FRUSTRATED MAGNETISM IN VANADIUM OXIDES

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9.7 cm

In magnetic compounds competing exchange interactions or their geometric frustration tend to suppress long range order by enhancing the effect of quantum fluctuations. This may even result in formation of spin liquid or exotic hidden order ground states.
A prime example is the 2D square lattice frustrated J_1-J_2 Heisenberg antiferromagnet [1]. Various quasi-2D layered vanadium oxide compounds have now been found which are described by this model. We discuss its basic thermodynamic, high-field and magnetocaloric properties and its phase diagram. We use both analytical and numerical exact diagonalisation methods for finite clusters. It is found that high field magnetisation is strongly nonlinear close to the spin nematic hidden order phase.
The geometrically frustrated vanadium oxide LiV_2O_4 is the first example of a 3d heavy fermion compound. We show that geometric frustration leads to nearly critical low energy spin fluctuations in a large part of momentum space [2], contrary to common magnets. They lead to a large mass renormalisation and heavy fermion characteristics. Furthermore, within self consistent renormalisation theory we explain the momentum and temperature dependence of low energy magnetic response from inelastic neutron scattering. In addition the NMR results will be discussed.

[1] B. Schmidt, P. Thalmeier, N. Shannon, Phys. Rev. B 76, 125113 (2007)
[2] V. Yushankhai, A. Yaresko, P. Fulde, P. Thalmeier, Phys. Rev. B 76, 085111 (2007)

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