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Magnetic moments in superconductors - Sources of opportunity and frustration

physikalisches

Mo. 16.12.19
16:00 Uhr
Ort: H34

Since their discovery in 1911, superconductors have played a prominent role in physics labs throughout the world. In recent years, they have taken on a new role, as the host for an even more exotic state of matter, referred to as a topological superconductor. These systems form at the interface between conventional superconductors like Al or Pb and semiconductors with strong spin-orbit coupling and/or suitable magnetic materials, and since they hold the promise of topologically protected quantum bits, they are currently at the center of attention in condensed matter physics.

Apart from their potential for quantum computing, topological superconductors have instigated renewed interest in the intricate interplay between superconductivity and magnetic degrees of freedom. This question dates back to the 1950'ies, but the recent advances in material growth and custom made hybrid materials provide an exciting new perspective on this venerable problem.

In this colloquium, I will outline the physics of single magnetic moments, spin chains and spin lattices embedded in superconductors, and the fascinating magnetic and superconducting phases, which arise through competing or supporting ordering.

