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Point group sensitive probes of the pseudogap electronic structure in Bi2212 J.P. HINTON, UC Berkeley, LBNL, J.D. KORALEK, LBNL, J. ORENSTEIN, UC Berkeley, LBNL, I. FIRMO, M. HAMIDIAN, K. FUJITA, LASSP Cornell U, CMPMS BNL, J.C. DAVIS, LASSP Cornell U, CMPMS BNL, SUPA U St. Andrews — We combine optical transient grating spectroscopy (TGS) and spectroscopic imaging scanning tunneling microscopy (SI-STM) to study the pseudogap electronic structure in the underdoped cuprate superconductor $\text{Bi}_2\text{Sr}_2\text{CaCu}_2\text{O}_{8+\delta}$. In TGS a pair of 50 fs pump pulses at 800 nm coincident on the sample surface generate a sinusoidal variation in the index of refraction. This index grating is phase sensitively probed, allowing us to clearly resolve two components in the optical response below T_c . We attribute one of the components to a coherent nonlinear optical process, whose properties are sensitive to the point group symmetry of the pseudogap electronic structure. We compare the results of these optical experiments with recent analysis of SI-STM data (M. J. Lawler *et al* **Nature** **466**,347 (2010)) which measures the amplitude of peaks at various reciprocal lattice vectors in the Fourier transform of atomically resolved images of the pseudogap electronic structure. The symmetry properties of the SI-STM Bragg amplitudes provide additional evidence relevant to the point group of the pseudogap electronic structure.

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