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Optimal photon polarization toward the observation of the nonlinear Breit-Wheeler pair production

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We investigate the optimization of photon polarization to increase the yield of Breit-Wheeler pair production in arbitrarily polarized plane wave backgrounds. We show that the optimized photon polarization can improve the positron yield by more than 20% compared to the unpolarized case, in the intensity regime of current laser-particle experiments.

The seed photon optimal polarization results from the polarization coupling with the polarization of the laser pulse. Compact expressions of the coupling coefficients in both the perturbative and nonperturbative regimes are given. Because of the evident difference in the coupling coefficients for the linear and circular polarization components, the seed photon optimal polarization state in an elliptically polarized laser background deviates considerably from the orthogonal state of the laser polarization.

Primary author: TANG, Suo (Max-Planck-Institut für Kernphysik)

Co-author: Mr GAO, YunQuan

Presenter: TANG, Suo (Max-Planck-Institut für Kernphysik)

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