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**Multi-wave coupling and non-linear interactions in DC planar magnetron microdischarges.**[1] NICOLAS GASCON, CHRISTOPHER YOUNG, Stanford University, TSUYOHITO ITO, Osaka University, MARK CAPPELLI, Stanford University — We study azimuthal wave structures in two planar DC magnetron microdicharges (~1-10W) operated with argon. Segmented anode/electrodes and high frame rate camera imaging of plasma emission are used to characterize azimuthal modes and transitions as evidenced in the spatial and temporal variation in the discharge current. The dominant stable mode structure varies with discharge voltage and electrode distance, and is observed rotating in the negative $E$ x $B$ direction. This negative drift direction is attributed to a local field reversal arising from strong density gradients that drive excess ions towards the anode. Observed mode transitions are shown to be consistent with models of gradient drift-wave dispersion in such a field reversal when the fluid representation includes ambipolar diffusion parallel to the magnetic field direction. Azimuthal wave dispersion ($f$-$k$) spectra obtained from two-point signal analysis ($f$ =100 kHz-100 MHz and $k$ =0-200 m$^{-1}$), reveal rich and complex waves and transient structures, and in some operating conditions, multi-wave coupling and nonlinear interactions. Preliminary analysis of these structures point to energy transfer mechanisms consistent with classic turbulence models, such as described by the Hasegawa-Mima equations.

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