Characterization of GAE modes and their effect on electron thermal transport

Joint T&T-WPI XP Proposal

The JHU Plasma Spectroscopy Group

WPI TSG Meeting
Feb. 26th 2009

Motivation:

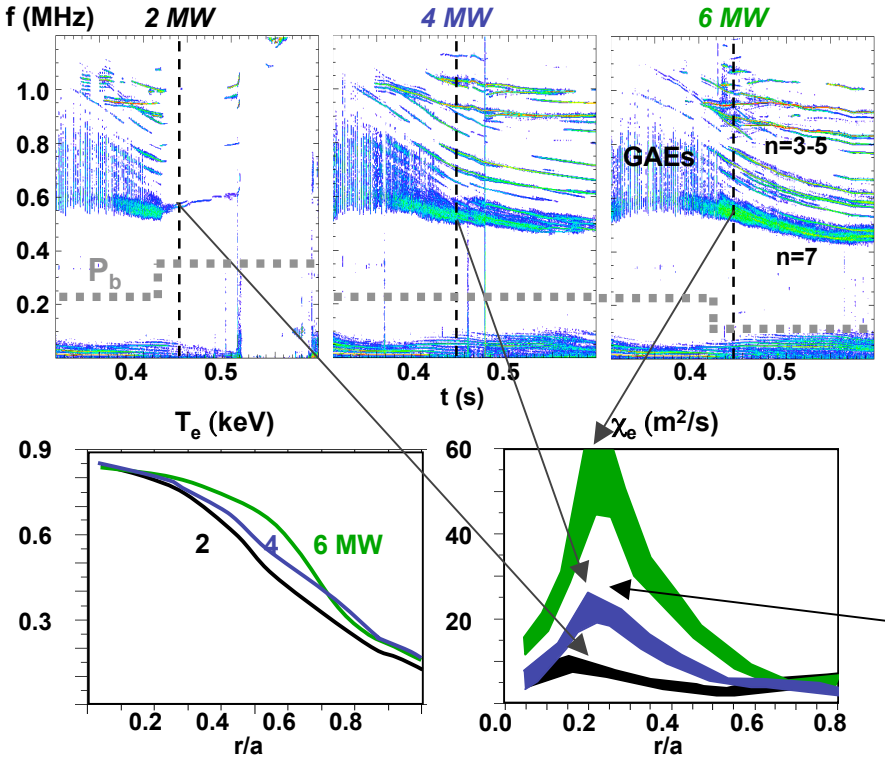
- Flat electron temperature profiles on NSTX have no explanation

- No temperature/density gradients to drive turbulence

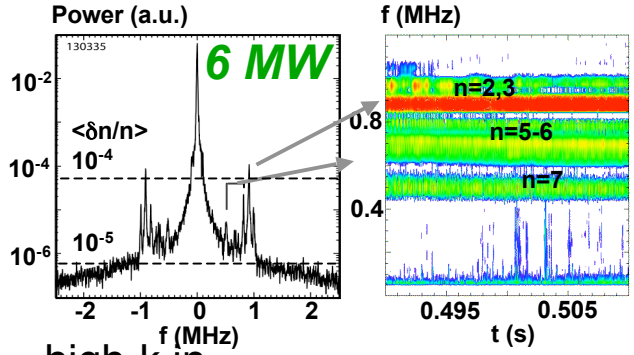
- Fast ion gradients can drive energetic particle modes

- Possible connection between GAEs and electron thermal transport

GAE/electron transport correlation observed using P_b steps



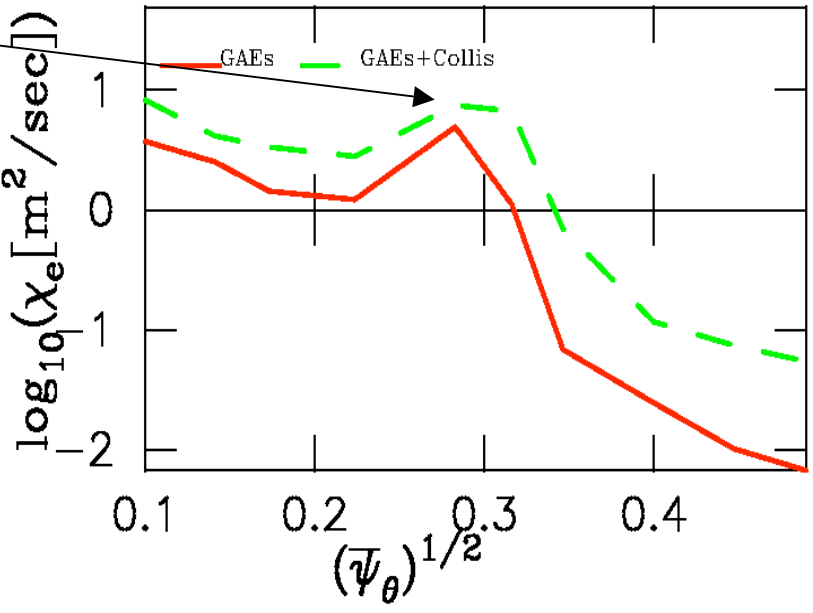
E. Mazzucato



high-k in interferometric mode

magnetics

N. Gorelenkov



- P_b steps at fixed q(r), n_e, ω_{ExB}
- GAE $\langle\delta n\rangle/\langle n\rangle \leq 1.5\ 10^{-4}$ at 6 MW
- Theory predicts χ_e peak at r/a~0.25

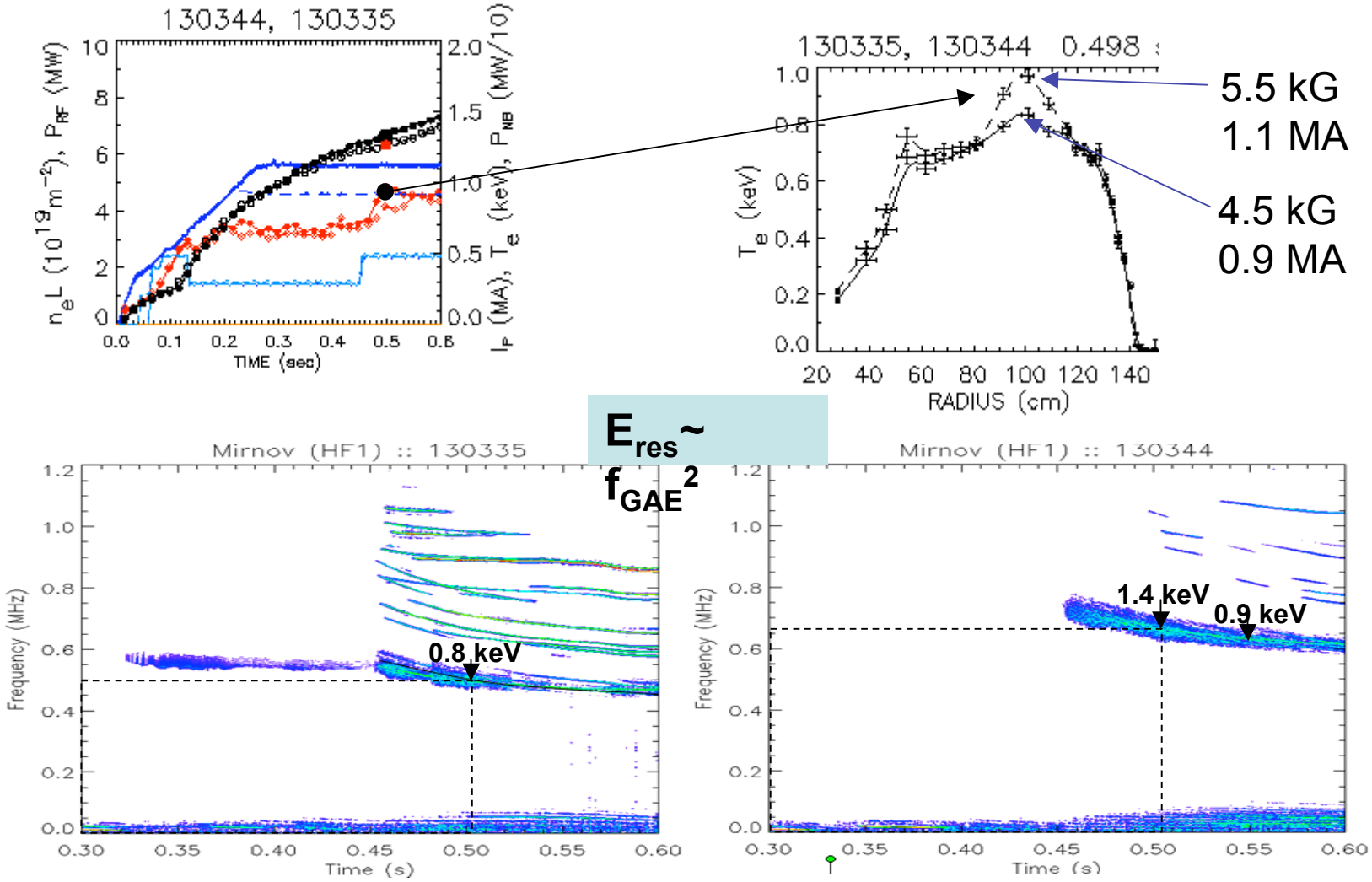
Part I: Characterization of GAE mode structure/amplitude

- Simulations have many free parameters
- Mode structure measurements will better constrain codes
- Improved transport predictions to compare with observations

- Use high-k (inter.) and FIReTIP (upgrade?) for internal measurements
- Detailed radial high-k scans 110-130cm provide amplitude/structure
- Change beam power steps to modify GAE amplitude and turbulence

- Scan beam power (ref shot 130335): 3MW 4.5MW 6MW
- Measure GAEs using FIReTIP, high-k at 110, 117, 124, 131cm
- 12 shots (x2 for statistics) ~24 shots: 1 day - repeatability crucial!

Higher GAE frequency at high B_t allows transient T_e peaking?



- Broad band of higher frequency GAEs at high field
- Resonance with higher energy electrons might allow transient Te peaking

Part II: Dependence of transport on GAE frequency

- GAE frequency-electron energy resonance depends on field
- Change in resonance may change electron transport, Te profile
- Field scan at constant q should help isolate GAE effect

- Detailed mode structure measurements needed (high-k scan)
- Radial high-k scans 110-130cm provide amplitude/structure
- Change Bt, Ip for field scan at constant q

- Scan fields at constant P_{NB}: .4T / 8MA, .47T / .95MA, .55T / 1.1MA
- Measure GAEs using FIReTIP, high-k at 110, 117, 124, 131cm
- 12 shots (x2 for statistics) ~24 shots: 1 day (total: 2 days)