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Super-resolution band structure reconstruction of monolayer tungsten diselenide CHRISTOPH SCHMID, LEONARD WEIGL, NIKLAS HOFMANN, FABIAN LANGER, CHRISTOPH LANGE, RUPERT HUBER, Department of Physics, University of Regensburg, Regensburg, Germany, MARKUS BORSCH, MACKILLO KIRA, Department of Electrical Engineering and Computer Science, University of Michigan, Ann Arbor, MI, USA — Harnessing the carrier wave of an intense lightwave to drive the quantum motion of electrons in solids has set the stage for exciting strong-field phenomena, such as high-harmonic generation, dynamical Bloch oscillations, and interband quantum interference [1], as well as high-order sideband generation (HSG) [2,3]. Here, we demonstrate a novel concept for high-resolution band structure reconstruction by exploiting the band-selective transport in HSG. Varying the center frequency of the accelerating multi-terahertz wave over a full optical octave reveals a dramatic suppression of specific odd-order sidebands. A full quantum mechanical description of the underlying dynamics links this anomaly with specific resonances in the odd-order HSG emission. The explanation involves crystal-momentum combs that introduce super-resolution imaging capabilities in reciprocal space. This novel type of band structure spectroscopy paves the way towards a scalable all-optical strategy to map out key features of the electronic structure of a solid quantitatively. [1] M. Hohenleutner et al., Nature 523, 572-575 (2015). [2] F. Langer et al., Nature 533, 225-229 (2016). [3] F. Langer et al., Nature 557, 76-80 (2018).

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