in spintronics via synthesis of heteroctructures of the desirable properties.

Anderson Topological Superconductor and Entanglement Entropy
Jan Borchmann, Aaron Farrell, T. Pereg-Barnea,

arXiv:1511.03942
In this paper we study the phase diagram of a disordered, spin-orbit coupled superconductor with s-wave or d+id-wave pairing symmetry in symmetry class D. We analyze the topological phase transitions by applying three different methods which include a disorder averaged entanglement entropy, a disorder averaged real-space Chern number, and an evaluation of the momentum space Chern number in a disorder averaged effective model. We find evidence for a disorder-induced topological state. While in the clean limit there is a single phase transition from a trivial phase with a Chern number C=4 to a topological phase with C=1, in the disordered system there is an intermediate phase with C=3. The phase transition from the trivial C=4 phase into the intermediate phase with C=3 is seen in the real-space calculation of the Chern number. In spite of this, this phase transition is not detectable in the entanglement entropy. A second phase transition from the disorder induced C=3 into the C=1 phase is seen in all three quantities.

Phase-tunable Majorana bound states in a topological N-SNS junction
Esben Bork Hansen, Jeroen Danon, Karsten Flensberg, arXiv:1511.03877
We theoretically study the differential conductance of a one-dimensional normal-superconductor-normal-superconductor (N-SNS) junction with a phase bias applied between the two superconductors. We consider specifically a junction formed by a spin-orbit coupled semiconducting nanowire with regions of the nanowire having superconducting pairing induced by a bulk s-wave superconductor. When the nanowire is tuned into a topologically non-trivial phase by a Zeeman field, it hosts zero-energy Majorana modes at its ends as well as at the interface between the two superconductors. The phase-dependent splitting of the Majorana modes gives rise to features in the differential conductance that offer a clear distinction between the topologically trivial and non-trivial phases. We calculate the transport properties of the junction numerically and also present a simple analytical model that captures the main properties of the predicted tunneling spectroscopy.

Skyrmion-induced bound states on the surface of 3D Topological Insulators
Dimitrios Andrikopoulos, Bart Soree, Jo De Boeck, arXiv:1511.04237
The interaction between the surface of a 3D topological insulator and a skyrmion / anti-skyrmion structure is studied. Both hedgehog and vortex skyrmions are considered. For the hedgehog skyrmion the in-plane components cannot be disregarded and their interaction with the surface state of the TI has to be taken into account. For this purpose, a semi-classical description of the skyrmion angle is obtained using the variational principle. It is shown that both the hedgehog and the vortex skyrmion can induce bound states on the surface of the TI. However, the number and the properties of these states depend strongly on the skyrmion type and on the skyrmion topological number N_{Sk}. The probability densities of the bound electrons are also derived where it is shown that they are localized within the skyrmion region.