PAUL SCHERRER INSTITUT

Invitation

LMU-Seminar

Title: **Structural and Magnetic Properties of the Spin-Dimer Compound $Ba_{3-x}Sr_xCr_2O_8$**

Speaker: **Dr. Alsu Gazizulina**
University of Zurich

Time: **Wednesday, March 13th 2019, 14:00**

Place: **WBGB/019**

Abstract:

A number of insulating magnets show a magnetic-field-induced phase transition that can be interpreted as magnon Bose-Einstein condensation (BEC). $Sr_3Cr_2O_8$ and $Ba_3Cr_2O_8$ exhibit this magnetic phase transition, but in very different critical magnetic fields. These two compounds are isostructural Cr^{5+-} dimer antiferromagnets. Spin-1/2 ions of this type form hexagonal bilayers with a strong J0 intradimer antiferromagnetic interaction, which is manifested in the energy structure as the appearance of the singlet and triplet states. The energy states can be tuned by introducing chemical disorder, which acts as a perturbation field. The introduction of impurities into such systems can lead to exotic phenomena, for example a Bose glass state.

In the present work, the effect on the structural and magnetic properties by replacing Sr with non-magnetic Ba in $Sr_3Cr_2O_8$, is demonstrated. Polycrystalline powders of $Ba_{3-x}Sr_xCr_2O_8$ compounds were prepared and analyzed by means of X-ray, magnetometry and heat capacity measurements over the full range of x from 0 to 3, where x is the content of Sr. Single crystals of $Ba_{3-x}Sr_xCr_2O_8$ with x=2.9 and x=2.8 were grown for the first time, using the floating-zone method. These single crystals were investigated by means of X-ray and neutron-based techniques, and a noticeable change in the magnetic and structural properties, due to the random substitution effect, is evidenced. The studied $Ba_{3-x}Sr_xCr_2O_8$ compounds demonstrate a Jahn-Teller transition, which is accompanied by changes in the crystal structure from hexagonal to monoclinic. The structural phase transition appears to be dynamic over an extended temperature range. This effect is connected with strong orbit-lattice fluctuations, which are suppressed with increased Ba content. In terms of the magnetic properties, it is observed that the value of the intradimer interaction constant J0 decreases with x. The inelastic neutron scattering data reveal three singlet to triplet magnon modes in the dispersion relation. It is shown that the introduction of Ba into the $Sr_3Cr_2O_8$ system leads neither to magnetic disorder nor to intra-gap intensities in the dispersion relation. The theoretical approach of corrections to the dispersion relation, caused by the introduction of Ba, agrees well with the experimental results.