

Seminar

Transverse shock acceleration in near-critical-density plasmas with femtosecond PW laser pulses

Prashant Singh

Institute for Basic Science, South Korea

Study of ion acceleration mechanism, driven by laser-plasma interactions, provides a pathway to understand cosmic accelerators. Predominant transverse acceleration of MeV Helium ions from near-critical-density plasma irradiated with 30 fs, 10^{20} W/cm² intense laser pulse is investigated. Ions, accelerated radially by the space charge force, undergo ballistic bunching at the edge of laser channel, creating a large density spike associated with strong bipolar electrostatic field. Protons, present in a negligible fraction of the bulk Helium plasma, are also accelerated along the transverse direction. However, acceleration mechanism of proton shows a strong dependence on the plasma density. At low plasma density (2.3×10^{20} cm⁻³ or $\sim 0.13 n_c$) the maximum energy of proton and helium have same energy-per-charge, implying that they are accelerated under the same electrostatic field. However, in the high-density regime (4.2×10^{20} cm⁻³ or $\sim 0.24 n_c$) both, proton and helium have same maximum energy, or proton velocity is twice the velocity of Helium. The origin of proton acceleration is linked with the electrostatic shock reflection occurring in the Helium plasma channel.

Thursday, May 24th 2018

4:00 PM (Tea/Coffee at 3:30 PM)

Seminar Hall, TIFR-H