SFB 608

Einladung zum Kolloquium

Ort: Universität zu Köln
II. Physikalisches Institut, Seminarraum 201

Zeit: 13. Juli 2005, 14 Uhr c.t.

Sprecher: Dr. Clemens Ulrich
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Thema: Spin and Orbital Correlations in Transition Metal Oxides (Titanates and Vanadates)

In cubic perovskite systems like the titanates and vanadates, the d-valence electrons exhibit a multitude of competing many-body ground states where quantum fluctuations play an important role. Neutron spectroscopy in the Mott--Hubbard insulator $LaTiO_3$ has revealed a reduced magnetic moment and a nearly isotropic spin wave dispersion [1]. Our results are difficult to reconcile with predictions based on the Goodenough-Kanamori rules. This indicates the presence of orbital fluctuations [2]. Further investigations of the ferromagnetic Mott insulator $YTiO_3$ [3] and antiferromagnetic YVO_3 [4] also underline that orbital zero-point fluctuations play a major role in explaining unusual features in the spin correlations.YVO_3 undergoes a series of temperature induced phase transitions between states with different spin and orbital ordering patterns [5]. The C--type magnetic phase has highly unusual magnetic structure and spin dynamics that cannot be understood within a conventional spin wave theory. A good description of the neutron scattering data is obtained by introducing quasi-1D orbital fluctuations. This leads to the tentative identification of this phase with the theoretically proposed 'orbital Peierls state' [4]. A consequence of the orbital fluctuations is the existence of collective orbital excitations, i.e. orbitons, which have been recently observed in our Raman light scattering experiments in the titanates [6].

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A. G\"ossling, M. Gr\"uninger, J. Hemberger,
M. Reehuis, A. Ivanov, M. Ohl, M. Reinstaedter, W. Schmidt, J.W. Lynn,
H. Roth, M. Cwik, T. Lorenz, S. Miysaska, Y. Taguchi, Y. Tokura,
and B. Keimer.
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[3] C. Ulrich et al., Phys. Rev. Lett. 89, 167202 (2002).
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Gez. Dr. T. Lorenz, A. Gößling