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Dreaming of predictable, reproducible fusion FREE

Ashley Piccone

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Octahedral spherical hohlraum design provides ideal and clear radiation drive, paving the way towards inertial fusion energy power plants.

Efficient fusion energy power plants will require yields close to the expected result from an ideal spherical implosion for ignition and energy gain. Such “dream” fusion would transform the energy landscape but is challenging to achieve.

Experiments at the National Ignition Facility have demonstrated the feasibility of indirect drive inertial confinement fusion, which uses cavities called hohlraums to convert high power laser light into X-rays and achieve fusion conditions in a fuel capsule. The next step involves attaining predictable and reproducible ignition.

Ke Lan explored how an octahedral spherical hohlraum can generate an ideal and clear drive for ignition and energy gain. The specialized cavity has laser entrance holes and lasers in an ideal arrangement so that it can efficiently convert the three-dimensional lasers into one-dimensional spherical radiation, successfully meeting ignition requirements.

“An octahedral spherical hohlraum can provide an ideal and clear radiation drive without any supplementary technology for symmetry tuning,” said Lan. “It has high spherical symmetry, high efficiency, and is robust, moving the remaining uncertainties to the engineering side.”

The paper examines the physical characteristics of the technology, presents a practical approach toward achieving it, and outlines the challenges and essential tasks ahead — many of which involve building and optimizing the hohlraum.

“It is time to draw attention to the octahedral spherical hohlraum to choose an ideal and practical approach for the next generation of laser systems for multiple schemes,” said Lan. “Meanwhile, it also time to consider the challenges and difficult tasks in the path forward to achieve dream fusion.”

Source: “Dream fusion in octahedral spherical hohlraum,” by Ke Lan, *Matter and Radiation at Extremes* (2022). The article can be accessed at https://doi.org/10.1063/5.0103362.