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Laser-aided measurements of plasma transport (invited) (abstract)

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(Presented on 14 March 1988)

Laser induced fluorescence (LIF) diagnostic techniques[1–3] allow investigation of diverse plasma phenomena. LIF techniques will be discussed in the context of a series of experiments carried out at UCI including: (1) phase space reconstructions of ion response to electron and ion beam generated modes,[4,5] ion acceleration and anomalous transport in the near wake of plasma-obstacle systems, (2) optical tomographic techniques[2] applied to ion acceleration in velocity space,[6] and (3) optical tagging techniques used to quantitatively assess classical and turbulent models of cross-field particle diffusion.[7] This work was supported by NSF Grants #PHY-8606081 and #ATM-8411189.

[a)] In collaboration with H. Boehmer, T. Good, D. Hill, R. Koslover, A. Lang, M. Okubo, N. Rynn, R. Stern, and N. Wolf.

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Laser induced fluorescence measurements in the Pisces plasma (abstract)

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By resonantly exciting neutrals in a cool plasma, the local neutral density and possibly ion temperature can be measured. If the neutrals are pumped by a laser with an intensity sufficient to saturate the transition, then observation of the fluorescence at the same wavelength will show an enhancement in the spontaneous emission during the laser pulse. The pump radiation changes the excited level population distribution in such a way that theoretical modeling can extract the ground-state population from the measured enhancement. Here, a 350-kW flash-lamp pumped dye laser is being used at 656 and 481 nm to pump the Balmer alpha and beta lines of hydrogen in the continuous Pisces plasma which simulates the edge using a tokamak. The fluorescence is observed with a photomultiplier tube through a narrow-band interference filter. Great care has been taken to reduce stray light to a negligible level. Data will be presented taken from plasmas with densities between 10^{11} and 10^{13} cm^{-3} and electron temperatures between 5 and 25 eV. In addition, by spectrally resolving the fluorescence, local ion temperatures can be inferred from Doppler broadening. However, actual temperatures measured are close to the resolution limit of the spectrometer. Future work could include these temperature measurements in the edge region of a tokamak. This work was supported by the U.S. DOE Contract No. DE-F03-86-ER-53225.

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