**Li2O(CuSO4)2: A Rare Realization of Frustrated Spin-1/2 Two-Leg Ladder?**

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**Introduction**

 Li2O(CuSO4)2 has been synthetized for the first time in 2015. This cuprate displays a very peculiar crystal structure, shown in Figure 1 (a) and (b). In this structure, spin-1/2 are held by Cu2+ ions forming chains oriented along the **c** axis of the crystal and well separated from each other by the Li ions. These chains are build from a stacking of [Cu2O6]4- plaquettes sharing the central oxygens ions with neighboring plaquettes oriented at 90°. If one only considers super-exchange mechanisms supported by Cu-O-Cu bonds, this geometry is exactly that of a linked-tetrahedra spin chains with intra-plaquette coupling J1 and inter-plaquette coupling J2. Additional large interactions through the SO4 non-magnetic units (J4) are also present. We are therefore in the presence of a very rare example of frustrated spin-1/2 two-leg ladder (see Figure 1(c) and (d)), a system at the center of a very impressive amount of theoretical work over the past decades. Magnetic susceptibility measurements (see Figure 1(e)) show a clear spin-singlet ground-state and a spin-gapped behavior indicative of dominant AFM couplings of the order of ~ 100K and powder neutron diffraction confirms the absence of long-range order down to 2K.


**Figure 1:** (a) Atomic structure of Li2OCu2(SO4)2.Cu are in blue, O in red, S in yellow and Li in green. (b) Detail of the atomic structure of the chains (c) Magnetic model deduced from the atomic structure (d) Topologically equivalent frustrated two-leg spin ladder (e) Temperature dependence of the magnetic susceptibility.

**Experimental**

 Pulsed field magnetization experiments have been carried out at different temperatures ….

**Results and Discussion**

 The main goal of these experiments was: (1) to determine experimentally the value of the spin gap in this material and (2) investigate the potential presence of magnetization plateaus associated with the frustration.

 Up to 65T, we only observed a very weak signal under the form of a quasi-linear behavior of the magnetization with the field, recorded for different temperatures and consistent with the above magnetic susceptibility. Unfortunately, **we were not able to induce any magnetic order with fields up to 65T.**

**Conclusions**

 As mentioned above, we were not able to reach the main goals of this project. The energy scale involved in this compound through magnetic couplings J1, J2 and J4 is very large and an investigation of the physics of this frustrated system would require larger fields.

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