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

Internal Webinar

FDTD-Based Simulation of Submicron Laser-Plasma Interaction

Haritha Rajeev Nair

TIFR, Hyderabad

Laser–plasma interactions involving targets with dimensions comparable to the laser wavelength present significant modelling challenges, as conventional radiation hydrodynamics approaches fail to accurately capture electromagnetic energy deposition in this regime. Motivated by experimental observations of enhanced electron heating in both micron-scale and wavelength-scale spherical targets under pre-pulse irradiation, we present ongoing efforts toward the development of an electromagnetic modelling framework tailored for such interactions.

This work describes the design and preliminary implementation of a Finite Difference Time Domain (FDTD)–based approach aimed at resolving laser interaction with small, curved targets at high spatial and temporal resolution. We outline the numerical formulation, discuss current implementation status and limitations, and identify the remaining development milestones required for completion. The present study establishes the foundation for a future self-consistent coupling between electromagnetic solvers and plasma evolution equations and defines a clear pathway toward improved modelling of early-time laser–target interaction dynamics in sub-wavelength regimes.

Monday, Jan 19th 2026

11:30 Hrs