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Transition from collisional drift-wave to multi-instability turbulence in a helicon plasma device[1] S. CHAKRABORTY THAKUR, A. ASHOURVAN, L. CUI, P. DIAMOND, C. HOLLAND, R. HONG, G. TYNAN, P. VAEZI, UCSD, J. MCKEE, E. SCIME, S. SEARS, WVU — Recent studies in the Controlled Shear Decorrelation eXperiment reported a sharp non-monotonic global transition in the plasma dynamics during the transition to broadband turbulence [1]. Using a combination of probes, high speed imaging and laser induced fluorescence, we find that below a threshold magnetic field, the plasma is dominated by density gradient driven resistive drift waves. Above this threshold a new global equilibrium occurs, characterized by steepened density and ion temperature gradients and both azimuthal and parallel velocity shear layers, along with multiple plasma instabilities. At the center, high azimuthal mode number fluctuations are observed rotating in the ion diamagnetic drift direction, while in the density gradient region, drift waves propagate in the electron diamagnetic direction. Outside of this zone, velocity shear-driven fluctuations are observed. Simultaneously a very bright helicon blue core forms, and appears to be associated with a radial particle transport barrier. This new regime shows very rich plasma dynamics including intermittency, blobs, radial transport barrier, inward particle flux against density gradients [2] etc. Above the threshold conditions, linear stability analysis show co-existence of the ion temperature gradient (ITG) instability and velocity shear instability together with collisional electron drift waves. [1] S. C. Thakur *et. al.*, *PSST* **23** 044006 (2014) [2] L. Cui *et. al.*, *PoP* **22** 050704 (2015)

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