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Scattered field formalism in the particle-in-cell method for tightly focused ultrashort laser beams

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We combine the scattered field formalism with Smilei's particle-in-cell code, using the PrescribedField block to model the relativistic dynamics of laser plasmas in complex field configurations. Despite the strong nonlinearity of the interaction, we provide theoretical justifications for the applicability of this method, supported by numerical analysis. We then apply this method to describe electron acceleration under real experimental conditions in a subcritical plasma from tightly focused linear and radially polarized beams. According to our simulations and their analysis, this approach looks very promising for optimizing laser-induced relativistic electron beams at ultra-high intensities.

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