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Optical properties of tetragonal and nanoscale BiFeO₃¹ P. CHEN, X. S. XU, J. L. MUSFELDT, University of Tennessee, A. C. SANTULLI, C. KOENIGSMANN, S. S. WONG, State University of New York at Stony Brook, N. J. PODRAZA, A. MELVILLE, E. VLAHOS, V. GOPALAN, Pennsylvania State University, D. G. SCHLOM, Cornell University, R. RAMESH, University of California, Berkeley — We measured the optical properties of tetragonal thin film and nanoscale rhombohedral BiFeO₃ in the range from near infrared to the near ultraviolet. The absorption spectrum in the tetragonal film is overall blue-shifted compared with that of the rhombohedral BiFeO₃ film. It shows an absorption onset near 2.25 eV, a direct 3.1 eV band gap, and charge transfer excitations that are ~0.4 eV higher than those of the rhombohedral counterpart. In the nanoparticles, the band gap decreases from 2.7 eV to ~2.3 eV, and the well-known 3.2 and 4.5 eV charge transfer excitations split into multiplets. We discuss these results in terms of structural strain, surface strain, and local symmetry breaking.

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