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**Fast Ion and Thermal Plasma Transport in Turbulent Waves in the Large Plasma Device (LAPD)**[1]

SHU ZHOU, University of California, Irvine

The transport of fast ions and thermal plasmas in electrostatic microturbulence is studied. Strong density and potential fluctuations ($\delta n/n \sim \delta\varphi/kT_e \sim 0.5$, f$\sim$5-50 kHz) are observed in the LAPD in density gradient regions produced by obstacles with slab or cylindrical geometry. Wave characteristics and the associated plasma transport are modified by driving sheared E$\times$B drift through biasing the obstacle, and by modification of the axial magnetic fields ($B_z$) and the plasma species. Cross-field plasma transport is suppressed with small bias and large $B_z$, and is enhanced with large bias and small $B_z$. Suppressed cross-field thermal transport coincides with a 180$^\circ$ phase shift between the density and potential fluctuations in the radial direction, while the enhanced thermal transport is associated with modes having low mode number (m=1) and long radial correlation length. Large gyroradius lithium ions ($\rho_{fast}/\rho_s \sim 10$) orbit through the turbulent region. Scans with a collimated analyzer and with Langmuir probes give detailed profiles of the fast ion spatial-temporal distribution and of the fluctuating fields. Fast-ion transport decreases rapidly with increasing fast-ion gyroradius. Background waves with different scale lengths also alter the fast ion transport: Beam diffusion is smaller in waves with smaller structures (higher mode number); also, coherent waves with long correlation length cause less beam diffusion than turbulent waves. Experimental results agree well with gyro-averaging theory. When the fast ion interacts with the wave for most of a wave period, a transition from super-diffusive to sub-diffusive transport is observed, as predicted by diffusion theory. A Monte Carlo trajectory-following code simulates the interaction of the fast ions with the measured turbulent fields. Good agreement between observation and modeling is observed.

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