

Tutorial on high-order harmonic generation from solids

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In this tutorial we will cover the fundamentals of high-order harmonic generation (HHG) by focusing on the similarities and differences between solid-state dynamics and their atomic counterparts. As we know HHG in gas phase has been the foundation of attosecond science with its demonstrated use in the generation of attosecond pulse in extreme ultraviolet wavelength range, high-harmonic probing of structure and dynamics of molecular orbitals, and generation of coherent short wavelength radiation beyond the water window. Solid-state HHG is about 25 years younger. Let us discuss the opportunities it presents to the attosecond science community and beyond, by going over the dynamics involving intra-band and inter-band processes and their subsequent sensitivities to the electronic structure of the source materials such as their electronic band structure, Berry curvatures, and topologically non-trivial phases. We will setup a battleground to argue about multiple HHG pathways in solids, as well as to discuss broadly if the strong-field driven dynamics in crystalline materials more quantum than those in atoms and molecules.