Effect of ExB shear on Turbulence

Ease of ExB shear stabilization of low-k modes in STs in general has long been recognized.
This is one key feature of the attractiveness of ST reactor-scale devices.
Need to document and understand this issue.

Need nonlinear simulations to determine if (and how) γ_{ExB} stabilizes low-k turbulence.
Standard ExB "quench rule" applied to linear results is of questionable validity in NSTX:
"*We cannot be confident of these modifications and limitations on the quenching condition for general profiles at finite ρ^* without nonlinear simulations. These cannot be done with the fast flux tube codes and require three dimensional (3-D) full radius codes …*" Waltz, et al., Phys. Plasmas 5 (1998) 1784.

TEM and ITG modes interact synergistically in most tokamaks, but
In NSTX the TEM drive may be much more important than in higher aspect ratio devices.

Vary ExB shear: study gradual stabilization - not bifurcation to complete stabilization.
- **See effect on $\langle r_{corr} \rangle$ and $\langle \tilde{n}/n \rangle$? Compare with turbulence simulations.**
- **What are the operational 'knobs' for varying ExB shear?**

Experimental Issues

Need a *peaked* density profile for NSTX reflectometers.

- **Density range for quadrature homodyne reflectometer operation is 1-3x10^{19} /m^3 .**
- **Correlation reflectometer density range is 1-2x10^{19} /m^3 .**

Avoid interference from MHD, this can easily produce more scattering than the turbulence.

No NBI, or low power? (fast-ion driven activity is common in NSTX).

But we need some NBI for diagnostics that measure T_i, Z_{eff}, and MSE?

- **If TEM drive is dominant we may be able to ignore ∇T_i ?**

Beam blip for MSE; effect on q(r) not very perturbative - long current relaxation time.

Ohmic plasmas have very low rotation? What is accessible density range? TS needs n_e

Density peaked for reflectometers?

Vary q(r), see change in $T_e(r)$?

Vary Z_{eff} to change heating power? Helium discharges?

Use NBI blips of varying duration to change ExB shear?

- **Major perturbation of density and temperatures if rotation is changed significantly?**
- **HHFW to change rotation without changing temperatures much??**