Universal exchange-driven phonon splitting

JOACHIM DEISENHOFER, Augsburg University, CHRISTIAN KANT, Technical University of Vienna, MICHAEL SCHMIDT, ZHE WANG, FRANZ MAYR, VLADIMIR TSURKAN, ALOIS LOIDL, Augsburg University

— We report on a linear dependence of the phonon splitting on the non-dominant exchange coupling $J_{nd}$ in the antiferromagnetic monoxides MnO, Fe$_{0.02}$O, CoO and NiO, and in the highly frustrated antiferromagnetic spinels CdCr$_2$O$_4$, MgCr$_2$O$_4$ and ZnCr$_2$O$_4$. For the monoxides our results directly confirm the theoretical prediction of a predominantly exchange induced splitting of the zone-centre optical phonon [1,2]. We find the linear relation $\hbar \Delta \omega = \beta J_{nd} S^2$ with slope $\beta = 3.7$. This relation also holds for a very different class of systems, namely the highly frustrated chromium spinels. Our finding suggests a universal dependence of the exchange-induced phonon splitting at the antiferromagnetic transition on the non-dominant exchange coupling [3].


Joachim Deisenhofer
Augsburg University

Date submitted: 18 Nov 2011

Electronic form version 1.4