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Structural symmetries of the 112-type iron-based superconductor ($Ca_{1-x}La_x$)$FeAs_2$ studied using nonlinear and ultrafast optics JOHN HARTER, HAO CHU, Institute for Quantum Information and Matter, California Institute of Technology, SHAN JIANG, NI NI, Department of Physics Astronomy, University of California, Los Angeles, DAVID HSIEH, Institute for Quantum Information and Matter, California Institute of Technology — The crystal structure of the newly discovered 112-type iron-based superconductors contains symmetry-breaking arsenic chains, avoiding the need for local probes or uniaxial strain in order to study the ubiquitous electronic nematic state that exists in the vicinity of magnetic order in the iron pnictides. In addition, the 112-type materials are the first known high-temperature superconductors without a center of inversion, with interesting ramifications for Cooper pairing in the superconducting state. We present details of the structure of 112-type ($Ca_{1-x}La_x$)$FeAs_2$ using rotational anisotropy second harmonic generation and pump-probe transient reflectivity experiments. These all-optical techniques are complimentary to conventional diffraction measurements and enable a precise determination of crystallographic symmetries. Our measurements highlight the novel structural properties of the 112-type materials.

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