Towards probing multi-electron effects in high-harmonic generation in xenon

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Our understanding of atomic processes induced by strong laser fields is largely based on effective single-particle or mean-field models, which are often well suited to provide a qualitative understanding of the underlying process. For a quantitative understanding, the inclusion of multi-electron effects is crucial, all the more so since they can have a dramatic impact. One prominent example is the giant dipole resonance in Xe, which strongly enhances the yield in high-harmonic generation (HHG) yield at around 100 eV, as has been experimentally observed [1] and theoretically described [2]. However, an accurate description of this multi-electron effect, in a strong-field driven system, is still lacking due to the considerable challenge posed by the many-body dynamics in this 54-electron system. Recently, we have shown that the time-dependent two-particle reduced density matrix theory (TD2RDM) is able to capture the multi-electron dynamics during HHG in atoms with high accuracy, while avoiding the exponential barrier that typically plagues wavefunction based methods [3]. Accurate ground states of Xe are required to initialize the propagation. The ground state of Xe is computed using imaginary time-propagation within the time-dependent complete active space self-consistent field (TDCASSCF) method [4]. We will present first results on HHG generation in Xe within TD2RDM.

References

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