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Spooktroscopy: a ghost imaging approach to ultrafast absorption spectroscopy[1] SIQI LI, JOSEPH DURIS, THOMAS J. LANE, AGOSTINO MARINELLI, DANIEL RATNER, ELIO CHAMPENOIS, JAMES CRYAN, TARAN DRIVER, SLAC National Accelerator Laboratory, OLIVER ALEXANDER, THOMAS BARILLOT, DOUGLAS GARRATT, JON MARANGOS, Imperial College London, LU00 COLLABORATION, LR25 COLLABORATION — With the advent of an X-ray free-electron laser, scientists can probe femtosecond ultrafast molecular dynamics with atomic-site specificity. One well-established technique is transient absorption spectroscopy, where transient sample absorption is determined by scanning the central photon energy and recording the resultant photoproducts. When using sub-femtosecond pulses, this method is limited in spectral resolution due to the large energy bandwidth inherent to the short pulses. Here, we present a novel technique based on the principle of ghost imaging, and demonstrate sub-bandwidth absorption spectroscopy measurements with sub-femtosecond pulses. We show both one-dimensional and two-dimensional results. Our method is applicable to any spectral measurement limited by the bandwidth or noise level of the probing source, provided the probe spectrum is known at each shot.

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