V-D Quantum Emissions from Solid in Femtosecond Intense Laser Field and Its Application to Dynamic Imaging

Quantum emissions, which are high-energy electron, ion and photon beams, generated by interaction of femtosecond intense laser field with matter has recently been attracting considerable attention because of interest in fundamental science and its potential applications in compact acceleration, proton therapy and materials sciences. We have studied a mechanism of quantum emissions from solid target and its application to dynamic imaging of materials.

V-D-1 Picosecond Time-Resolved X-Ray Diffraction from a Laser-Shocked Germanium Crystal over Hugoniot Elastic Limit

NAKAMURA, Kazutaka[1]; KAWANO, Hidetaka[2]; KISHIMURA, Hiroaki[2]; OKANO, Yasuhisa[2]; HIRONAKA, Yoichiro[2]; KONDO, Ken-ichi[2]
([1]IMS and Tokyo Inst. Tech.; [2]Tokyo Inst. Tech.)

[*Jpn. J. Appl. Phys.* **43**, 5477–5479 (2004)]

Picosecond time-resolved X-ray diffraction has been performed on a 300-ps laser-irradiated germanium crystal at 1.2 GW/cm^2. Lattice deformation due to shock compression and the propagation of shock waves are directly observed. The observed lattice compression is 4.3% at maximum, which is higher than that at the Hugoniot elastic limit (HEL). The data suggest that the germanium-crystal lattice behaves elastically under shock compression at 7.5 GPa (above HEL) for 27 ps.

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

KISHIMURA, Hiroaki[1]; MORISHITA, Hiroto[1]; OKANO, Yasuaki[1]; OKANO, Yasuhisa[1]; HIKONAKA, Yoichiro[1]; KONDO, Ken-ichi[1]; NAKAMURA, Kazutaka[2]; OISHI, Yuji[3]; NEMOTO, Koshichi[3]
([1]Tokyo Inst. Tech.; [2]IMS and Tokyo Inst. Tech.; [3]CRIEP)

[*Appl. Phys. Lett.* **85**, 2736–2738 (2004)]

The results of generation of fast protons from 5-μm-thick copper foil targets by 60fs laser irradiation at 1.5 × 10^{17} W/cm^2 are presented. Both polyvinylmethylether (PVME)-coated and uncoated copper foil targets are examined. Fast protons are measured using a Thomson mass spectrometer and maximum proton energies are 570 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.

V-D-3 Electron Imaging of Charge Separated Field on a Copper Film Induced by Femtoseond Laser Irradiation

OKANO, Yasuaki[1]; HIRONAKA, Yoichiro[1]; KONDO, Ken-ichi[1]; NAKAMURA, Kazutaka[2]
([1]Tokyo Inst. Tech.; [2]IMS and Tokyo Inst. Tech.)

[*Appl. Phys. Lett.* **86**, 141501–141503 (2005)]

An instantaneous charge-separated field, built up at the femtosecond-laser-irradiated surface of a copper film, was observed by time-resolved electron imaging using an energy-chirped electron probe-beam. The probe beams with effective energies of 170 keV were generated by intense femtosecond laser irradiation onto a molybdenum target at an intensity of 10^{17} W/cm^2. From the deflection of the probe electrons, the electric field was estimated to be 1.5 MV/m at a pump-laser intensity of 10^{15} W/cm^2.