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Hysteresis as a Probe of Turbulent Bifurcation in Intrinsic Rotation Reversals on Alcator C-Mod[1]

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Analysis and modeling of a set of rotation reversal hysteresis experiments unambiguously show that changes in turbulence are responsible for the intrinsic rotation reversal and the Linear to Saturated Ohmic Confinement (LOC/SOC) transition on Alcator C-Mod[2]. Plasmas on either side of the reversal exhibit different toroidal rotation profiles and therefore different turbulence characteristics despite profiles of density and temperature that are indistinguishable within measurement uncertainty. The deactivation of subdominant (in linear growth rate and heat transport) ITG and TEM-like instabilities in a mixed-mode state is identified as the only possible change in turbulence within a quasilinear transport approximation which is consistent with the measured profiles and the inferred heat and particle fluxes across the reversal. This indicates an explanation for the LOC/SOC transition that provides a mechanism for hysteresis through the dynamics of subdominant modes and changes in their relative populations, and does not involve a change in the most (linearly) unstable ion-scale drift-wave instability.

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[2]N.M. Cao et. al. Nucl. Fusion (2019) *submitted*