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Giant Spin Gap and Magnon Localization in the Disordered Heisenberg Antiferromagnet Sr2Ir1-xRuxO4 YUE CAO, Brookhaven National Lab, XUERONG LIU, Institute of Physics, Chinese Academy of Sciences, WENHU XU, WEIGUO YIN, DEREK MEYERS, Brookhaven National Lab, JUNGHO KIM, DIEGO CASA, MARY UPTON, THOMAS GOG, Advanced Photon Source, Argonne National Lab, TOM BERLIJN, GONZALO ALVAREZ, Oak Ridge National Lab, SHUJUAN YUAN, JASMINKA TERZIC, Department of Physics and Astronomy, University of Kentucky, J. M. TRANQUADA, JOHN HILL, Brookhaven National Lab, GANG CAO, Department of Physics, University of Colorado at Boulder, ROBERT KONIK, M. P. M. DEAN, Brookhaven National Lab —
We study the evolution of magnetic excitations in the disordered two-dimensional antiferromagnet Sr_2Ir_1-xRu_xO_4. A gigantic magnetic gap greater than 40 meV opens at x = 0.27 and increases with Ru concentration, from 40 meV to >150 meV, rendering the dispersive magnetic excitations in Sr2IrO4 almost momentum independent. Up to a Ru concentration of x = 0.77, both experiments and first-principles calculations show the Ir J_eff = 1/2 state remains intact. The magnetic gap arises from the local interaction anisotropy in the proximity of the Ru disorder. Under the coherent potential approximation, we reproduce the experimental magnetic excitations using the disordered Heisenberg antiferromagnetic model with suppressed next-nearest neighbor ferromagnetic coupling. Ref: Y. Cao et al., arXiv:1608.04640 (2016).

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