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Experimental and Numerical Studies of Coherent and Chaotic Azimuthal Disturbances in a Magnetron Discharge MARK CAPPELLI, ANDREA MARCOVATI, Stanford University — Studies of instabilities in magnetron discharges (0.1-10 MHz) is an active area of research due to the important role they play in many technologies (Hall effect thrusters, magnetron sputtering, and Penning discharges). Our study focuses on a magnetron discharge confined between two parallel electrodes within a toroidal region of E x B field, under conditions where only the electrons are magnetized. A segmented anode is used to measure the cross-field current from which Fourier analyses give the power density spectrum of the fluctuations. In a highly obstructed discharge, the instabilities appear to be quite coherent, exhibiting a range of principal azimuthal modes depending on the gas mixture and discharge voltage. Under some conditions, the spectrum shows evidence of three-wave mixing suggesting nonlinear mode interactions. A linear model appears to capture the growth of coherent structures in the linear regime, but the development of a nonlinear model is necessary to understand the behavior seen between modes. We show through a sensitivity analysis that the transit time of the non-magnetized ions plays an important role in the growth of the instability.

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