24th ECLIM

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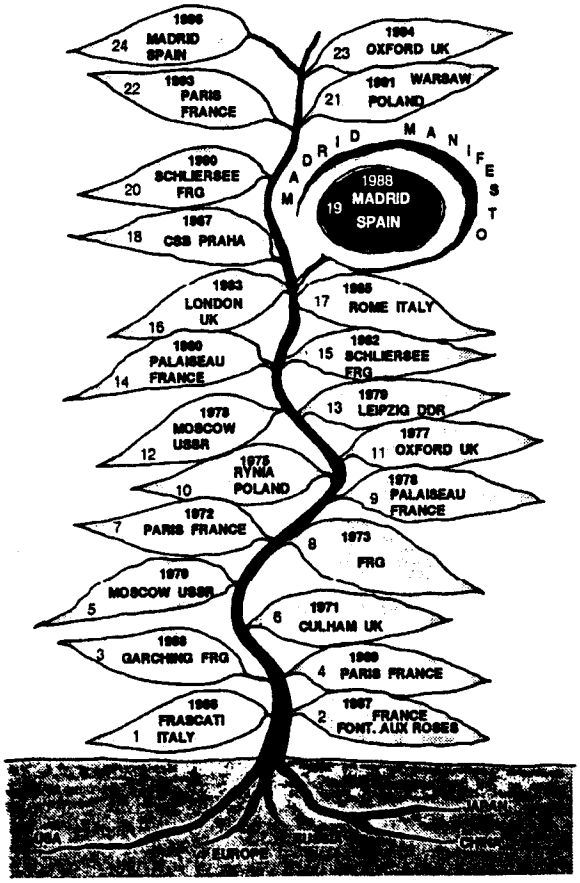
THE TREE OF ECLIM



TECHNICAL PROGRAMME

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BOOK OF ABSTRACTS

XXIV ECLIM-Madrid (Spain) 3-7 June 1996

UNDERDENSE PLASMAS FROM THIN FOILS: PRODUCTION, CHARACTERISATION AND SHORT-PULSE INTERACTION

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The propagation of an intense short EM wave packet through a plasma is of great relevance for both basic physics and applications, the latter including new schemes[1] of fuel ignition for Inertial confinement Fusion (ICF), X-ray lasers[2], plasma based electron accelerators[3]. The production of plasmas from thin targets, their characterisation and their use in short pulse interaction studies was the aim of an experiment recently performed at the Rutherford Appleton Laboratory.

The plasma was preformed from Al disks (either coated on plastic foils, or held by 4 Al arms in the shape of a X) by symmetrical laser irradiation, at irradiances below 10^{14} W/cm^2. 2-D density maps of the plasma were obtained, at times of interest for interaction studies, via interferometry with picosecond temporal resolution. The progresses achieved in the interferometric characterisation of the plasma due to the use of a short probe pulse are evident from comparison with interferograms obtained in a previous experiment[4] with 100 ps resolution. The readability of the interferograms was in that case limited by fringe motion during the pulse duration, while with the shorter probe the electronic density could be reconstructed virtually over the whole length of the plasma. 2-D hydro-code[5] predictions for the density profiles show good agreement with the experimental results.

The propagation of a picosecond pulse at intensities between 10^{16} and 10^{17} W/cm^2 through these plasmas was also studied. Signatures of the pulse propagation through the plasma, probably due to residual ionisation, were observed in the interferograms. The short pulse energy transmitted through the plasma was also monitored. The fraction of energy transmitted showed to be independent from the short pulse irradiance in the considered range, but to strongly depend on the plasma density distribution.

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[1]M.Tabak ,J.H.Hammer, M.Glinsky, W.Kruer, S.Wilks, J.Woodworth, E.Campbell, M.Perry, Phys.Plasmas 1, 1626 (1994)
[2]C.Durfee, H.Milchberg, Phys.Rev.Lett 71, 2409 (1993)
[3]P.Sprangle, E.Esarey, Phys.Fluids B 4, 2241 (1992)
[4]L.A.Gizzi, D.Giulietti, A.Giulietti, T.Ashfar-Rad, V.Biancalana, P.Chessa, C.Danson, E.schifano, S.M.Viana, O.Willi, Phys.Rev.E 49, 5628(1994)
[5]G.J.Pert, J.Comput.Phys. 43, 111 (1981)