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Physical Sciences Seminar

Rashba spin-orbit coupling in ultracold fermions: Exact results from quantum Monte Carlo

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Host: Maksym Serbyn

Exotic states of matter, including high-Tc superconductors, and topological phases, have long been a focus of condensed matter physics. With the recent advent of artificial spin-orbit coupling in ultracold gases, and the remarkable experimental control and enhanced interactions provided by optical lattices, a broad range of novel strongly correlated systems are quickly becoming experimentally accessible. One system of particular interest, given its potential impact on spintronics and quantum computation, is the attractive 2D Fermi gas with spin-orbit coupling, both in the continuum and optical lattice regimes. Here we examine the combined effects of Rashba spin-orbit coupling and interaction in this system, with particular focus on the unique pairing, charge, and spin properties of the ground state, which is computed using a set of high-precision auxiliary-field quantum Monte Carlo techniques. We also study the behavior of edge currents, which are a potential precursor of various topological phenomena, such as Majorana fermions. In addition to illuminating the behavior of this exotic charge ordered superfluid state, our results serve as high-accuracy benchmarks for the coming generation of precision experiments with ultracold gases. Finally, we provide an outlook on future theoretical and computational directions, including the treatment of spin polarized systems, which may support finite-momentum pairing states and topological superconductivity.

Thursday, February 22, 2018 11:30am - 12:30pm

IST Austria Campus Big Seminar room Ground floor / Office Bldg West (I21.EG.101)

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