

Positron Acceleration with Transition Radiation Driven by Ultra Intense Laser at SULF and SEL

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We report our progress on positron generation and acceleration. We proposed a scheme that utilizes laser-driven electrons to produce, inject, and accelerate positrons in a single setup. A high-density gas jet is employed experimentally to generate from several to hundred MeV electrons with high charge above 100 nC. Thus, positron beam with high charge is obtained during the laser-accelerated electrons irradiating high-Z solid targets [1].

The high-charge electron beam creates copious electron-positron pairs via the Bethe-Heitler process, followed by enormous coherent transition radiation due to the electrons exiting from the metallic foil [2]. This intense transition radiation accelerates and focuses the positrons efficiently. Since the intensity of the coherent transition radiation scales to the square of the electron charge number, this scheme is extremely effective for 10–100 PW laser.

We discuss the use of a channel to guide the transition radiation [3,4]. We propose to use diffraction radiation to extract the energy from the electron beam more efficiently [5]. This new method has been demonstrated with a 10 PW laser at SULF [6]. We are planning experiments with the 50 PW laser at SEL@SHINE in Shanghai. Other experimental plans at SEL@SHINE are also introduced.

References

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