Experiment towards the Gamma Flare regime


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Gamma-Flare, which is an efficient regime of MeV to GeV hard x-ray generation, is one of the most promising and expected applications of high-power lasers [1,2]. The generation mechanism is the nonlinear Thomson/inverse Compton scattering, and the efficiency can be as high as 30–40% when a relatively large optimized preplasma is used [3]. Another mechanism acting nearly simultaneously and producing similar photon energies is Bremsstrahlung by the electrons going through the target [4–6], which includes refluxing [5,7]. According to the theoretical predictions and simulations, the Gamma Flare regime dominates at high intensities, while at presently attainable intensities Bremsstrahlung dominates. Thus, the Gamma Flare mechanism has not yet been demonstrated experimentally.

Here we present results of our experiment performed with the J-KAREN-P laser [8–10] at the intensity approaching 1022 W/cm2, including 20 keV-10 MeV hard x-rays measured with spectrographs comprising scintillator stack [11]. The x-ray spectra were reconstructed with a method [12]. We also discuss a range of additional diagnostics used for fine positioning of the target into the best focus and to understand the interaction physics.

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