HEDLA 2022
13th International Conference on High Energy Density Laboratory Astrophysics
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Creating and accelerating electron-positron beams with intense laser pulses

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The next generation of pulsed lasers will have intensities in excess of 10^{23} W/cm^2. Scattering a laser that intense with an electron beam can generate pairs of electrons and positrons through Breit-Wheeler pair creation. In addition, the same laser can provide direct laser acceleration (DLA) of leptons in the radiation reaction dominated regime. The DLA scheme has already been demonstrated to provide high-charge electron beams (at a $\sim$ nC level) even at moderate laser intensities ($\sim 10^{20}$ W/cm^2). Here I show what can be accomplished with near-future laser facilities.

Increasing the laser power is bound to augment the DLA electron charge content even further. The field structure formed due to electron beam loading allows for accelerating positrons without defocusing them. What is more, the interaction in the radiation dominated regime will provide a high flux of emitted photons, in hard x-ray and gamma-ray range. These photons can then be used as a seed for electron-positron pair creation, as well as a radiation source for applications.

This work was supported by FCT grants CEECIND/01906/2018, PTDC/FIS-PLA/3800/2021. We acknowledge PRACE for granting access to MareNostrum in BSC, Spain.