Electronic Structure and Spin Fluctuations of Polar Magnet Fe2Mo3O8

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Abstract

Magnetoelectric materials which possess more than one ferroic order have attracted much interest because of the spontaneous coexistence of electricity and (anti)ferromagnetism. The magnetoelectric (ME) effect is a key in designing novel multiferroic devices. The polar magnet Fe2Mo3O8 shows not only strong ME coupling but also chemical-doping controllability of the distinct ME phases. To study the change of electronic structure with doping, we carried out the high-resolution soft RIXS measurements at Fe L3-edge on (Fe1-xZnx)2Mo3O8 with x = 0 and 0.125. In combination with charge-transfer multiplet calculations, our RIXS results disentangle the electronic properties of octahedral and tetrahedral Fe2+ and provide spectroscopic evidence that the doped Zn favors to replace tetrahedral Fe in the doped compound. We also observed pronounced temperature and polarization dependences of its low energy excitations across phase transition temperature.