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High-order harmonic generation from laser interaction with a plasma grating

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High-order harmonic generation (HHG) from laser plasma interaction is promising as an efficient source for extreme ultra-violet (XUV) and attosecond pulses. The physics involved is of basic interest and the resulting radiation are relevant for applications in many areas. Powerful HHG with a quite different characteristics has been observed in experiment from the grating surface normally irradiated by a linearly laser pulse [1]. The results showed that only the harmonics of the grating periodicity were strongly generated, which is emitted along the surface direction with a narrow solid angle. Indicated by the related numerical studies [2], such HHG is attributed to the relativistic dynamic of electron bunches coming from the corrugated surface, meanwhile the diffractive prosperities of grating play important roles in spectrum and angular distribution of the emission. However, a satisfactory physical understanding of the HHG on the grating plasma is still lacking. In this talk, we propose an analytical surface-current model for investigating HHG when a relativistic linearly polar- ized laser pulse incidents normally on a solid plasma grating. It is found that the relativistic quiver motion of teeth electrons in the laser light leads to HHG. Due to the interference effect of the grating, harmonics that suitably match the harmonic of the grating periodicity are greatly amplified and folded into a narrow solid angle nearly parallel to the surface. Both the HHG spectrum and the angular distribution obtained from two-dimensional (2D) particle-in-cell (PIC) simulation are consistent with that from the analytical results.

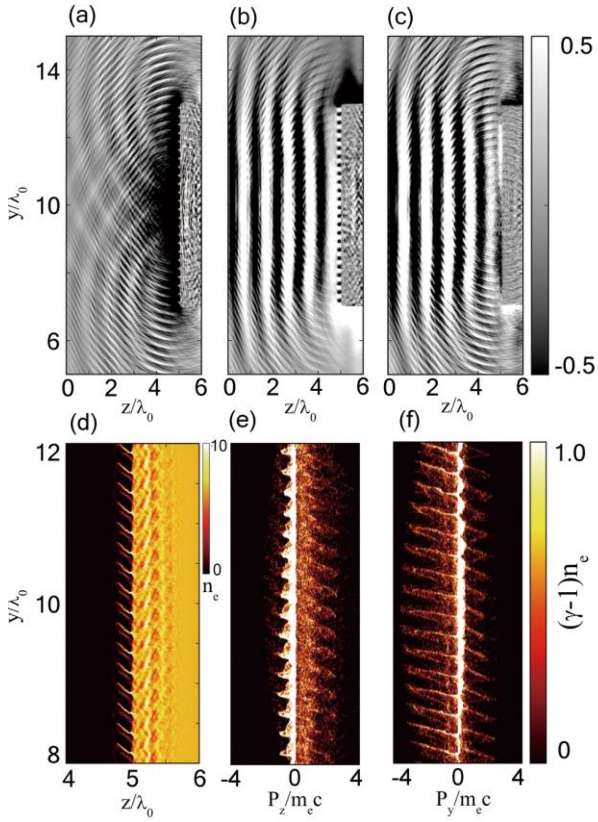

Figure.1 Simulations results of HHG field components (a) Ez, (b) Ey, and (c) Bx. (d) Electron density distribution and phase spaces (e) (y-Pz) and (f) (y-Py).

Reference

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