

# Theory of Condensed Matter: Hard Condensed Matter

July 10, 2018 at 11 a.m.  
Galilei room 01-128 (Staudinger Weg 9)

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## **Magnetic Skyrmion materials as a platform for quantum information theory**

Quantum Computation received great interest in the last years. There two level systems, in which the energy levels can be described as effective spin up or spin down, are used. The special feature here is, that the state of this two-level system is not forced to be either of the two spin directions, but also every superposition in between which is then also known as a Qubit. Such Qubits form the basis of quantum information theory, a fully new paradigm of computation with still undisclosed potential. In Spintronics systems topological protected spin-structures can be stabilized through the Dzyaloshinski-Moriya interaction. These objects are called magnetic skyrmions, which have many interesting properties and are promising candidates for new applications. In my first Master talk, I will introduce two ideas how magnetic skyrmion materials could potentially be used as a platform for quantum computation connecting these two fields. The first idea is to exploit the excitation modes of skyrmions to define a qubit analogous to the ones in Ion Trap quantum computers. The second idea is to use the topological properties of skyrmions for topological quantum computation.