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Modeling radiation spectra and polarization from particle-in-cell simulations

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Computing radiated fields from particle-in-cell (PIC) simulations are limited by the grid resolution. In PIC codes, the spatial scales are either the plasma skin-depth or the laser wavelength. Hence, resolving the radiated fields on the PIC grid requires extremely large computational resources. As the PIC codes can compute the particle trajectories for the entire simulation duration, a practical and efficient method is to post-process the position and momenta of the particles over time to calculate the radiated fields at a fixed point of observation. We describe a recently developed radiation post-processing code CASPER that can compute the radiated fields and their polarization from a sample of particles extracted directly from PIC simulations on a detector similar to those employed in experiments. Furthermore, using CASPER, we describe radiation and polarization generated during the propagation of a relativistic electron-positron beam in a magnetized electron-ion plasma and compare it with astrophysical observations and laboratory astrophysics experiments.

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