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Monte-Carlo event generation for the interaction of x-ray laser fields and hot electrons

With the advent of advanced laser systems producing high-frequency X-ray beams, e.g. the EuropeanXFEL as a prominent example, a regime of laser-plasma interaction is reached, where all-optical methods, as used in particle-in-cell simulations, are no longer applicable. Instead, the interaction of hot electrons and the X-ray laser pulse needs to be modeled with a QED-driven approach. Furthermore, future experiments taking place at HED-HIBEF, LCLS, and other facilities targeting this regime, will encounter processes in x-ray scattering from (laser-driven) relativistic electrons, where the effects of the energy spectrum of the x-ray laser field as well as multi-photon interactions can not be neglected anymore.
To explore this regime, where strong fields meet high frequencies, we present a novel approach for a numerical modeling tool, QED.jl, which inherently uses exact strong-field QED descriptions. This brings, for the first time, the technique of Monte-Carlo event generation to X-ray laser physics experiments.

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