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Ultra-brilliance isolated attosecond gamma-ray light source from nonlinear Compton scattering

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In this work, we propose a novel method to generate high charge (~1nC) attosecond (<200 attosecond) electron bunch by the near-threshold self-injection mechanism in wakefield acceleration with current-generation laser, and demonstrate the ability to generate an ultra-brilliance (> 2 ×1024 photons s-1 mm-2 mrad-2 0.1%BW) attosecond (<200 attosecond) gamma-ray (Emax > 3 MeV) pulse via nonlinear Compton scattering. To the best of our knowledge, this is the first method to generate attosecond gamma-ray photon source using current-generation laser. This gamma-ray source is the shortest gamma-ray photon source even compared with the results (>800 attosecond) generated with next-generation laser, and the highest brilliance (orders higher than the results, reported) photon source in MeV range. This method can be widely applicated for experimental generation of 100 keV to several MeV high brilliance attosecond gamma-ray sources with certain ~100 TW laser facilities, will benefit ultra-high resolutions radiography application and some basic science.

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