Abstract Submitted
for the DPP20 Meeting of
The American Physical Society

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 at high plasma current and/or low density. This occurs when the inner-most- resonant tearing mode grows to large enough amplitude ($\sim$ 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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Date submitted: 29 Jun 2020 Electronic form version 1.4