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Magnetic Color Symmetry of Lattice Rotations in a Non-magnetic Material SAVA DENEV, A. KUMAR, M. D. BIEGALSKI, Pennsylvania State University, H. W. JANG, C. M. FOLKMAN, University of Wisconsin-Madison, A. VASUDEVARAO, Pennsylvania State University, Y. HAN, I. M. REANEY, University of Sheffield, S. TROLIER-MCKINSTRY, Pennsylvania State University, C.-B. EOM, University of Wisconsin-Madison, D. G. SCHLOM, V. GOPALAN, Pennsylvania State University — Oxygen octahedral rotations are the most common phase transitions in perovskite crystal structures. Here we show that the color symmetry of such pure elastic distortions is isomorphic to magnetic point groups, which allows their probing through distinguishing polar versus magnetic symmetry. We demonstrate this isomorphism using nonlinear optical probing of the octahedral rotational transition in a compressively strained $SrTiO_3$ thin film that exhibits ferroelectric ($4mm$) and antiferrodistortive ($4'mm'$) phases evolving through independent phase transitions. The approach has broader applicability for probing materials with lattice rotations that can be mapped to color groups.

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