High Harmonic Generation and QED Effects Induced by Relativistic Oscillating Mirror

Y. J. Gu$^{1,2}$, O. Klimo$^{1,3}$, S. Weber$^1$, G. Korn$^1$, S. V. Bulanov$^{1,4,5}$

1 Institute of Physics of the ASCR, ELI-Beamlines, Prague 18221, Czech Republic
2 Institute of Plasma Physics of the CAS, Za Slovankou 1782/3, Prague, Czech Republic
3 FNSPE, Czech Technical University in Prague, 11519 Prague, Czech Republic
4 Kansai Photon Research Institute, National Institutes for Quantum and Radiological Science and Technology, 8-1-7 Umemidai, Kizugawa-shi, Kyoto 619-0215, Japan
5 A. M. Prokorov Institute of General Physics, the Russian Academy of Sciences, Vavilova 38, 119991 Moscow, Russia

The laser-plasma interactions are dominated by the QED regime since intensities of the forthcoming laser facilities are approaching $10^{23-24}$ W/cm$^2$. Here we present the high brightness $\gamma$-photon emission and $e^+e^-$ pair creation accompanied with the high harmonic generation. Relativistic oscillating mirror reflects the incident intense laser field and generates the focused attosecond pulse with enhanced intensity. A large number of high energy photons are emitted by the collisions between the radiation trapped electrons and the high harmonic pulses. The corresponding photons are counter-propagating through the strong laser field which provides a large cross section for pair creation. Relativistic positron bunches are generated and further accelerated in the reflected laser field. The peak intensity of the $\gamma$-ray reaches 0.74 PW with the brilliance of $2\times10^{24}$ s$^{-1}$mm$^{-2}$ sr$^{-1}$ (0.1%BW)$^{-1}$ (at 58 MeV). A GeV positron beam is obtained with density of $4\times10^{21}$ cm$^{-3}$ and a particle number of $5.6 \times 10^9$.

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