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Shedding New Light on Spin Excitations: Magnon-Magnon Scattering in a High-T_c Parent Compound Using Soft X-rays B. FREELON, LBNL- UC Berkeley, P.G. MEDAGLIA, A. TEBANO, G. BALESTRINO, INFM COHERENTIA Tor Vergata, P.A. GLANS, T.E. LEARMONTH, K. SMITH, Boston University, K. OKADA, Okayama University, A. KOTANI, RIKEN-Spring8, D.E. KILCOYNE, B. RUDE, I. FURTADO, J.-H. GUO, LBNL — The struggle to understand high-temperature superconductivity (HTSC) has taken place in the field of condensed matter physics for a relatively long time. The difficulty in discovering a HTSC mechanism seems to originate from the confluence of two very complicated problems; electron correlation and quantum magnetism. Novel techniques that specifically probe the electronic or magnetic behavior of these materials are highly sought. We report the direct observation of spin-flip (SF) excitations using resonant inelastic soft x-ray scattering (RIXS). The antiferromganetic (AFM) charge transfer insulator, $CaCuO_2$, was irradiated by soft x-rays tuned to the Cu M-edge ($\sim$ 75 eV). Magnon-magnon (2 spin-flips) excitations were revealed as low-energy loss (0.39 eV) features in photon-in/photon-out experiments. The process is analogous to 2-magnon laser Raman scattering. Collected RIXS spectra provide a measurement of the 2 spin-flip excitation energy and the extraction of the AFM exchange of $CaCuO_2$. These results mark the first report of two-spin-flip magneto-optical excitations revealed through Raman scattering using x-rays. This work reveals the utility of RIXS as a new probe of the spin structure in strongly correlated electron materials.

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