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Betatron radiation emission from laser-wakefields driven by pulses with OAM

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Betatron radiation from laser-wakefield accelerators (LWFA) has shown great potential as a source of high brightness ultra-short radiation. In typical experimental and simulation LWFA setups, the driver is a single laser pulse with a Gaussian profile. However, the recent advances in the field of structured light, in particular in the study and production of light pulses with orbital angular momentum, for example Laguerre-Gaussian modes, has opened new prospects for laser-wakefield acceleration.
In this work, we explore LWFA driven by structured pulses comprised of Laguerre-Gaussian modes. We show that by using pairs of Laguerre-Gaussian modes, multiple wakefields can be driven with non-trivial dynamics. We investigate the possibility of driving pairs of wakefields rotating around the propagation axis though three-dimensional particle-in-cell simulations. Using a post-processing radiation diagnostic and the trajectories of bunch electrons taken from simulations, we examine the properties of the emitted radiation taking into account coherence effects.

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