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Magnon Sidebands and Spin-Charge Coupling in Bismuth Ferrite Probed by Nonlinear Optical Spectroscopy AMIT KUMAR, M. RAMIREZ, S. DENEV, N. PODRAZA, X. XU, R. RAI, Y-H. CHU, J. SEIDEL, L. MARTIN, J. IHLEFELD, J. KLUG, M. BEDZYK, O. AUCIELLO, D. SCHLOM, R. RAMESH, J. ORENSTEIN, J. MUSFELDT, V. GOPALAN — The interplay between spin waves (magnons) and electronic structure in materials leads to the creation of additional bands associated with electronic energy levels, called magnon sidebands which are difficult to probe due to their smaller energy scales (meV). Linear light absorption and scattering techniques at low temperatures are traditionally used to probe these sidebands. We show that optical second harmonic generation (SHG) can successfully probe the magnon sidebands at room temperature and up to 723K in bismuth ferrite, associated with large wave-vector multi-magnon excitations which linear absorption studies have thus far been unable to resolve. Polarized light studies and the temperature dependence of these sidebands reveal a spin-charge coupling interaction between the spontaneous polarization (P_s) and antiferromagnetic order parameter, L in bismuth ferrite, that persists with short range correlation well into the paramagnetic phase.

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