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Spin state transitions in cobaltites: spectroscopic perspective

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The class of cobalt-oxide based materials has attracted increasing interest in the last decade. A key aspect of the cobaltites that distinguishes them clearly from the Cu, Ni, and Mn oxides is the spin state degree of freedom of the Co^{3+} and Co^{4+} ions: the ions can be low spin, high spin, and perhaps even intermediate spin. This aspect comes on top of the orbital and charge degrees of freedom that already make the Cu, Ni, Mn systems so exciting. It is, however, also precisely this aspect that causes considerable debate in the literature. In this presentation we would like to show how synchrotron based soft-x-ray spectroscopies can successfully resolve the local electronic structure of the Co ions and thus contribute to a better understanding of the physical properties of the cobaltites. In particular, we will address the issue of spin state transitions, metal insulator transitions and the newly proposed spin-blockade phenomenon in several layered cobalt materials. — Work done in collaboration with Z. Hu, M.W. Haverkort, C.F. Chang, H. Wu, T. Burnus, Y.Y. Chin, N. Hollmann, C. Schussler-Langeheine, M. Benomar, T. Lorenz, D.I. Khomskii (Univ. Cologne), A. Tanaka (Univ. Hiroshima), S.N. Barilo (NAS, Minsk), J. Cezar, N.B. Brookes (ESRF-Grenoble), H.H. Hsieh, H.J. Lin, C.T. Chen (NSRRC-Hsinchu). Supported by the DFG through SFB 608.