NUMERICAL SIMULATIONS OF GAE STABILIZATION IN NSTX-U

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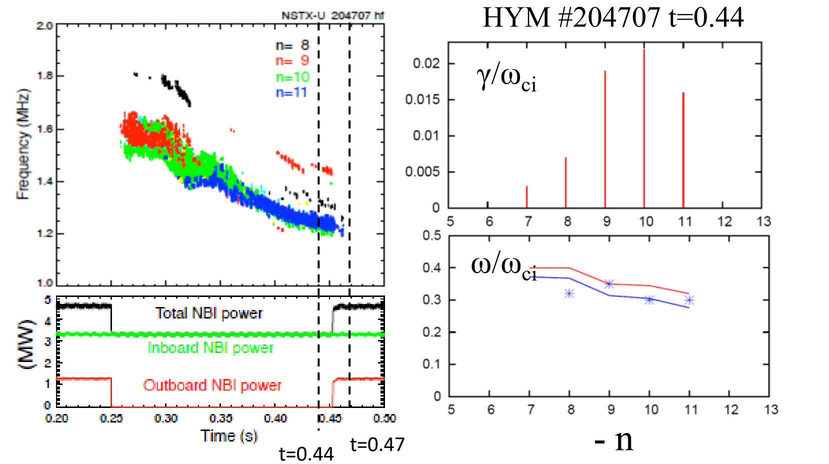
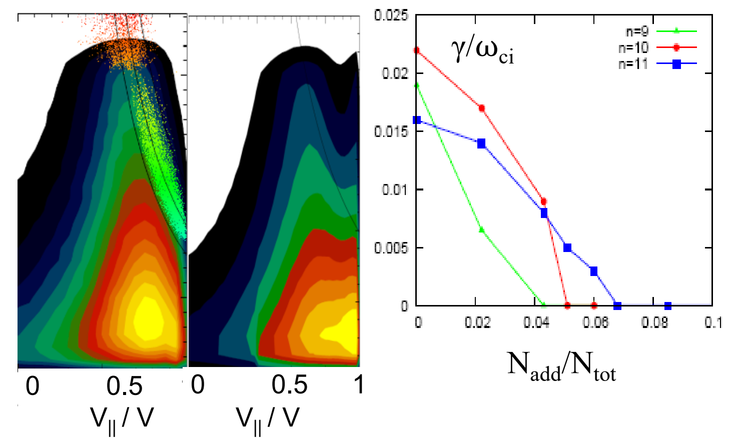
- Simulations confirm robust stabilizing mechanism for beam-driven global Alfvén eigenmodes (GAEs) discovered experimentally in NSTX-U, where new beam sources injecting nearly parallel to magnetic field reliably and strongly suppressed unstable GAEs [E. Fredrickson, PRL 2017].
- GAEs have been linked to flattening of electron temperature profiles and anomalously low central temperature at high beam power in the NSTX.
- Good agreement of simulations with experimental observations from NSTX-U:
  - range of toroidal mode numbers, frequencies, and saturation amplitudes of unstable GAEs match the experimentally observed.
- A very effective mechanism for stabilizing GAEs - threshold for stabilization of all modes for extra beam is less than 7% of total beam power – demonstrated both experimentally and numerically.
- Relevant to ITER, and other fusion devices where super-Alfvénic fast ions might be present.



(a) Spectrogram on magnetic fluctuations (|n|=8-11 counter-GAEs); (b) Injected beam power; (c) Growth rates and frequencies of unstable counter-GAEs from HYM simulations. Blue line is Doppler-shift corrected frequencies, points – experimental values.



Fast ion distribution function (a) before and (b) after addition of 5%off-axis injected neutral beam ions; Growth rate of the n=-11(blue), -10(red), -9(green) GAEs vs fraction of outboard beam ion population.