Sources of electrons, positrons and gamma-rays from lasers within plasma channels

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The next generation of pulsed lasers will have intensities in excess of 10^{23} W/cm^2. While propagating through a pre-formed plasma channel, a laser of such intensity allows for 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) with moderate laser intensities ($\sim 10^{20}$ W/cm^2). In this work, we show what can be accomplished with near-future laser facilities.

We have found that increasing the laser power is bound to augment the charge content even further. The field structure formed due to electron beam loading allows for accelerating positrons. 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 pari creation, as well as a radiation source for applications.

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