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High magnetic field magnetization of a new triangular lattice antiferromagnet

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Introduction

In $\text{CsV}(\text{MoO}_4)_2$, the magnetic V^{3+} ions with octahedral oxygen-coordination form a geometrically frustrated triangular lattice [1]. So far, there is no magnetic properties reported on it. Recently, we successfully grew single crystals of $\text{CsV}(\text{MoO}_4)_2$ by using flux method. The susceptibility shows a sharp drop around 24 K, representing a long range magnetic ordering.

To understand the physical properties of this new triangular lattice antiferromagnet (TLAF), we pursued high field magnetization measurements to answer two questions: (i) *what is the saturation field*, which will be very useful to calculate the exchange interaction of the system? (ii) *Will it exhibit spin state transition*, such as the up up down phase with 1/3-saturation moment as other TLAFs? Recently, we performed VSM measurements in Cell 8, Tallahassee, NHMFL, the results show that the magnetization reaches 0.38 μ_B at 34 T, which is just 19% of the full moment of 2 μ_B for V^{3+} ($3d^2$) ions. Apparently we need higher field to reach 1/3 value or full moment.

Experimental

The magnetization was measured with the inductive compensated coil technique in the pulsed field facility.

Results and Discussion

Figure 1 shows the measured magnetization with $H \parallel c$ -axis of the single crystal $\text{CsV}(\text{MoO}_4)_2$ at different temperatures up to 60 T. First, the obtained moment is around 0.65 μ_B at 60 T, which is still significantly smaller than the full moment 2 μ_B . Therefore, we fail to reach the saturation field. Second, for the 1.4 and 4.2 K data, it tends to show a flat regime around 50 ~ 60 T with 0.65 μ_B , which is around 1/3 of the full moment. This could be the signature of 1/3 M_s . However due to the limitation of our experiment up to 60 T, we can not unambiguously confirm the existence of 1/3 M_s . In order to reach the saturation field and clearly demonstrate the 1/3 M_s feature, we need higher field measurements.

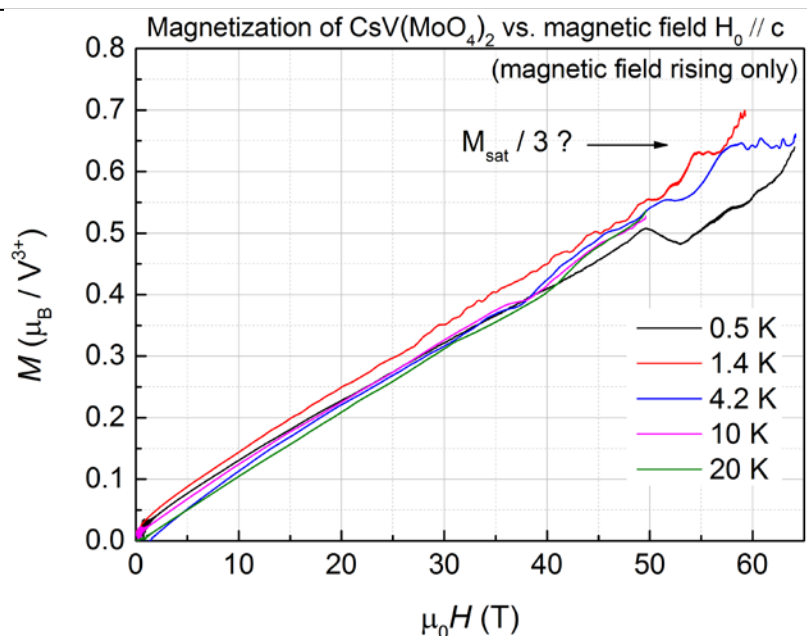


Figure 1 The magnetization measured at different temperatures for $\text{CsV}(\text{MoO}_4)_2$.

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