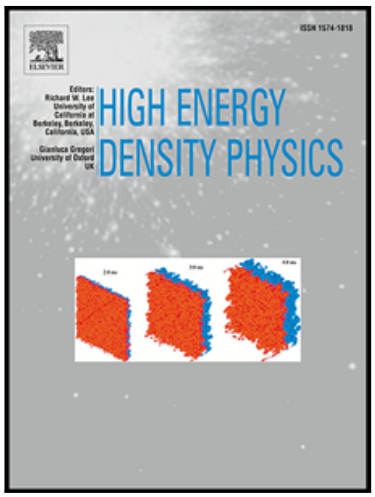

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Measuring impact of M-band and soft X-rays on radiation-driven ablation performance

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M-band and soft X-rays play different roles in radiation-driven ablation. In the SGIII-prototype laser facility, experiments were performed to deduce the absorbed M-band and soft X-rays at different angles. Both the absorbed energy and the absorption rate of the M-band and soft X-rays were studied. The results showed that the M-band (1.6–4.4 keV) and soft (0.1–1.6 keV) X-rays performed differently in radiation-driven ablation. The difference was determined by the radiation source, the state of the ablator, and the field of view. A time-varying radiation source, the opacity change of the ablator, and fields of view at different angles were studied by using the one-dimensional multi-group radiation hydrodynamic code Multi-1D and the three-dimensional view-factor code IRAD3D. Radiation-driven ablation is the interaction between X-rays and the ablator. These studies are useful for understanding the ablation process and provide guidance for increasing the ablation rate and reducing the preheat effect.

Key Words: radiation-driven ablation; X-rays transmission; inertial confinement fusion

1. INTRODUCTION

In indirect-drive inertial confinement fusion (ICF), laser beams are converted to X-rays. These X-rays can ablate and drive the capsule to ignition, causing it to burn[1]. In general, these X-rays contain not only soft X-rays but also high-energy X-rays[2]. The soft X-rays can drive the ablation wave and cause the capsule to implode. However, the high-energy X-rays, which have a long mean free path, can pass though the ablator before the shock wave and cause a preheating effect[3,4]. The preheating effect, which cannot be avoided, can seriously affect the final ignition. Mid-Z dopants are used in the target design to reduce the preheating[5,6]. For a Au hohlraum, the high-energy X-rays are mainly M-band X-rays, and the photon energy is approximately 2–5 keV[7].

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