Polarization dependence of charge-transfer excitations in La$_2$CuO$_4$

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We have carried out an extensive resonant inelastic x-ray scattering (RIXS) study of La$_2$CuO$_4$ at the Cu K-edge. Multiple charge-transfer excitations have been identified using the incident photon energy dependence of the cross section and studied carefully with polarizations E//c and E //ab. An analysis of the incident photon energy dependence, the polarization dependence, as well as the K-edge absorption spectra, indicates that the RIXS spectra reveal rich physics about the K-edge absorption process and momentum-dependent charge-transfer excitations in cuprates.