Experimental research carried out at the Prague Asterix Laser System (PALS)

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Abstract

Prague Asterix Laser System is a kJ-class iodine infrared laser system dedicated mainly to the hot dense plasma research. The research area is focused mainly on inertial confinement fusion scheme and astrophysical plasma. Within this lecture, the fusion-related experiments performed in recent years will be introduced; in particular, the lecture will be focused on the generation of parametric instabilities in the plasma corona (arising from various targets) and the hot electron generation. The parametric instabilities as two-plasmon decay or stimulated Raman scattering are responsible for the generation of hot electrons (with keV temperatures) which may penetrate through compressing shock wave front and preheat the fuel; thus the efficiency of the shock wave is minimized. Nevertheless, on the other hand, for the shock ignition, the hot electrons may deposit their energy on the shock wave front if their kinetic energy is not so high; the shock wave effect can be strongly magnified. The parametric instabilities are always present in the plasma corona even if the laser and plasma are initially perfectly uniform; thus, understanding their nature is key for the successful fuel ignition. Within this lecture, the commonly used diagnostics for observation and characterization of hot electron and parametric instabilities will also be introduced.