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Overview of Inertial Confinement Fusion developments in Europe

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The achievement of ignition on NIF [1] has renewed a worldwide interest in Inertial Confinement Fusion (ICF) and Inertial Fusion Energy (IFE), including Europe [2]. A dedicated session will describe the national initiatives, mostly based on Private-Public-Partnership, which have emerged in Germany, UK and France. At the academic level, European collaboration is for the moment mostly funded by EUROFUSION grants. The most recent ones are devoted to magnetized ICF [3] and foams physics for IFE [4]. In the latter case, XFEL facilities, (Eu-XFEL, SACLA or SLAC) coupled to HED end-stations naturally provide the brilliance and very high spatial resolution (< few micrometers) which are required to investigate hydrodynamics details. An emerging targets fabrication supply chain sustains all this efforts.

Direct drive European laser facilities hardly exceed kJ level at 2ω, in planar geometry, making the scaling to ignition and reactor size challenging. Apart detailed EOS and hydrodynamics studies, the current experimental efforts focused on increased laser bandwidth to mitigate laser plasma instabilities and CBET. On the other hand, LMJ PETAL [5] is the second most powerful laser in the world, delivering up to 450 kJ at 3ω with 120 beamlines. LMJ is devoted to indirect drive ICF and stockpile stewardship studies [6]. However its diagnostics suite could also be used for direct drive ICF and laboratory astrophysics studies within the ALPES calls of proposals.

This presentation will cover some of the above-mentioned scientific highlights.

References

[1] H. Abu-Shawared et al., Physical Review Letters 132 (6), 065102 (2024)

[2] Fusion Expert Group Opinion paper, European Commission publishes Fusion Expert Group opinion paper - Fusion for Energy

[3] J. Santos et al., ENR-IFE.02.CEA-01 – Magnetized ICF.

[4] S. le Pape et al., ENR-IFE.02.CEA-02 – Foams as a pathway to energy for high gain IFE.

[5] A. Casner et al., High Energy Density Physics **17,** 2-11 (2015)

[6] S. Liberatore et al., Phys. Plasmas 30, 122707 (2023).

[7] Academic Laser Program for Excellent Science, ALP – Association Lasers Plasmas

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