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Overview of MST research J.S. SARFF, University of Wisconsin-Madison and Center for Magnetic Self-Organization in Laboratory and Astrophysical Plasmas, MST TEAM AND COLLABORATION — MST progress in advancing the RFP for (1) fusion plasma confinement with ohmic heating and minimal external magnetization, (2) predictive capability in toroidal confinement physics, and (3) basic plasma physics is summarized. Integrated data analysis (IDA) tools are under development to maximize information in MST's advanced diagnostic set. Special emphasis is given to Z_{eff} measurements, for which no single diagnostic appears adequate. Measurements of the plasma resistivity are essential for MHD validation studies, e.g., scaling of magnetic fluctuations with Lundquist number, S. At high S, the plasma transitions to the quasi-single helicity state with a stellarator-like equilibrium. Applied magnetic perturbations allow controlling the 3D phase for optimal diagnosis of the 3D structure. Density fluctuations that are distinct from tearing instability are observed in improved-confinement, reduced-tearing plasmas. Gyrokinetic simulations indicate several types of drift waves can be unstable for these plasma conditions. Runaway of NBI-generated energetic ions is observed during sawtooth magnetic reconnection, which induces a large inductive electric field that could be important for the observed spontaneous ion energization as well. Supported by U.S. DoE and NSF.

John Sarff
University of Wisconsin-Madison

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