High-harmonic generation in graphene

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We explore high harmonic generation (HHG) from a graphene sheet exposed to intense femtosecond laser pulses based on the Lewenstein model [1]. It is demonstrated that the HHG cutoff frequency increases with graphene size up to the classical limit for distant diatomic systems. In contrast to two-center systems the cutoff frequency remains constant with increasing power of the harmonics as the graphene diameter extends beyond maximal electron excursion.

It is shown that the extended nature of the graphene sheet allows for strong HHG signals at maximum cutoff for linearly as well as circularly polarized laser pulses, the latter opening for generation of strong circularly polarized attosecond pulses.

In addition, we investigate the HHG spectrum beyond the extensively used stationary phase method (SPM). Comparisons to analytic evaluations of the momentum integrals show discrepancies, and even a breakdown of the SPM for in-plane laser fields, encouraging a more exact treatment of the Lewenstein model for certain systems.

References:
[1] S. A. Sørngård, S. I. Simonsen, J. P. Hansen, submitted to Phys. Rev. A (2013)
[2] S. I. Simonsen, S. A. Sørngård, J. P. Hansen, to be submitted to Phys. Rev. A (2013)