DENSITY FLUCTUATIONS FOLLOWING FUEL PELLET INJECTION ON THE ALCATOR C TOKAMAK

by

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ABSTRACT

A series of solid hydrogen and deuterium pellet fueling experiments have been conducted on Alcator C. The pellets are injected into the discharge at velocities approaching 1000 m/sec and penetrate deep into the plasma column. Highly peaked density profiles are achieved and the global energy confinement time of pellet fueled discharges is found to exceed that for similar discharges fueled by gas puffing. A review of the general pellet injection results is given.

Immediately following the pellet event, strong $m = 1, n = 1$ oscillations of the soft x-ray signals are sometimes observed. Careful measurements of the electron temperature during this period indicate that the x-ray fluctuations cannot be accounted for by temperature variations. This implies that the densities must vary. Experimental data and computer modeling support this conclusion, finding that the fluctuation of the electron/proton density accompanied by the fluctuation of a light impurity can account for the data.

It is found that the oscillation frequency decreases with increasing pellet mass, suggesting a sound-like disturbance. In addition, measurements of the magnetic field variation at the plasma edge show no fluctuations correlated with the $m = 1, n = 1$ oscillations and indicate that the density perturbation may be electrostatic. The density perturbation is found to propagate in a region that is neither collisional nor collisionless. In the collisional approximation, the dispersion relation for very low frequency waves is derived from fluid theory and a regime of propagation is found that is consistent with the data. The question of the plasma collisionality and the validity of fluid theory is discussed and suggestions for future work are given. In addition, collisionless Landau damping is considered but is found to disagree with the experimental measurements.

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