PAUL SCHERRER INSTITUT

Invitation

LMU-Seminar

Title: **Muon spin spectroscopy study of the magnetic field and pressure-induced quantum phase transition in $CsFeCl_3$**

Speaker: **Dr. Artem M. Nikitin**
Laboratory of Muon Spin Spectroscopy, PSI

Time: **Wednesday, February 27th 2019, 10:00**

Place: **WBGB/019**

Abstract:

$CsFeCl_3$ is a gapped quantum magnet with a singlet ground state that exhibits a putative magnetic field-induced Bose-Einstein condensation of magnons leading to a longrange antiferromagnetic order for fields above H_c=4 T and at temperatures below T_N=2.6 K [1]. This compound crystallizes in a hexagonal crystal structure [2], in which the magnetic Fe^{2+} ions are octahedrally coordinated by six Cl ions. The Fe ions form ferromagnetically coupled chains along the c-axis and are antiferromagnetically coupled within the hexagonal plane. The gap in this system originates from non-dimerized S=1 spins where the S_z=0 state is gapped from the doublet S_z=±1 state due to the single ion anisotropy D. Recently, the rare case of a pressure-induced quantum phase transition was reported for this system with a critical pressure of 0.9 GPa [3]. We have carried out an extensive experimental investigation of the pressure and field-induced ordered states by muon spin rotation and relaxation (μSR). μSR allows to investigate the magnetism on a microscopic level and to obtain the ordered volume. The pressure dependent measurements have been performed using a piston-type clamp pressure cell reaching up to 2.0 GPa and temperatures down to 0.25 K. The measurements in field were carried out in magnetic fields up to 4.5 T and temperatures down to 20 mK. These measurements have been performed with the magnetic field parallel to the single ion anisotropy axis (c-axis) for which Bose-Einstein condensation of magnons is predicted.

The obtained results show that $CsFeCl_3$ is in a dynamic magnetic state at low pressures and it possesses static long-range magnetic order at pressures above p_c as evidenced by spontaneous zero field μSR oscillations. We have obtained the ordered volume and the Néel temperature as a function of pressure from transverse field μSR measurements. The high field results confirm the magnetic ordering of the system above the critical field. In addition, the progress on development of a new piezo driven uniaxial compressive strain cell will be discussed.

[1] H. Yoshiwaza, et al. J. Phys. Soc. Jpn. 49, 144 (1980)
[2] H. Seifert and K. Klatyk, Z. Anorg. Allg. Chem. 342, 1 (1966)
[3] N. Kurita and H. Tanaka, Phys. Rev. B 94, 104409 (2016)