V-E Quantum Emissions from Solid in Femtosecond Intense Laser Field

Quantum emissions, which are high-energy electron, ion and photon beams, generated by interaction of ultrashort intense laser field with matter has recently been attracting considerable attention because of interest in fundamental photosciences and its potential applications in compact accelerator, proton therapy and materials sciences. We have studied a mechanism of quantum emissions (especially on hard X-ray and fast protons) form metal target in intense laser field.

V-E-1 Hard X-Ray Emission from a Cooper Target by Focusing a Picosecond Laser Beam at 3 x 10^{13} W/cm^2

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Hard X-ray pulses are generated by focusing a picosecond laser beam (25-ps, 1064 nm) on a copper target in air at an intensity of 3×10^{13} W/cm^2. X-ray energy is measured using an X-ray charge-coupled device. The obtained spectrum consists of strong K_α and K_β emissions and a weak continuum at an energy range of 4–10 keV. The photon numbers of the hard X-rays (4–10 keV) were estimated to be approximately 4000 photons/4πsr/pulse.

V-E-2 Enhanced Generation of Fast Protons from a Polymer-Coated Metal Foil by a Femtosecond Intense Laser Field

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The results of generation of fast protons from 5-μm thick copper foil targets by 60 fs laser irradiation at 1.5×10^{17} W/cm^2 are presented. Both poly-vinyl-methyl-ether (PVME)-coated and uncoated copper foil targets are examined. Fast protons are measured using a Thomson mass spectrometer and maximum proton energies are 570 keV and 280 keV for the PVME-coated and the uncoated target, respectively. The intensity of fast protons with energy of 160 keV from the PVME-coated target is approximately 80-fold higher than that from the uncoated target.