

PRESS RELEASE

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Boost for laser-based Inertial Fusion as energy source of the future

In a historic breakthrough in December 2022, the National Ignition Facility (NIF) at Lawrence Livermore National Laboratory (LLNL), California, USA, successfully achieved a self-sustaining burning plasma, providing compelling evidence for the viability of Inertial Fusion Energy (IFE) as a crucial addition to carbon-free, safe, and clean energy sources. This remarkable accomplishment has led to the allocation of \$16 million in funding by the US Department of Energy to establish the IFE Science & Technology Accelerated Research for Fusion Innovation & Reactor Engineering (STARFIRE) Hub. Fraunhofer ILT proudly contributes as part of the multi-institutional team led by Lawrence Livermore National Laboratory.

The U.S. Department of Energy (DOE) has awarded a \$16 million, four-year funding project to a team of multiple institutions led by Lawrence Livermore National Laboratory (LLNL) to establish the STARFIRE Hub for Inertial Fusion Energy (IFE) Science & Technology Accelerated Research. Among the collaborating partners is the Fraunhofer Institute for Laser Technology ILT.

The IFE hub will expedite the development of high-gain target designs; target manufacturing and engagement; as well as diode-pumped solid-state laser technologies. These technology advancements will be guided by an IFE-plant modeling framework. Additionally, the project will foster the development of the future workforce for IFE by establishing partnerships with top universities and implementing innovative curriculum development and implementation.

“Germany, with its rich history in R&D of lasers, optics, production engineering, power plant technology, and more, is excellently positioned to develop key technologies for the realization of practical fusion power plants. By fostering collaboration in transnational teams, we can accelerate progress and overcome challenges together, bringing us closer to the realization of fusion energy for a sustainable future,” says Prof. Constantin Haefner, Representative for Fusion Research at the Fraunhofer-Gesellschaft and Managing Director of Fraunhofer ILT.

The viability and potential of Inertial Fusion Energy as a future technology is highlighted by the USA's comprehensive STARFIRE program for laser-based inertial confinement fusion.

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German government promotes key technologies in the field of IFE

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In May 2023, Germany's Federal Ministry of Education and Research (BMBF) expert commission, led by Prof. Haefner, presented a memorandum outlining the technical realization of a laser-based inertial confinement fusion power plant. This significant step emphasizes the commitment of the German Federal Government to promote key technology development in the field of IFE.

Federal Minister for Education and Research, Bettina Stark-Watzinger, has expressed support for the IFE approach, announcing a program of more than EUR 1 Billion over the next five years into Fusion Technologies development. This endorsement further emphasizes the importance and recognition of Fusion as a feasible solution for meeting future energy needs.

At the forefront of advancing cutting-edge technologies related to laser-based IFE are institutes such as Fraunhofer-Gesellschaft and the Helmholtz-Gemeinschaft, along with universities and Germany's industry. These institutions play a crucial role in driving research and development in this field, further propelling the progress of IFE technology.

STARFIRE Hub creates international synergies for inertial fusion energy

The LLNL-led Hub is one of three projects totaling \$42 million in funding selected via competitive peer review under the DOE Funding Opportunity Announcement for Inertial Fusion Energy Science & Technology Accelerated Research (IFE-STAR).

"The achievement of ignition at LLNL's National Ignition Facility provides fresh impetus and the scientific foundation for IFE," says Dr. Tammy Ma, lead for LLNL's IFE initiative. "DOE's IFE STAR program represents the re-establishment of the public U.S. program, and we are incredibly excited to bring together an excellent team to advance fusion energy."

The project aims to establish the fundamental science and technology for various laser-based Inertial Fusion approaches. Alongside researchers from Lawrence Livermore National Laboratory (LLNL) and Fraunhofer ILT, other key contributors include General Atomics, University of California campuses (San Diego, Berkeley, Los Angeles), University of Rochester, Massachusetts Institute of Technology (MIT), University of Oklahoma, Texas A&M University, TRUMPF Inc., Leonardo Electronics US Inc., the Livermore Lab Foundation, SLAC National Accelerator Laboratory, Oak Ridge National Laboratory, Savannah River National Laboratory, Xcimer Energy, Focused Energy Inc., and Longview Fusion Energy Systems.

Laser-based Inertial Confinement Fusion - from physics experiment to fusion power plant

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At the Laser World of Photonics Congress 2023 in Munich, Germany, Ma and Haefner presented a joint plenary lecture on the potential of laser-based IFE as a future energy source. They emphasized the necessity of establishing the framework conditions required for its realization. This topic garnered significant attention at the International Fusion Science and Applications Conference in September 2023 in Denver, highlighting its global importance and the urgency in tackling the technological challenges. Haefner underscored the magnitude of the task, stating, "In order to realize our vision of deploying fusion power plants in the latter half of the century, it is crucial to maintain investments in fundamental physics and engineering research while simultaneously advancing key technologies to facilitate their commercialization. Consider, for example, the need for multiple high-energy lasers per power plant, which calls for a transformative shift in laser and optics production. This entails the implementation of automated production lines reminiscent of the automotive industry, yet with the precision required at the scale of a few optical wavelengths."



Image 1:
Fusion Energy.
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Image 2:
Prof. Constantin Haefner, head of the BMBF expert commission on laser fusion, presented the memorandum on laser-based Inertial Fusion Energy (IFE) to Federal Research Minister Bettina Stark-Watzinger on May 22, 2023.
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Image 3:
The plenary lecture by Dr. Tammy Ma, LLNL (left), and Prof. Constantin Haefner, Director of Fraunhofer ILT, on the potential of laser-based Inertial Fusion Energy (IFE) was met with great interest at the Laser World of Photonics Congress in Munich.
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Image 4:
STARFIRE Logo.
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