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Topological quantum criticality in spin-orbit coupled fermions[1]

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Spin-orbit coupled fermions offer a fascinating playground for realizing interesting topological quantum phases and the associated quantum critical phenomena. In two dimensions and in the presence of an attractive s-wave pairing interaction and a Zeeman field, spin-orbit coupled fermions can condense into a fully gapped non-Abelian topological superfluid phase separated from a conventional s-wave superfluid phase by a topological quantum phase transition. The critical point for this transition is marked by the proliferation of gapless nodal quasiparticles which can be tracked by studying the momentum-resolved excitation spectrum from the center of the Brillouin zone. In three dimensions the same system goes through a series of topological quantum transitions with increasing Zeeman field and the low energy excitations in some of these phases realize the long-sought low-temperature analog of Weyl fermions of particle physics. In this talk I will describe in some detail the interesting topological phases and the associated quantum criticality that can be realized using spin-orbit coupled fermions in cold atom systems.

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