PAUL SCHERRER INSTITUT

PSI

CONDENSED MATTER THEORY SEMINAR

Competing magnetic orders and spin liquids in three-dimensional quantum magnets

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Abstract:

Quantum magnetism and the formation of quantum spin liquids remains one of the most intriguing aspects of contemporary solid state physics, which is corroborated by the high research activity of experimentalists and theorists alike. Candidate materials to host spin-liquid behavior include a variety of two-dimensional compounds, ranging from geometrically frustrated Heisenberg models to exchange-frustrated models of Kitaev type, but they also comprise three-dimensional structures. Only recently, interest was sparked by the discovery of spin liquid signatures in $NaRh_2O_4$, a three-dimensional material that realizes spin-1 moments on the diamond lattice with additional frustration mediated by next-nearest neighbor interactions. To complement experimental findings with appropriate theoretical understanding, an efficient methodological framework is vital which is capable of capturing quantum magnetism in three dimensions – a challenging regime that is inaccessible to many conventional (both numerical and analytical) methods. In this work, we report on recent methodological advances of the pseudofermion functional renormalization group (pf-FRG), which is suited to describe three-dimensional frustrated quantum magnetism even at finite temperatures, and leverage the method to model the interplay of magnetic order, quantum order-by-disorder, and spin liquids in NiRh2O4 as well as in other materials.

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