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Modification of turbulence and turbulent transport associated with a confinement transition in LAPD[1]

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Azimuthal flow is driven in the edge of the Large Plasma Device (LAPD) through biasing a section of the vacuum vessel relative to the plasma source cathode. As the applied bias exceeds a threshold, a transition in radial particle confinement is observed, evidenced by a dramatic steepening in the density profile, similar to the L- to H-mode transition in toroidal confinement devices. The threshold behavior and dynamic behavior of radial transport is related to flow penetration and the degree of spatial overlap between the flow shear and density gradient profiles. An investigation of the changes in turbulence and turbulent particle transport associated with the confinement transition is presented. Two-dimensional cross-correlation measurements show that the spatial coherence of edge turbulence in LAPD changes significantly with biasing. The azimuthal correlation in the turbulence increases dramatically, while the radial correlation length is little altered. Turbulent amplitude is reduced at the transition, particularly in electric field fluctuations, but the dominant change observed is in the cross-phase between density and electric field fluctuations. The changes in cross-phase lead to a suppression and then apparent reversal of turbulent particle flux as the threshold is exceeded.

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