Seminar

Institute for Plasma Research

Title : Hydrodynamics simulation of plasma plume for the study of the lateral interaction of two plasma plumes

Speaker: Dr. Sharad Kumar Yadav
Columbia University, New York

Date : 7th February 2019 (Thursday)

Time : 03.30 PM

Venue : Committee Room 3, (New Building), IPR

Abstract :

For many years, the intense-field interaction of light with matter has been a subject of active research. Besides the fundamental aspects of laser matter interaction, the multitude of application of pulsed laser ablation (PLA) of the solid targets has attracted a great deal of attention. Applications like thin film deposition, nanoparticle and cluster generation significantly depend on the expansion dynamics of plasma plume. In the aforementioned applications the plasma plume expands against an ambient background gas [1]. In this study, a numerical simulation is performed where the laser generated plasma is treated as an ideal gas which is initially confined in a small region and suddenly allowed to expand in the background gas. Using this simulation the interactions between spatially separated laser-blow-off (LBO) plasma plumes in the presence of ambient gas are studied. In this approach, the whole system is considered as a binary mixture of two species, plasma and background gas species. Characteristic dynamics of two plasma plumes in ambient gas, shock wave formation and their interactions are thoroughly studied. Formation and geometrical aspect of the interaction zone and their pressure dependence agree well with the experimental results. Simulation suggests that colliding shock fronts play an important role in the formation of structured interaction zone in colliding plasma plume. Depending on the ambient gas pressure which governs the shape and strength of the shock waves, the presence of regular and Mach reflections are exactly captured in the simulation as observed in experimental study. Overall performance of the developed numerical model with respect to the reported experimental results is quite satisfactory [2].

References:
[1] Rajiv et. al., Phys. Rev. B, 41 (13), 8843,1990.
[2] Sharad et. al., J. Phys. D: Appl. Phys. 50, 355201, 2017.