Quest for Spin Nematic states in high magnetic fields

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Searching for a new state of matter and its guiding principle is one of the recent trends in condensed matter physics. Apart from conventional ordered states associated with well-known degrees of freedom, such as atoms, electrons and spins, there are emergent states with non-intuitive objects ordered, which are often called “hidden” orders. A spin nematic (SN) state expected for a frustrated quantum magnet is one such an example, in which spins themselves do not order completely but their axes are perfectly aligned, as in molecules in the nematic liquid crystal [1,2].

In this talk, I present our recent sequential studies on $Cu_3V_2O_7(OH)_2\cdot 2H_2O$ [3], $LiCuVO_4$ [4], $HgCr_2O_4$ [5], and $SrCu_2(BO_3)_2$ [6], which are known to be candidates for SN state. Here, by using recently developed entropy measurement techniques [7,8], the “hidden orders” are evinced in narrow ranges of magnetic fields. A personal perspective on the future challenges in this emerging ordered state is also discussed.

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