Laser-driven nuclear physics experiments at ELI-NP

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Abstract. The Extreme Light Infrastructure -Nuclear Physics (ELI-NP) project in Bucharest-Magurele, facilitates the Chirped Pulse Amplification Technology invented by Strickland and Mourou, the 2018 Physics Nobel Prize laureates [1]. Nuclear experiments driven by a 10 PW light source will be undertaken, heralding the dawn of a new era in accelerator technology. Experimental efforts are concentrated to exploit new ion and electron plasma acceleration regimes and the production of ultraintense bursts of gamma radiation [2]. Among those is the quest to efficiently transfer laser energy into ion- and X-ray beams by the hitherto unmatched laser light peak intensities, $I_0 > 10^{23}\,\mathrm{Wcm}^{-2}$. Moreover, theory predicts that kinetic proton energies above 200 MeV with minimized energy spread will be technical feasible [3]. This research will naturally progress into studies to accelerate macroscopic thin sheets of matter from ultra-thin targets to relativistic energies via the so-called Radiation Pressure regime [4]. The talk will give an outline of approved Day-1 experiments, sketching the natural progression into possible nuclear studies within stellar-like plasma regimes. A focus will be on the all-optical, 'faster than electronics' instrumentation which is currently designed at ELI-NP to cope with the femtosecond-long time durations and high intensity levels which are characteristic of physics phenomena triggered in the ultraintense regime.

References

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