

# H-MODE PEDESTAL FLUCTUATION DYNAMICS IN ELM'ING AND ELM-FREE SCENARIOS

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**Goal:** Measure long-wavelength fluctuation properties and their evolution in the H-mode pedestal region of NSTX during the ELM-cycle, as well as in ELM-free operation (a la Maingi-Lithiumization). Vary collisionality to change the relative balance between the predicted peeling and ballooning instabilities.

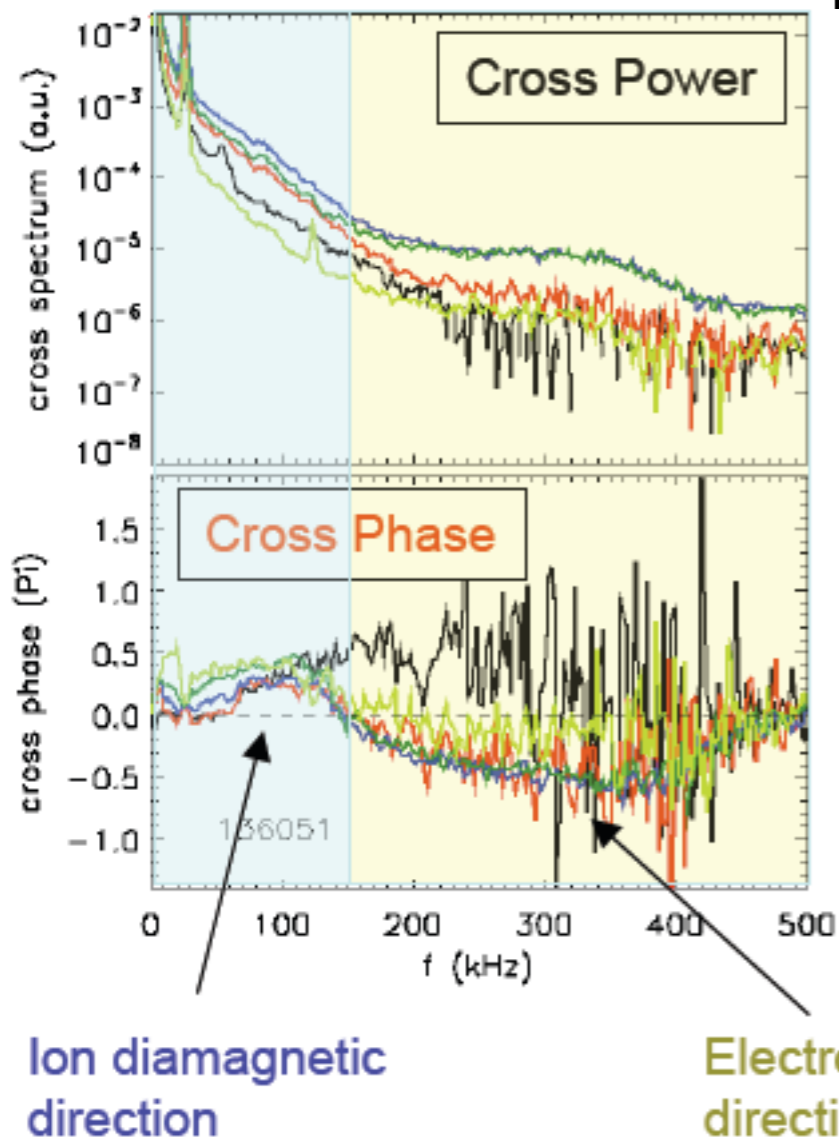
## Background and Motivation:

- Edge pressure and current density gradient driven instabilities predicted in pedestal region
- High  $j'$  tends to drive low- $n$  kink-peeling, while high  $p'$  tends to drive medium to high- $n$  ballooning modes (a la ELITE, P. Snyder)
- Some ELM-free scenarios (QH on DIII-D, Lithiumized wall on NSTX) sit near or just below instability (high-growth rate) limits
- FY11 Joint Research Milestone to characterize pedestal structure and compare theory to measurements: provide important fluctuation measurements with new BES diagnostic on NSTX
- Compare and contrast observed behavior in ST with that in conventional/advanced tokamak (DIII-D) to compare with models



# FLUCTUATIONS OBSERVED IN PEDESTAL REGION OF ELM'ING AND ELM-FREE H-MODE TOKAMAK PLASMAS

$0.9 < r/a < 1.0$

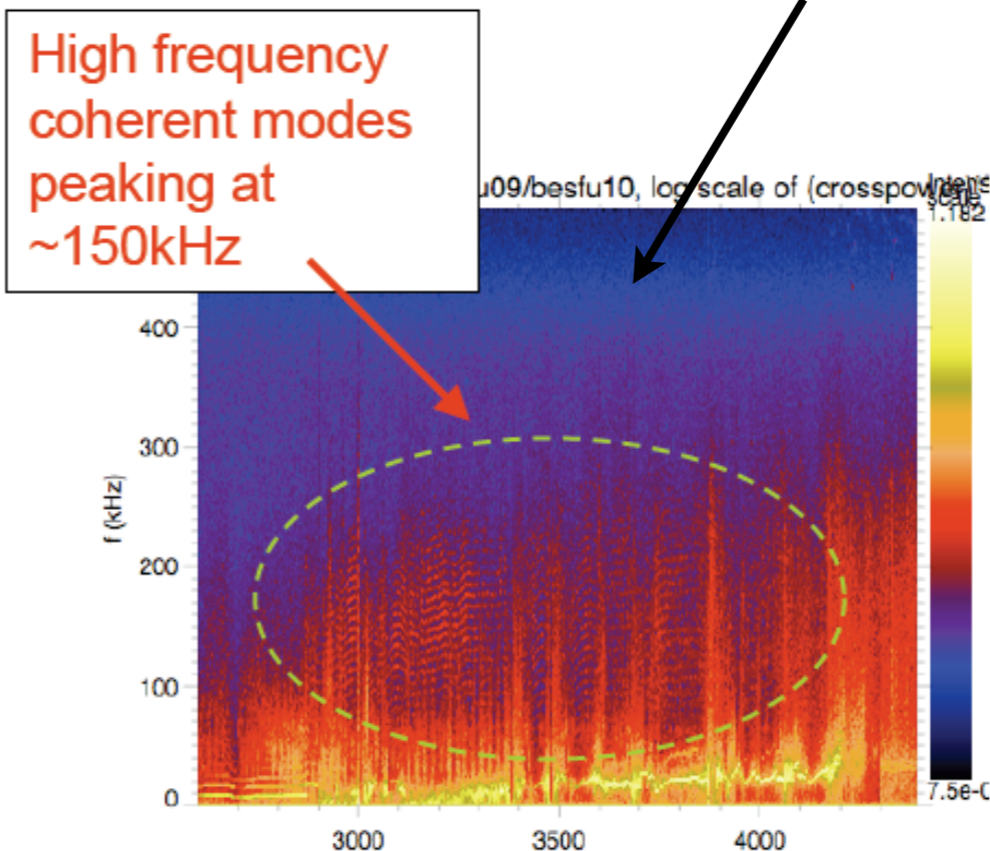


Broadband fluctuations observed in Type-1 ELM'ing H-modes:

- Modulated with ELM cycle
- Often, counter-propagating mode co-exist simultaneously
- Radial scale length  $\sim 10\rho_i$

QH-modes plasmas with *high pedestal pressure* exhibit unique band of coherent oscillations

- Very short decorrelation times
- Exist throughout pedestal in high-shear region



Z. Yan, H-mode Workshop-2009

(from BES@DIII-D)



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# EXPERIMENTAL PLAN

- **Develop discharge with ELM'ing pedestal:**
  - Measure long-wavelength fluctuation properties with newly installed BES diagnostic(see D. Smith discussion)
  - Vary collisionality (density) to alter relative strength of  $j'$  &  $p'$
  - Search for ELM pre-cursors
- **Perform similar measurements in ELM-free discharge**
  - Work with Lithium group
  - Vary pedestal pressure and characterize local fluctuation properties (BES & GPI)
- **Compare with models and gyrokinetic simulations of edge region (under development)**