Contribution ID: **25**  Type: **not specified**

# Generation and acceleration of linear Breit-Wheeler positrons in ultra-intense laser plasma interactions

*Wednesday 31 August 2022 16:05 (20 minutes)*

Creation of electrons and positrons via binary photon collisions, i.e. the linear Breit-Wheeler (BW) process, is a basic prediction of quantum electrodynamics, but it is yet to be observed in the laboratory. Motivated by experimental capabilities of newly constructed laser facilities and by recent developments in target fabrication, we have performed PIC simulations supplemented by a post-processing algorithm that have shown that over $10^7$ linear BW pairs can be produced by a single laser pulse [New J. Phys. 23, 115005 (2021)] and over $10^8$ linear BW pairs can be produced by two colliding laser pulses [Comm. Phys. 4, 139 (2021)] propagating inside a structured plasma channel. The simulations use an experimentally achievable laser intensity in the range of $10^{22}$ W/cm$^2$. We have also found that the pair yield from the linear BW process dominates over the yield from the nonlinear BW and Bethe-Heitler processes [Phys. Plasmas, 29, 053105 (2022)].

In order to assesses the dynamics of the linear BW positrons, we have recently developed a first-ever fully kinetic code for predictive simulations of the linear BW pair creation in high-intensity laser-matter interactions and the subsequent positron acceleration. Using this new tool, we found that the linear BW pairs created in both setups can form collimated positron beams with a narrow divergence angle and energy in the GeV range. Our results suggest feasible experimental setups for the observation of the linear BW process in the laboratory and for generation of collimated energetic positron beams. Our findings also indicate that one should no longer automatically assume that the yield of the linear BW process is inferior to the yield from the nonlinear BW process, so the linear BW process must be included when considering ultra-intense laser plasma interactions.

**Primary author:** HE, Yutong

**Co-authors:** Mr SUGIMOTO, Kaoru (Osaka University); Prof. BLACKBURN, Thomas (University of Gothenburg); Prof. NATSUMI, Iwata (Osaka University); Mr YEH, I-Lin (University of California, San Diego); Mr TANGTARTHARAKUL, Kavin (University of California, San Diego); Prof. TONCIAN, Toma (Helmholtz-Zentrum Dresden-Rossendorf); Prof. SENTOKU, Yasuhiko (Osaka University); Prof. AREFIEV, Alexey (University of California, San Diego)

**Presenter:** HE, Yutong

**Session Classification:** Strong Field QED

**Track Classification:** Methods: Numerical simulations