Plasma radiography employing laser-driven protons

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Ion beams accelerated through the Target Normal Sheath Acceleration mechanism are characterised by peak energies in the tens of MeV range, short duration (~ps), and a Maxwellian energy spectrum (characteristic temperatures in the MeV regime) [1]. The high-laminarity of these beams is associated to a virtual, point-like source with a characteristic size of the order of a few microns.

All these properties are ideal for obtaining temporally and spatially resolved maps of the electric and magnetic fields in or around a secondary, laser-irradiated target, in a backlighting arrangement referred to as proton imaging or radiography [2].

In this talk we will present an overview of this technique and discuss its main qualities and limitations. Recent experiments by our group have investigated the transient charge dynamics following high intensity laser interactions with matter, obtaining detailed information which has been key to the development of innovative ion acceleration approaches. Another area of recent activity has been the detection and diagnosis of electrostatic and electromagnetic shock structures in tenuous plasmas, in a context of relevance to laboratory astrophysics. Results of these experiments will be discussed, as examples of the unique capabilities of this diagnostic technique.

References:

[1] A.Macchi, M.Borghesi, M. Passoni, Rev. Mod. Phys., **85**, 751 (2013)
[2] M.Borghesi *et al*, Phys. Plasmas, **9**, 2214 (2002)
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