PAUL SCHERRER INSTITUT

PSI

CONDENSED MATTER THEORY SEMINAR

Topological excitations in quantum spin systems with spin-orbit coupling

Dr. Darshan Joshi, MPI Stuttgart

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WHGA/121 (PSI-West)

Abstract:

Many frustrated magnets host exotic states of matter with non-trivial ground states. We show that in certain systems even if the ground-state is trivial, one can realize exotic states by the virtue of non-trivial topological excitations. These topological excitations are in a way analogs of the fermionic topological states of matter, albeit with many differences. We shall show that the paramagnetic phase of coupled-dimer systems on a ladder as well as a honeycomb bilayer support topological excitations in the presence of spin-orbit coupling. These excitations are localized at the edges and in case of the ladder they are even fractionalized. We discuss relevant observables, topological invariants, and possible experimental signatures. Another important example, namely the Kitaev-Heisenberg model, will be shown to host chiral edge states. In this case, we will discuss interplay between external magnetic field and spin-asymmetric interaction. In all the cases, we shall show that there is a well-defined tuning parameter (eq. field, pressure) which can be used to also study a topological quantum phase transition.

Contact: Markus Müller, WHGA/136, Markus.Mueller@psi.ch, tel: 056 310 44 30