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Extreme Light Infrastructure – Nuclear Physics

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Extreme Light Infrastructure – Nuclear Physics (ELI-NP) [1] is the nuclear physics pillar of the pan-European Extreme Light Infrastructure project [2]. ELI-NP was implemented on the Măgurele National Physics Platform by the National Institute for R&D in Physics and Nuclear Engineering “Horia Hulubei”. Two state-of-the-art sources of extreme light stay at the core of the project: a 2×10 PW ultra-short pulse high-power laser system and a high-intensity gamma beam system. Several experimental setups were developed to take advantage of the extreme photon beams with unprecedented characteristics provided by ELI-NP. A rich science program was established within a large international collaboration with the aim to advance the field of Nuclear Photonics. Basic science research aims at revealing the mechanisms at the basis of particle acceleration driven by high-power lasers and to enable exotic nuclear physics experiments in plasma conditions to reproduce stellar environment evolution in laboratory. Gamma beams will enable the study of electromagnetic dipole response of nuclei and nuclear reactions of astrophysical interest. The results of the basic research will enable novel applications in life sciences, industrial and medical fields. The development of the basic and applied research activities at ELI-NP have a strong interdisciplinary character as they involve laser physics, nuclear physics, material physics, biophysics, engineering, computing, ecc.

The high-power laser system is operational since 2020 and a thorough program of experimental setups commissioning was performed since then. The experimental setups at 100 TW and 1 PW laser power were successfully commissioned and are available for users. The 10 PW experimental setups are under commissioning and they will become available to users in 2024. ELI-NP started the operation as user facility in 2022 when the first call for users was launched in close collaboration with ELI ERIC.

Among the applied research topics, the ones dedicated to investigate the possibility of using laser-driven secondary sources of radiation for medical application, such as high-contrast X-ray imaging, hadron therapy with heavy ions and generation of radioisotopes of medical interest, are given a particular interest at ELI-NP. The ELI-NP project Phase II is co-funded by the European Union through the European Regional Development Fund and by the Romanian Govern through the Competitiveness Operational Programme

Keywords: Extreme Light Infrastructure, high-power lasers, nuclear physics, medical applications.

References

[1] <https://www.eli-np.ro> .

[2] G. Mourou et al., “WHITEBOOK ELI – Extreme Light Infrastructure; Science and Technology with Ultra-Intense Lasers” (2011). doi: 10.13140/2.1.1227.0889.

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