Multi-keV X-ray source generation at the Shenguang-III prototype

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Efficient multi-keV sources are essential in inertial confinement fusion and high energy density physics for radiography, opacity measurements, material testing, and so on[1-5]. In this talk, we present the recent progress in multi-keV sources developments at the Shenguang-III prototype laser facility. An underdense plasma mechanism was used to improve the laser-to-X-ray conversion efficiency. Main targets are small cylindrical cavities with 700-800 μm diameter, and 500-800 μm height. The main wall materials are Ti, V and Ni enclosed by CH tubes of 30 μm thick. Eight 3ω laser beams with total energy of about 6.4 kJ in a 1 ns square pulse were focused on the inner wall of the cavity. The absolute X-ray fluxes were measured by absolutely calibrated HXRDs and FXRDs for X-ray energy higher and lower than 4keV, respectively. HXRDs and FXRDs were installed at different angles for X-ray angular distribution measurements. *K*-shell X-ray spectra were recorded by crystal spectrometers. The electron temperatures were deduced from both the laser Thomson scatters and X-ray spectra. The time behaviors of the X-ray images in two energy ranges were recorded through an X-ray framing camera. The X-ray conversion efficiency was about 2-3 times higher than the traditional thick solid.

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