566th ASRC Seminar

Date: 13:30 ～15:00, 8 October

Location: Meeting room 103, ASRC Building

Speaker: Dr. Clemens Ulrich
(The University of New South Wales)

Title: Spin wave dispersion in the helical spin ordered system $SrFeO_{3-\delta}$ and $CaFeO_3$

In the ferrates $SrFeO_{3-d}$ and $CaFeO_3$, spin and charge degrees of freedom play an intriguing role. Their detailed interplay results in various electronic and magnetic phases, for example as consequence of charge order [1]. The ferrates are isoelectric to the Jahn-Teller distorted manganite system and exhibit also colossal magnetoresistance effects. But in contrast, the ferrates show a helical instead of a collinear spin structure [2]. Oxygen doping has a dramatic effect on the electronic properties of the ferrates since the oxygen deficiencies order systematically, leading to different well defined crystallographic phase with different electronic properties, e.g. metal-insulator transitions or charge order [1-3]. Remarkably, our elastic and inelastic neutron scattering experiments have revealed an almost universal magnetic behavior for all the different electronic phases. The spin wave dispersion is comprising upward- and downward-dispersing branches in the form of an hour glass. Such a dispersion is common to compounds with metallic and charge-ordered insulating ground states and closely resembles the extensively studied, universal dispersion of spin excitations in layered copper oxides such has high temperature superconductors. The helical spin arrangement is a consequence a competition between long range double-exchange and short range superexchange interactions [4]. Our theoretical calculations were able to convincingly reproduce the helical spin structure and the experimentally obtained spin wave dispersion in the ferrates $SrFeO_{3-d}$ and $CaFeO_3$.

[1] A. Lebon, P. Adler, C. Bernhard, A.V. Boris, A.V. Pimenov, A. Maljuk, C.T. Lin, C. Ulrich, and B. Keimer, Phys Rev. Lett. 92, 037202 (2004).

[2] M. Reehuis, C. Ulrich, A. Maljuk, Ch. Niedermayer, B. Ouladdiaf, A. Hoser, T. Hofmann, and B.Keimer, Phys. Rev. B 85, 184109 (2012).

[3] J. P. Hodges, S. Short, J. D. Jorgensen, X. Xiong, B. Dabrowski, S. M. Mini, and C. W. Kimball, Journal of Solid State Chemistry 151, 190 (2000).

[4] P.-G. De Gennes, Phys. Rev. 118, 141 (1960).

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