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High Flux Polarized Positron Production based on high efficiency FEL and high gradient IFEL

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In this paper we discuss the design of polarized positron source for an e+e- linear collider based on polarization transfer from circularly polarized gamma-ray photons in a conversion target. A very high flux of gamma-ray photons can be obtained via inverse compton scattering a high current ultra-relativistic electron beam with an intense laser pulse circulating in an optical cavity. In order to sustain interactions at MHz-scale repetition rates, the electron beam is laser-accelerated to 1 GeV in a tapered helical undulator using the same laser which drives the ICS interaction and right after the ICS interaction is laser-decelerated to replenish the energy in the optical beam. The design of the tapered undulator system and the estimates for the gamma ray flux, spectrum and polarization are presented. The results suggest that positron beams with currents up to 30 uA (well in excess of the International Linear Collider requirements) and polarization of up to 70 \% could be obtained with this scheme.

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