Microtearing Instabilities, ∇B Reversal, and Magnetic Drifts in the Pegasus Local Minimum |B| Regime

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A local minimum |B| "magnetic well" region is readily accessed in high-β plasmas driven by local helicity injection in the $A \sim 1$ Pegasus ST. This magnetic topology may afford novel, favorable characteristics affecting turbulent transport. ∇B reversal on the low-field-side is stabilizing for drift waves, reduces the trapped particle fraction, and expands the parameter space for fast ion trapping. The magnetic configuration, however, remains net-paramagnetic with near omnigeneity ($|B| \approx |B|(\psi)$) in the bad curvature region. Small banana orbit widths in an omnigeneous region reduce neoclassical transport. Here, we report on the gyrokinetic stability of microtearing modes in the Pegasus minimum |B| regime. Multiple classes of microtearing instabilities arise at $k_y\rho_s \sim 0.1$-1 in the magnetic well region at $\psi_N \sim 0.3$-0.9 on the outboard midplane. Modes at $k_y\rho_s \sim 0.2$ are insensitive to the ∇p component in magnetic drifts which is common in lower β scenarios. Modes at $k_y\rho_s \sim 0.8$, however, are highly sensitive to the ∇p component. Also, exclusion of the ion species is destabilizing for $k_y\rho_s \sim 0.8$ modes in contrast to typical microtearing modes. Preliminary nonlinear simulations will also be presented.

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