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Optical study of CuIr2S4 and MgTi2O4: experimental support for orbital-Peierls transitions NAN LIN WANG, JUN ZHOU, Institute of Physics, Chinese Academy of Sciences, Beijing 100080, PR China, GUANGHAN CAO, Department of Physics, Zhejiang University, JING SHI, Department of Physics, Wuhan Univeristy — In metals with low-dimensional electronic structure, Fermi surface instability can drive a system into a symmetry-breaking insulating state. However, such instability is not expected to develop in a three-dimensional (3D) system. Recently two types of highly exotic orderings were discovered by Radaelli et al. in two spinel compounds: an octamer ordering in CuIr2S4 and a helical ordering in MgTi2O4. In both cases, sharp metal-insulator transitions (MIT) and spin-dimerizations associated with the structural distortions occur simultaneously. It was suggested that the orbital degree of freedom plays a key role in such transition: the ordering of the orbitals makes the electrons travel exclusively along certain chains which effectively reduces the dimension from 3D to 1D, then is susceptible to Peierls instability at low T. Here we present optical measurement on spinels CuIr2S4 and MgTi2O4, and show that the spectral change across the MIT can be well understood from the picture of 1D Peierls transitions driven by the d_{xy} orbital ordering in CuIr2S4, and the d_{yz} and d_{zx} orbital orderings in MgTi2O4, respectively, proposed by Khomskii et al.

Nan Lin Wang
Institute of Physics, Chinese Academy of Sciences

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