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Observation of Chaos in a Magnetized Laboratory Plasma under the Influence of Variable Biasing[1] S. XIE, C. WATTS, M. GILMORE, L. YAN, University of New Mexico — Ion saturation current fluctuation data from helicon plasmas in the linear HELCAT (HELicon-CAThode) device under positive biasing (with respect to the vacuum chamber wall) of a set of concentric rings is analyzed. HELCAT is 4 meters long, 0.5 meter in diameter, with dual plasma sources (RF Helicon and Ni-BaO thermionic cathode), helicon plasma peak density $\sim 10^{19}$ m^{-3}, and magnetic field up to 0.22T. Analysis shows that the helicon plasma is in a weakly turbulent state caused by drift waves before positive biasing of the rings. When the bias voltage is increased, drift waves start to be suppressed, finally disappearing when the bias voltage is around 12 volts ($\sim$ 3kTe/e). At suppression, a phase plot shows a simple attractor. As the bias is further increased, period doubling bifurcations are observed, and simultaneously the plasma enters a chaotic state with correlation dimension 2–3. At higher bias, the plasma develops a new, intermittent, instability, which is believed to be a Kelvin-Helmholtz mode, and a continued increase of the correlation dimension to values greater than 3.

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