Abstract Submitted
for the DAMOP19 Meeting of
The American Physical Society

Comparison of numerical methods for High Harmonic Generation (HHG) in 1D solids.[1] MARCELO, J. AMBROSIO, FRANCISCO NAVARRETE, UWE THUMM, Kansas State University — The recent renewed interest in HHG from solid targets started with the experiment by Ghimire et al. [1]. Based on numerical models for HHG by electronic currents that are induced by a driving laser pulse in the substrate, interband and intraband transitions are currently being discussed for solid HHG [2,3]. As the characterization of HHG spectra in numerical studies requires the repeated solution of the TDSE in a large space of driver-pulse, substrate, and model parameters, it is desirable to identify fast and accurate numerical methods. We benchmarked five numerical schemes: second order Magnus expansion (ME), Crank-Nicolson (CN), Runge-Kutta of orders 2(3) and 4(5), and Leapfrog and compared their performance with regard to CPU-time and accuracy (wavefunction-norm preservation and signal/noise level of the calculated HHG spectra). We find that the ME and CN methods produced very similar HHG spectra and the best norm preservation, with the ME approach being the faster of the two.
[1] Ghimire et al., Nat. Phys. 7, 138-141 (2011); Nat. Phys. 437, 330 (2019). [2] Wu et al., Phys. Rev. A 91, 043839 (2015). Vampa et al., Phys. Rev. B 91, 064302 (2015). Tancogne-Dejean et al., Phys. Rev. Lett. 118, 087403 (2017). Hawkins et al., Phys. Rev. A 91, 013405 (2015). [3] Navarrete et al., in preparation.

[1]Supported by the NSF and the Division of Chemical Sciences, Office of the Basic Energy Sciences, Office of Energy Research, US DoE

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Date submitted: 30 Jan 2019 Electronic form version 1.4