NSTX
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Study of the Parametric Dependence of High-k Turbulence in NSTX

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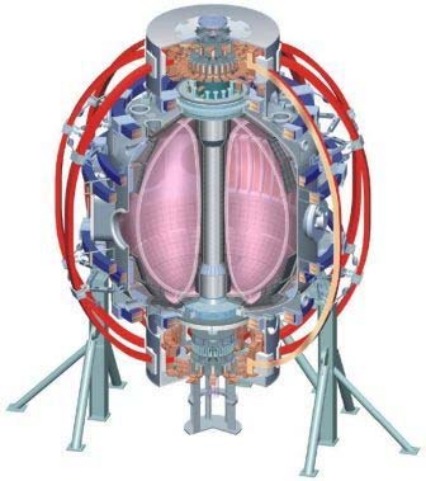
NSTX Research Forum, December 2, 2009



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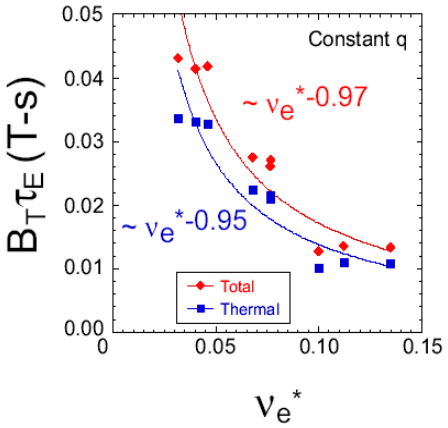
Background and Motivations

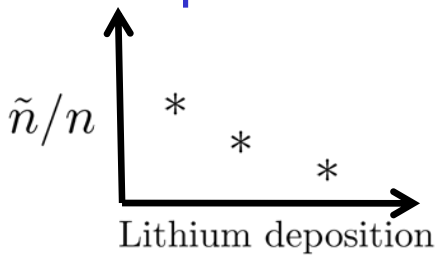
- The mechanism responsible for anomalous electron thermal transport in NSTX is unclear:
  - Electron energy transport is always anomalous.
  - Ion transport is largely neoclassical.
- Global confinement and local transport studies show:
  - Electron transport has strong dependences on Bt and collisionality (ν_e^*) but has a weaker dependence on Ip.
- Recent results from high-k scattering demonstrated the existence of electron-gyro-scale density turbulence in NSTX.
  - Driven by ETG and can be stabilized by equilibrium ExB shear.
  - Correlation with local transport not established.
- Study of the parametric dependence of high-k turbulence will:
  - Reveal the correlation between the observed high-k turbulence and local transport.
  - Identifying the operating turbulence through changing driving terms, coupled with transport analysis and gyrokinetic simulations.

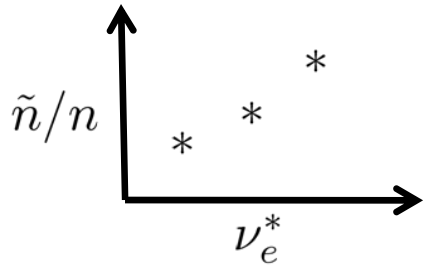
Experimental Idea 1: Collisionality Dependence of High-k Turbulence

- The confinement in NSTX strongly depends on collisionality.
- Is the change of τ_E with collisionality driven by the collisionality dependence of high-k turbulence?
- Collisionality can be changed by varying Bt and Ip.
- New (lower) collisionality regime can by achieved by utilizing the newly implemented LLD.



- Measure high-k turbulence on different days with different Lithium deposition on the LLD with fixed Bt and Ip at selected radial locations.
- On selected days, measure high-k turbulence as function of ν_e^* by varying Bt and Ip.

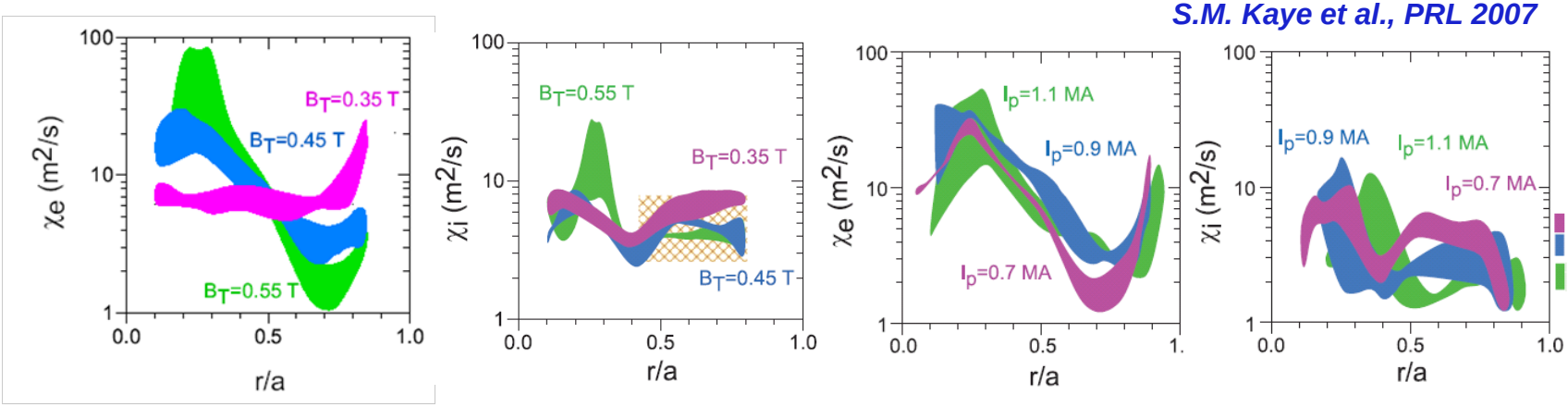




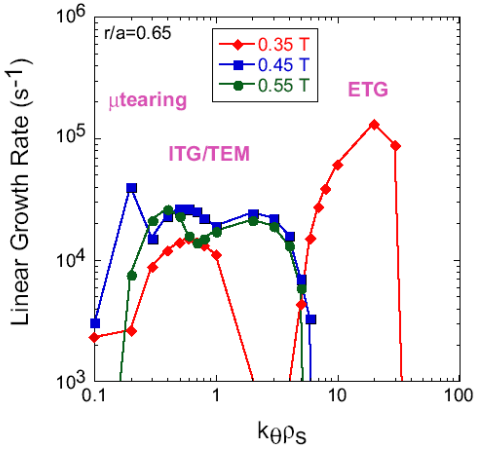
Experimental Idea 2: Dependence of High-k Turbulence on Bt and Ip

- Transport analysis has shown differences in electron and ion transport dependences on Bt and Ip.

S.M. Kaye et al., PRL 2007



- ETG turbulence is shown to be unstable for the lowest Bt.

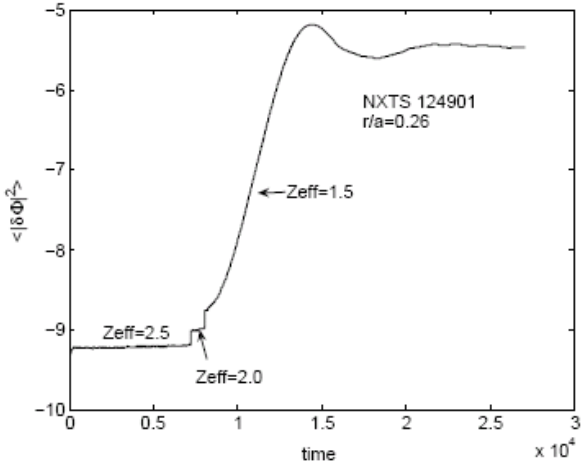


- Measure high-k turbulence at selected radial positions when changing Bt with fixed Ip and when changing Ip with fixed Bt in both low and high collisionality regimes.
- Achieve long MHD-quiescent discharges with the help of LLD.

Experimental Idea 3: Dependence of High-k Turbulence on Zeff

- ETG turbulence is very sensitive to Zeff as shown by gyrokinetic simulations.
  - Zeff has stabilizing effects on ETG turbulence.

- How to study the effects of Zeff:
  - Compare Deuterium and Helium discharges with HHFW heating.
    - Producing similar T_e and n_e profiles
    - Zeff changed for about a factor of 2



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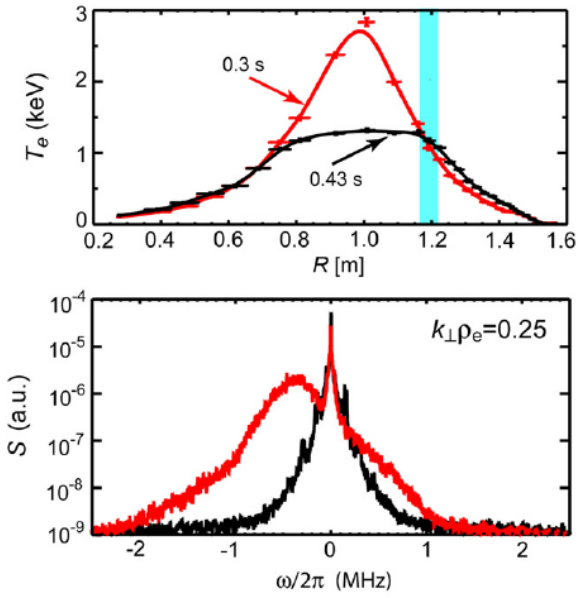

E. Mazzucato et al., NF 2009