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Laser harmonic generation with tuneable orbital angular momentum using a structured plasma target

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In previous studies of spin-to-orbital angular momentum (AM) conversion in laser high harmonic generation (HHG) using a plasma target, one unit of spin AM is always converted into precisely one unit of OAM [1,2]. Here we show, through analytic theory and numerical simulations, that we can exchange one unit of SAM for a tuneable amount of OAM per harmonic step, via the use of a structured plasma target. The target absorbs the difference in total AM between that of n fundamental photons and the outgoing n-th harmonic photon. We introduce a novel way to analyse the frequency, spin and OAM content of the harmonic radiation which provides enhanced insight into this process. The prospects of structured targets for HHG with high-order transverse modes will be discussed.

References

[1] J. W. Wang, M. Zepf and S. G. Rykovanov, Nature Communications **10**, 5554 (2019).
[2] Shasha Li *et al.*, New J. Phys. **22**, 013054 (2020).