PAUL SCHERRER INSTITUT

Invitation

LMU-Seminar

Title: **Spin Liquid Ground State in a Vanadium Based *S* = 1/2 Trimerized Kagome Compound**

Speaker: **Jean-Christophe Orain**
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Time: **Tuesday, October 20, 2015 at 09:30**

Place: **WBGB/020**

Abstract:

The search for quantum liquid state is a very active field in condensed matter research. In two dimensions, the antiferromagnetic spin 1/2 kagome lattice (KAFM) seems to be the most able to stabilize such a ground state. Indeed, from recent theoretical investigations, we are now quite sure that this system has a quantum spin liquid ground state. However, we still do not know its nature, in particular the nature of its correlations. They could be short ranged, which will be characterized by a gap in the excitation spectrum, or long ranged, characterized by a gapless excitation spectrum. On the experimental side, only few materials exist and only one compound possesses a geometrically perfect lattice, the Herbertsmithite. All the experiments that have been done on this compound revealed a gapless spin liquid state along with deviations to the spin 1/2 Heisenberg Hamiltonian which could be responsible of the gap closure [1].

Among the rare experimental realizations of the KAFM model the recently synthesized compound, $[NH_4]_2[C_7H_{14}N]\,[V_7O_6F_{18}]$ (DQVOF) [2], is the first one to host magnetically active V^{4+} (d^1) ions rather than more usual Cu^{2+} (d^9). Despite a complex bilayer magnetic lattice, the magnetic ions, V^{4+} (S = 1/2) and V^{3+} (S = 1) turned out to be weakly coupled leaving well decoupled kagome planes [3]. Further, this compound seems to be the first experimental realization of the trimerized kagome model, formed by two dfferent equilaterals triangles, initially theoretically studied by M. Mambrini and F. Mila [4].

Although the AF interactions in the kagome planes are rather strong (J_{kago} = – 61(5) K), µSR experiments point out the absence of frozen magnetic moment down to 20 mK [5] revealing the spin liquid behavior of the ground state. Furthermore, the heat capacity and some recent ^{19}F and ^{17}O NMR studies unveil a gapless excitation spectrum despite the trimerization of the lattice and the likely weak Dzyaloshinskii-Moriya interactions. Our results demonstrate that the gapless ground state, whether intrinsic or due to deviations to the ideal Hamiltonian, is a rather robust characteristic of kagome materials.

[1] L. Balents, Nature **464**, 199 (2010)
[2] F. H. Aidoudi *et al.*, Nat. Chem. **3**, 801 (2011)
[3] L. Clark *et al.,* Phys. Rev. Lett. **110**, 207208 (2013)
[4] M. Mambrini and F. Mila, Eur. Phys. J. B. **17**, 651-659 (2000)
[5] J. C. Orain *et al.,* J. Phys. Conf. Ser. **551**, 012004 (2014)