CONTROL ON FEMTOSECOND LASER-DRIVEN SHOCK IN HOT DENSE PLASMA

Moniruzzaman Shaikh, Amitava Adak, Prashant Kumar Singh, Gourab Chatterjee, Amit D. Lad, P. Brijesh, and G. Ravindra Kumar
Tata Institute of Fundamental Research, Dr. Homi Bhabha Road, Colaba, Mumbai-400005, India

We present the dependence of a plasma super-critical layer dynamics on the laser intensity contrast in the regime of intense femtosecond laser-solid interaction. Time-resolved pump-probe reflectrometry and Doppler spectrometry diagnostics reveal the interplay of inward shock strength and laser contrast, when excited by 10^{17} – 10^{18} W cm^{-2} intense, 30 fs infrared pulse. The measurements show that the pulses with 2 orders of magnitude higher intensity contrast are nearly 10 times more effective in launching inward shocks. This observation is further verified by employing an external prepulse to control the inward motion of the critical surface by tuning the preplasma scale length, which opens up the opportunities of controlling the inward moving shock disturbance leading to industrial, medical, science and engineering applications.

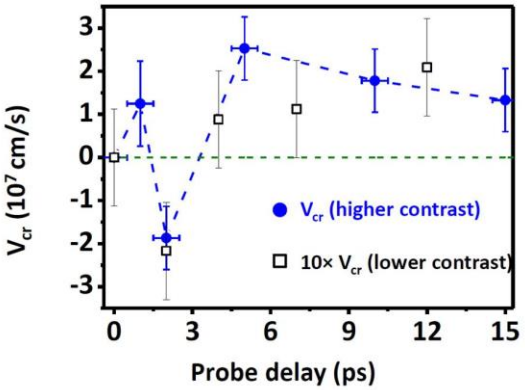

Fig.1:-The temporal dependence of the probe critical surface velocity for the higher contrast laser is calculated by the formula Vcr = -0.5c $\frac{\delta\lambda}{\lambda}$, where c, λ, δλ are the speed of light in free space, probe wavelength, Doppler shifts respectively. The velocity of the probe critical surface in earlier study with lower contrast pulse[1] are multiplied by 10 and plotted on the same axes (black open squares).

[1] A. Adak *et al.*, Phys. Plasma 21, 062704 (2014).