The study of laser plasma interaction on broadband Kunwu Laser Facility

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Laser plasma interaction (LPI) is one of the key issues in laser-driven inertial confinement fusion ignition (ICF), as it may affect target compression and fusion energy gain. Broadband laser technology is one novel option that may inhibit the related processes of LPI. It can be thought of a decrease of the effective light intensity felt in the plasma, which in turn may play a role in inhibiting the occurrence and development of related LPI processes in the plasma.

Several preliminary experiments into broadband-laser-driven laser plasma instabilities were carried out using the newly developed hundreds-of-joules broadband second-harmonic-generation (SHG) laser facility. Through direct comparison with the LPI results for the traditional narrowband laser, the actual LPI-suppression effect of the broadband laser was shown. The broadband laser had a clear suppression effect on both the back-stimulated Raman scattering and the back-stimulated Brillouin scattering at laser intensities below 1×10^{15} Wcm^{-2}.

The laser transmission energy with target of different thickness driven by broadband laser or narrowband laser has also been tested. We've found that it has significantly higher transmission energy for the same target driven by broadband laser than narrowband laser.

The plasma generated and coupled by laser incident on target can be such important. As it directly determines the efficiency and quality of the energy conversion. The beam energy would be absorbed. In the direct-drive approach, electrons in the target's outer would transport that energy to the denser shell material to drive the ablation and the resulting implosion. In the indirect-drive approach, the laser energy is converted to X-rays. Higher transmission energy may indicate less energy loss during the laser interact with the plasma corona of the imploding capsule. Thus, this interesting and valuable experimental phenomenon may have influence on the fundamental understanding of the related processes of laser plasma interaction of novel broadband low- coherence laser facility.