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Overview of MST Research[1] J.S. SARFF, Univ Wisconsin-Madison and Center for Magnetic Self-Organization in Laboratory and Astrophysical Plasmas, MST TEAM — MST progress in advancing the RFP for (1) fusion plasma confinement with minimal external magnetization, (2) predictive capability in toroidal confinement physics, and (3) basic plasma physics is summarized. Investigation of energetic ion confinement and stability continues using a 1 MW, 25 keV neutral beam injector. Fast ion confinement is near classical, although the onset of bursty energetic particle modes limits the fast ion density. For plasmas with a 3D helical equilibrium (quasi-single-helicity regime) the fast ion confinement is reduced. Full orbit calculations are underway to investigate various classes of orbits, some different from the tokamak. The onset of the 3D equilibrium correlates with Lundquist number, and progress is made developing 3D equilibrium reconstructions using V3FIT. Several new diagnostics are in use. An advanced neutral particle analyzer measures both the NBI-generated and spontaneous energetic ion tail created by magnetic reconnection. A 2-color SXR tomography system measures the electron temperature profile and 3D thermal structures. The FIR interferometer-polarimeter is being upgraded for higher spatial resolution to measure $k_\perp \rho_s \sim 1$ fluctuations. Also, MST's frozen pellet injector has been upgraded for injecting larger pellets.

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