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Ultrafast extreme ultraviolet photoemission without space charge[1] THOMAS ALLISON, PENG ZHAO, CHRISTOPHER CORDER, JIN BAKALIS, AMANDA MURACA, XINLONG LI, Stony Brook University, MATTHEW KERSHIS, None, MICHAEL WHITE, Stony Brook University and Brookhaven National Laboratory — Time- and Angle-resolved photoelectron spectroscopy from surfaces can be used to record the dynamics of electrons and holes in condensed matter on ultrafast time scales. However, ultrafast photoemission experiments using extreme-ultraviolet (XUV) light have previously been limited by either space-charge effects, low photon flux, or limited tuning range. In this article, we describe space-charge-free XUV photoelectron spectroscopy experiments with up to 5 nA of average sample current using a tunable cavity-enhanced high-harmonic source operating at 88 MHz repetition rate. The source delivers $> 10^{11}$ photons/s in isolated harmonics to the sample over a broad photon energy range from 18 to 37 eV with a spot size of 58×100 μm^2. From photoelectron spectroscopy data, we place conservative upper limits on the XUV pulse duration and photon energy bandwidth of 93 fs and 65 meV, respectively. The high photocurrent and lack of space charge distortions of the photoelectron spectra enable time-resolved XUV photoemission experiments in a qualitatively new regime.

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