

P4.2003 High Coupling Efficiency of Foam Spherical Hohlraum Driven by 0.53 micrometre Laser Light

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See the full abstract here:

<http://ocs.ciemat.es/EPS2019ABS/pdf/P4.2003.pdf>

The majority of solid state laser facilities built for laser fusion research irradiate targets with third harmonic light ($0.35\ \mu\text{m}$) up-converted from the fundamental Nd wavelength at $1.05\ \mu\text{m}$. The motivation for this choice of wavelength is improved laser-plasma coupling. Significant disadvantages to this choice of wavelength are the reduced damage threshold of optical components and the efficiency of energy conversion to third harmonic light. Both of these issues are significantly improved if second harmonic ($0.53\ \mu\text{m}$) radiation is used but theory and experiments have shown lower optical to x-ray energy conversion efficiency and increased levels of laser-plasma instabilities resulting in reduced laser-target coupling. We propose to use the $0.53\ \mu\text{m}$ laser for future ignition facilities with a configuration designed for the octahedral spherical hohlraums, and to use a foam wall to increase the coupling efficiency from laser to capsule. The 2-dimensional radiation hydrodynamic code LARED-Integration is employed to simulate and compare the coupling efficiency between the Au foam and the solid Au spherical hohlraums driven by, respectively, the $0.53\ \mu\text{m}$ and the $0.35\ \mu\text{m}$ laser. The simulations show that the reduced optical depth of the foam wall leads to an increased laser-light conversion into thermal x-rays and about 10% higher radiation flux on the capsule than that achieved with $0.35\ \mu\text{m}$ laser irradiating a solid density wall commonly used in laser indirect drive fusion research. A new concept, effective laser to x-ray conversion efficiency, is defined. For laser fusion, this new concept is more accurate in describing the coupling efficiency from laser to capsule than the traditional definition of laser to x-ray conversion efficiency, because most part of the generated x-rays is stored inside the wall instead of transferring into hohlraum cavity to irradiate capsule.

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