

Ultra-high Intensity Laser-driven Plasma Based Accelerators

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Advancement in associated technologies has led to availability of laser systems providing ultra-short (femto-second) pulse duration with Petawatt (PW) peak power and hence extreme focussed intensities of $>10^{18-21}$ W/cm². Laser matter/plasma interaction at such extreme intensities involves fascinating physics and also applications, particularly towards research and development of Laser Plasma Accelerator (LPA). Due to associated large accelerating electric field (>GV/cm), three orders of magnitude higher than RF accelerator, LPA is seen as a potential technique to develop comparatively compact, and low-cost particle (electron/proton) accelerators. Extensive research and investigations performed at various facilities worldwide have shown acceleration of electrons upto ~10 GeV, and protons to ~100 MeV energy using PW class lasers. Laser plasma electron accelerator driven x-ray/γ-ray sources and development of compact Free Electron Laser (FEL) are also being explored. In this talk, various aspects of laser driven plasma based advanced particle acceleration techniques, and international scenario in this area would be presented. National scenario, particularly, experimental investigations performed on LPA at RRCAT, Indore, showing acceleration of electrons to >500 MeV energy, protons upto 20 MeV energy, and betatron x-ray source generation, using 150TW and 1 PW Ti:Sapphire lasers, along with future plan and possible applications would also be discussed.