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Probing Collective Spin Excitations in the $S = 1$ $\mathbf{La_2 - xSr_xNiO_4}$ using X-Rays[1] GILBERTO FABBRIS, D. MEYERS, Brookhaven Natl Lab, L. XU, V. M. KATUKURI, L. HOZOI, J. VAN DEN BRINK, IFW Dresden, X. LIU, Chinese Academy of Sciences, J. OKAMOTO, D. J. HUANG, National Synchrotron Research Center, T. SCHMITT, A. ULDRY, B. DELLEY, Paul Scherrer Institut, D. PRABHAKARAN, A. T. BOOTHROYD, University of Oxford, G. D. GU, MARK P. M. DEAN, Brookhaven Natl Lab — Resonant inelastic x-ray scattering (RIXS) has recently emerged as a direct probe of collective magnetic excitations (magnons) of spin $\frac{1}{2}$ materials, being particularly useful for systems that remain elusive to inelastic neutron scattering (INS), such as thin films or at ultra-fast timescales. However, the ability of RIXS to probe magnons in higher order spin systems has not been demonstrated. Here we show that Ni L_3-edge RIXS is sensitive to both $\Delta m_s = 1$ and 2 magnons in the $S = 1$ $La_{2-x}Sr_xNiO_4$. We observe a doping-induced softening of magnetic interactions, which agrees with INS results, but is different from the behavior observed in cuprates. Through the RIXS sensitivity to charge and orbital excitations, we infer that the observed differences between cuprates and nickelates are related to distinct electronic character of the doped charges. The consequences of this work for study of magnetism in Ni-based heterostructures will be briefly discussed. [1] G. Fabbris et al., in prep. (2017); [2] G. Fabbris et al. PRL 117, 147401 (2016).

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