

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 omnigenity ($|B| \approx |B|(\psi)$) in the bad curvature region. Here, we report on the gyrokinetic stability the Pegasus minimum $|B|$ regime at $\psi_N \sim 0.3-0.9$. Multiple classes of microtearing instabilities arise at $k_y \rho_s \sim 0.2-1$ in the magnetic well, and the microtearing instabilities exist at toroidal mode numbers as low as $n=1$ ($k_y \rho_s = 0.2$) due to large $\rho_s/a \approx 0.2$. Collisionless high- k modes at $k_y \rho_s \approx 1$ are destabilized at $\beta_{\text{crit}} \approx 3\%$, and collisional low- k modes are destabilized at $\beta_{\text{crit}} \approx 12\%$. Also, the ∇p contribution to the magnetic drift is stabilizing for the high- k modes, but not low- k modes. Preliminary nonlinear simulations will also be presented.

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