Generation of X-rays in cluster jets by relativistic laser pulses.

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Generation of X-rays by laser pulses on a target is developing along with the increase of accessible, routine laser intensity. The main advantages of the laser generation method are: sub-picosecond duration and point size of the source, synchronization with a powerful laser pulse for application in ”pump-probe” methods, the possibility of obtaining both narrow-band and broadband X-rays. The goal is to study the generation of characteristic, bremsstrahlung X-rays during the interaction of laser radiation of relativistic intensity with a jet of clusters to compare with the case of copper foil [1]. To evaluate the possibilities of γ-radiation from accompanying accelerated electrons. The studies were carried out at the NRC ”Kurchatov Institute” on a Ti:Sa laser complex with 300 mJ energy , 30 fs duration and 10 Hz rep.rate [2]. The cluster target was created by expanding the gas (5-35 bar) through a supersonic nozzle. Ar, Kr, N_2 and O_2 were used. The dependencies of the X-ray yield on the pressure and type of gas, energy and duration of the laser pulse were studied [3]. The optimal focusing point in a target with non-uniform density was determined. The maximum spectral brightness was achieved for K_α Kr 3×10^8photons/(4$\pi\times$pulse) (conversion efficiency 4.2×10^{-6}), comparable with copper targets 5×10^8photons/(4$\pi\times$pulse) (efficiency 10^{-5}) [1]. γ-radiation was obtained from a beam of relativistic electrons in a 1 cm thick converter with an exponential spectrum with a “temperature” of 285 ± 65 keV in the range of $2.5 - 7$ MeV and a divergence of 40° at the 1/2 level.

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