Broadband Coherent XUV Light from Electron-Positron Microbunching in an Intense Laser Pulse

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Attosecond pulses of XUV light can be produced from electron microbunches passing through an undulator, within a free electron laser (FEL). An optical-FEL (OFEL), which utilizes a counter-propagating laser pulse instead of an undulator, promises to be more compact and tunable than a FEL. Yet, an OFEL is difficult to realize because of the high electron density required, and subsequent high emittance. With numerical simulations, we demonstrate that coherent pulses of XUV light with duration 8 attoseconds at 92 attoseconds intervals can be generated by microbunching of relativistic electrons and positrons (e^-/e^+) in a laser pulse, of peak intensity $2.2 \times 10^{20}\,\mathrm{W/cm^2}$ and central wavelength 400 nm. The e^+ provide a restoring force which stabilizes the system, allowing for sustained coherent emission and the rapid formation of microbunches over short distances $\sim 10\,\mu\mathrm{m}$ compared to the typical length of an undulator $\sim 10\,\mathrm{m}$.