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Global transition from drift wave dominated regimes to multi-instability plasma dynamics and simultaneous formation of a radial transport barrier in helicon plasma SAIKAT CHAKRABORTY THAKUR, LANG CUI, JORDAN GOSSELIN, PAYAM VAEZI, CHRIS HOLLAND, GEORGE TYNAN, UC San Diego — Recent studies in CSDX reported a sharp global transition in the plasma dynamics during the route to turbulence [1]. For B <140 mT, the plasma is dominated by density gradient driven drift waves [DW]. For B >140 mT, a new global equilibrium is achieved with simultaneous existence of three radially separated plasma instabilities: coherent Rayleigh Taylor [RT] modes at the center, DW at the density gradient and turbulent, shear driven Kelvin-Helmholtz [KH] instabilities at the edge. Only the RT modes rotate in the ion diamagnetic drift direction. The radial particle flux is directed outward for small radii and inward for large radii, forming a radial particle transport barrier leading to stiff profiles and increased core density. Simultaneously the core Ar-II light emission increases (x 10) forming a very bright blue core. The radial extent of the inner RT mode and the blue core coincides with the radial location of the particle transport barrier. This equilibrium with simultaneous RT-DW-KH instabilities shows very rich plasma dynamics including intermittency, blob formation and propagation, inward particle flux against density gradients etc. We report detailed studies of azimuthal momentum balance and time resolved dynamics leading to the transition using Langmuir probes, fast imaging, spectroscopy, laser induced fluorescence etc.

[1] S. Chakraborty Thakur *et. al.*, *Plasma Sources Sci. and Technol.* **23** (2014)

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