

# 15th International Conference on Muon Spin Rotation, Relaxation and Resonance



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## Inducing Quantum Criticality in $\text{CrCl}_3$ Under Pressure

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Accelerated by the discovery of graphene, research on two-dimensional (2D) materials have attracted tremendous attention both from fundamental and applied sciences. Among the large number of 2D materials, chromium trihalides  $\text{CrX}_3$  ( $X = \text{Cl}, \text{Br}, \text{I}$ ) van der Waals (vdW) magnets have also raised a large interest due to the existence of many magnetic subtleties that cannot be explained by their magnetic and/or structural transitions. Numerous studies were performed on  $\text{CrI}_3$ , but only a few have been reported so far on its analogue  $\text{CrCl}_3$ . The 2D vdW  $\text{CrCl}_3$  compound is stabilized under a rhombohedral symmetry, consisting of 2D Cr layers arranged in a honeycomb web fashion and surrounded by octahedrally coordinated Cl, with weak vdW inter-layers coupling. The layer structure and inter-layer coupling make  $\text{CrCl}_3$  an ideal system to study under external stimuli such as pressure or magnetic field, where new intriguing states of matter can be unveiled. With such expectations, studies of  $\text{CrCl}_3$  under room temperature, high pressure have been reported[1]. However, its spin dynamics at low-temperature and high-pressure regime remain unexplored.

In this study, we present the results of our recent muon spin rotation (MuSR) investigations performed on hydrostatically pressured  $\text{CrCl}_3$ . Our previous MuSR results at ambient pressure revealed successive transitions from paramagnetic to short-ranged-order-ferromagnetic then to antiferromagnetic states with strong spin dynamics as the temperature decreases[2]. When applying pressure, we observed that the magnetic ground state is gradually suppressed. A linear extrapolation points toward the suppression of magnetism at about  $p_c = 30$  kbar indicating the possible existence of a quantum critical point at  $p_c$ . [3]

[1] Ahmad, Azkar Saeed, et al. "Pressure-driven switching of magnetism in layered  $\text{CrCl}_3$ ." *Nanoscale* 12.45 (2020): 22935-22944.

[2] Forslund, Ola Kenji, et al. "Spin dynamics in the Van der Waals magnet  $\text{CrCl}_3$ ." arXiv preprint arXiv:2111.06246 (2021).

[3] Ge, Yuqing, et al., in preparation.

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