Tata Institute of Fundamental Research
Survey No. 36/P, Gopanpally Village, Serilingampally, Ranga Reddy Dist., Hyderabad – 500 046

Students' Annual Seminar

Low-divergent, MeV electron beam driven by 10 kHz, femtosecond laser interaction with liquid-jets

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Intense laser driven plasmas are extreme states of matter with near-solid density and temperatures ranging beyond million-degree kelvin. Precise tailoring of the plasma density gradient with a collinear pre-pulse, allows control over the growth of different parametric instabilities to give hotter electron. Furthermore, there are many pathways of coupling between different modes such as electromagnetic, electrostatic, and ion-acoustic waves. We demonstrate the generation of MeV electron beam from a high-repetition-rate liquid-jet target irradiated by an industrial grade, 10 kHz, 2 mJ, sub-200 femtosecond laser system. An 80 µm thick liquid methanol jet, driven at a peak intensity of 3.8×10^{16} Wcm^{-2}, with an optimised co-linear pre-pulse, produces electrons with a spectrum extending up to 1 MeV energy. The angular distribution of the electrons shows highly confined (<50 mrad), beam-like features with pointing jitter as small as 16 mrad. The large aspect ratio of liquid-jet diameter (80 µm) to the laser spot size (3 µm), allows steering of the electron beam in an angular range> 90-degree, with the back reflected laser beam and parametric instabilities driven second harmonic. Single-shot electron radiography was possible with the estimated total charge of pC in the electron beam (>200 keV). Thus, some of the applications involving electron and soft-X Ray radiography would be discussed.

Wednesday, May 1st 2024

14:00 Hrs (Tea / Coffee 13:45 Hrs)

CR-4, TIFR-H