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High harmonic generation from Bloch electron in Solids MENGXI WU, Louisiana State University, SHAMBHU GHIMIRE, DAVID REIS, PULSE Institute, SLAC National Accelerator Laboratory, KENNETH SCHAFER, METTE GAARDE, Louisiana State University — We study the generation of high harmonic radiation by Bloch electrons in a model solid driven by a strong mid-infrared laser field. We solve the single-electron time-dependent Schrödinger equation (TDSE) using a velocity-gauge method [New J. Phys. 15, 013006 (2013)]. The resulting harmonic spectrum exhibits a primary plateau due to the coupling of the valence band to the first conduction band, with a cutoff energy that scales linearly with field strength and laser wavelength. We also find a weaker second plateau due to coupling to higher-lying conduction bands, with a cutoff that is also approximately linear in the field strength. To facilitate the analysis of the time-frequency characteristics of the emitted harmonics, we also solve the TDSE in the Houston states [Phys. Rev. B 33, 5494 (1986)], which allows us to separate inter- and intra-band contributions to the current. We find that the inter- and intra-band contributions display very different time-frequency characteristics. We show that solutions in these two bases are equivalent under an unitary transformation but that, unlike the velocity gauge method, the Houston state treatment is numerically unstable when more than a few low lying energy bands are used.

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