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Radiation cooling dominated regimes in the interaction of ultra intense lasers with electron beams and on ion acceleration MARIJA VRANIC, JORGE VIEIRA, JOANA LUIS MARTINS, RICARDO FONSECA, LUIS OLIVEIRA SILVA, GoLP/IPFN, Instituto Superior Tecnico, Lisboa, Portugal — Under extreme acceleration, charged particles can radiate strongly and the corresponding radiation damping can become important. Using a single particle dynamics code and Osiris 2.0 framework, we have identified different qualitative regimes for electron interaction with counter- and co- propagating ultra-intense laser fields. For conditions where the radiation cooling is important, qualitative differences arise as compared with the scenarios where radiation cooling is absent; this is reflected not only in the particle phase space trajectories, but also on the net velocity imparted to the counter-propagating electrons and the possibility of cooling particle beams. Possibilities to explore signatures for radiation cooling in future experiments (e.g. ELI) will be discussed. We have also explored how the radiation cooling affects the ion energy spectrum for laser-induced ion acceleration. In 1D simulations, we observe that the radiation cooling has stronger impact, the proton spectrum is narrower and has a slightly lower mean energy, while in 2D runs with a finite laser spot-size, the difference in the proton spectrum is not as strong.

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