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Direct Observation of Magnetic Frustration via Bond-directional Interactions in a Honeycomb Lattice Iridate Na_2IrO_3[1] SAE HWAN CHUN, H. ZHENG, C. STOUMPOS, C. MALLIAKAS, J.F. MITCHELL, Materials Science Division, Argonne National Laboratory, JONG-WOO KIM, JUNGHO KIM, Y. CHOI, T. GOG, Advanced Photon Source, Argonne National Laboratory, KAVITA MEHLAWAT, YOGESH SINGH, Indian Institute of Science Education and Research Mohali, A. AL-ZEIN, M. MORRETI SALA, M. KRISCH, European Synchrotron Radiation Facility, J. CHALOUPKA, Central European Institute of Technology, Masaryk University, G. JACKELI, G. KHALIULLIN, B.J. KIM, Max Planck Institute for Solid State Research — Despite its long-range zigzag magnetic ground state, the honeycomb Na2IrO3 is considered as a model system for approaching a Kitaev quantum spin liquid due to a proposed bond-directional magnetic frustration. Using resonant x-ray magnetic scattering, we find direct evidence of this frustration and follow its temperature dependence. We observe that three zigzag magnetic states with short-range correlation are displayed in the diffuse magnetic peaks as a function of scattering geometry up to $6T_N$. Each zigzag state breaks C3 symmetry individually, but the simultaneous C3 rotation in both real and spin spaces remains invariant as consequence of the distinct magnetic anisotropies tied to three Ir-Ir bonds in the lattice. This result confirms the dominant role of the bond-directional interactions in the frustration.

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