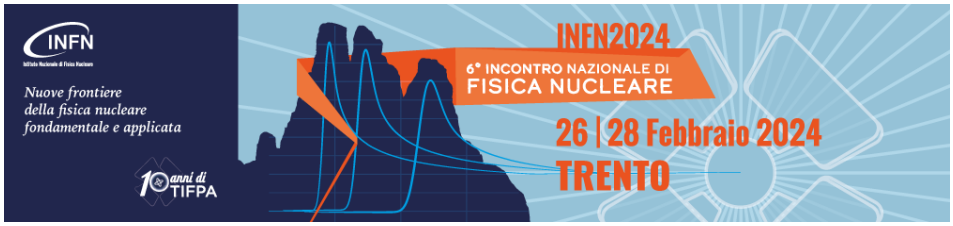

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A new radiation source based on laser-plasma interaction: status and perspective with the upcoming I-LUCE facility at INFN-LNS

The potential for developing compact, high-brightness particle and radiation sources have given a strong impetus to the development of the underpinning laser technology, including increasing the efficiency and repetition rate of the lasers. A result of this technological development can be seen in the new generation of ultrafast high-power laser systems working at a high repetition rate which have been built across Europe.
A new high-power laser facility called "I-LUCE"(INFN Laser indUced radiation acCEleration) will be realized at LNS-INFN (Laboratori Nazionali del Sud –Istituto Nazionale di Fisica Nucleare) in 2024.
The facility realization is funded by three projects financed by the PNRR (Piano Nazionale ripresa resilienza) Italian program: EuAPS (EuPRAXIA Advanced Photon Sources), Samothrace (SiciliAn MicronanOTecH. Research And Innovation) and Anthem (AdvaNced Technologies for HumancentrEd Medicine). The Ti:Sapphire laser will have two outputs: the first one will be a 50 TW beam line (25 fs, 25-30 mJ, 10 Hz) while the main beam line will be a 350 TW laser (25 fs, 10 J, 2 Hz). I-LUCE will serve two distinct experimental areas known as E1 and E2. E1 will offer a globally unique combination of intense laser radiation with heavy ion beams, generated by the Superconductive Cyclotron and Tandem (already installed at LNS), thereby providing opportunities for intriguing experiments in the fields of plasma physics, nuclear physics, and atomic physics. For moderate laser beam intensities (up to 1 TW), the experimental room E1 will be dedicated to conducting experimental runs focused on nuclear fusion and studying stopping power in plasma.
Conversely, the E2 experimental room will be dedicated to both proton and electron acceleration. A specialized beamline designed to select, transport, and focus proton beams with energies between 5-60 MeV will be installed and optimized for radiobiological experiments. A corresponding beamline for selecting electron beams will also be implemented. Furthermore, stand-alone experiments involving intense laser beams will be conducted to explore various studies, including X-ray laser generation and neutron production. This presentation will provide an overview of the current status and future prospects of the I-LUCE facility.

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