Observing the evolution of self-organized helical states in the Madison Symmetric Torus PATRICK VANMETER, University of Wisconsin - Madison, LUIS FELIPE DELGADO-APARICIO, Princeton Plasma Physics Laboratory, PAOLO FRANZ, Consorzio RFX, BRETT CHAPMAN, DANIEL DEN HARTOG, University of Wisconsin - Madison — Magnetically confined plasmas in the Madison Symmetric Torus (MST) reversed-field pinch spontaneously organize into helical equilibria under conditions of high plasma current and/or low density. This occurs when the inner-most- resonant tearing mode grows to large enough amplitude (∼ 7% of the equilibrium field strength) that the associated island envelopes the magnetic axis. A suite of x-ray diagnostics, including a new solid-state multi-purpose multi-energy soft-x-ray detector, a hard-x-ray detector, and a two-color diode-based tomographic array are used to study evolution of this quasi-single helicity (QSH) state. Evolution of temperature and impurity density profiles are inferred using an integrated data analysis procedure. Residual tearing mode activity is observed to resume during the quasi-stationary period and is correlated with intermittency in the thermal confinement. These observations are compared with the predictions of a predator-prey model by Terry, et al. which proposes that strong magnetic or flow shear suppresses energy transfer between tearing modes, significantly extending the lifetime of the QSH state. Work supported by US Department of Energy.

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