Research Opportunities Unique to NSTX

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5. Novel wave-particle interactions
   - ✓ Collisionless heating & reconnection btw ρ_i & ρ_e scales
   - ✓ Drift-cyclotron coupling (ETG + ion cyclotron = IBW?)

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- Investigate β scaling of Q_e ; is χ_e independent of magnetic field?

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- Particle transport likely dominated by long wavelength instabilities; trapped particle dynamics critical, unique in NSTX because of strong *B* variation along field line

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- Suggests fast particle and momentum transport studies

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- Is viscosity in the ST anomalous or not? Key question, with broad implications. Should be one focus of NSTX diagnostic deployments.

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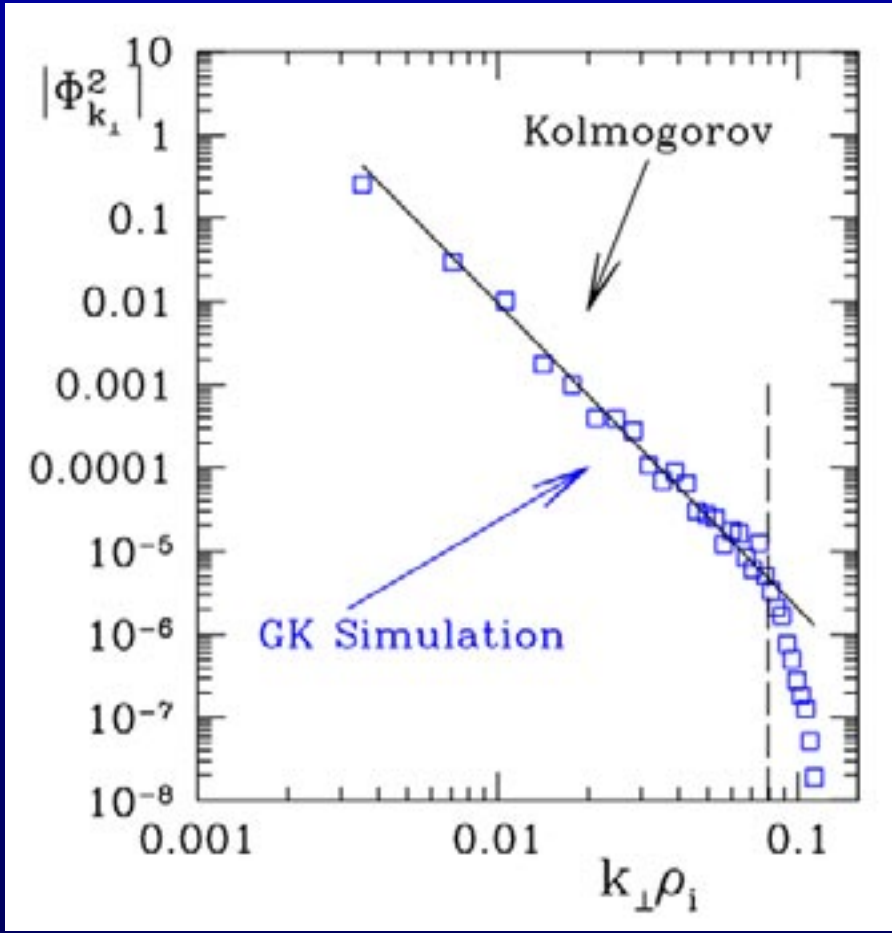
Nonlinear Physics Benchmarked Against Theoretical Predictions



High β Alfvenic turbulence in homogeneous, stirred plasma shows predicted perpendicular spectrum (and anisotropy, not shown). Here, β = 8 (i.e., 800%).

W Dorland, S C Cowley, G W Hammett and E Quataert

Parasitic Instability Model

→ Equilibrium unstable to ***primary*** (linear) instabilities

→ Primaries unstable to ***secondary*** instabilities

→ Some secondary instabilities have ***zonal flow*** component

→ Zonal flows unstable to ***tertiary*** instabilities

Key references:

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J F Drake, et al., PF B, (4:488:1992)

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