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Resonant Inelastic X-ray Scattering Study of the Model Superconductor $HgBa_2CuO_{4+\delta}$ LI LU, XUDONG ZHAO, GUILLAUME CHABOT-COUTURE, Stanford Univ., NOBUHISA KANEKO, Nat. Metrology Inst. of Japan, AIST, OWEN VAJK, NIST Center for Neutron Research, GUICHUAN YU, Stanford Univ., STEPHANE GRENIER, Rutgers State Univ. and Brookhaven National Laboratory, YOUNG-JUNE KIM, Brookhaven National Laboratory, DIEGO CASE, THOMAS GOG, Argonne National Laboratory, MARTIN GREVEN, Stanford Univ. — The characteristics of the elementary excitations in high-temperature superconductors (HTSC) and their Mott-insulating parent compounds remain a controversial issue after many years of extensive study by different spectroscopic methods. Energy- and momentum-resolved resonant inelastic x-ray scattering (RIXS) is gaining in importance as a powerful tool in the study of elementary charge excitations in HTSC. We report a RIXS study of charge excitations in the 2 - 8 eV range in the structurally simple compound $HgBa_2CuO_{4+\delta}$ at optimal doping ($T_c = 96.5$ K) at several high-symmetry points in the Brillouin zone. The spectra exhibit a significant dependence on the incident photon energy which we carefully utilize to resolve a multiplet of electron-hole excitations, including an excitation at 2 eV, which was previously observed in undoped parent compounds. The observation of the 2 eV excitation is suggestive of a remnant charge transfer gap in the superconducting phase. Our data are consistent with a relatively weak (< 0.5 eV) dispersion of all excitations.

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