MOTIVATION

$PPPL$

- Fast particle sources: NBI, HHFW.
- Detailed understanding

Single particle behavior

Test NSTX Parameters and Profiles

$B = 0.3$

Equilibrium

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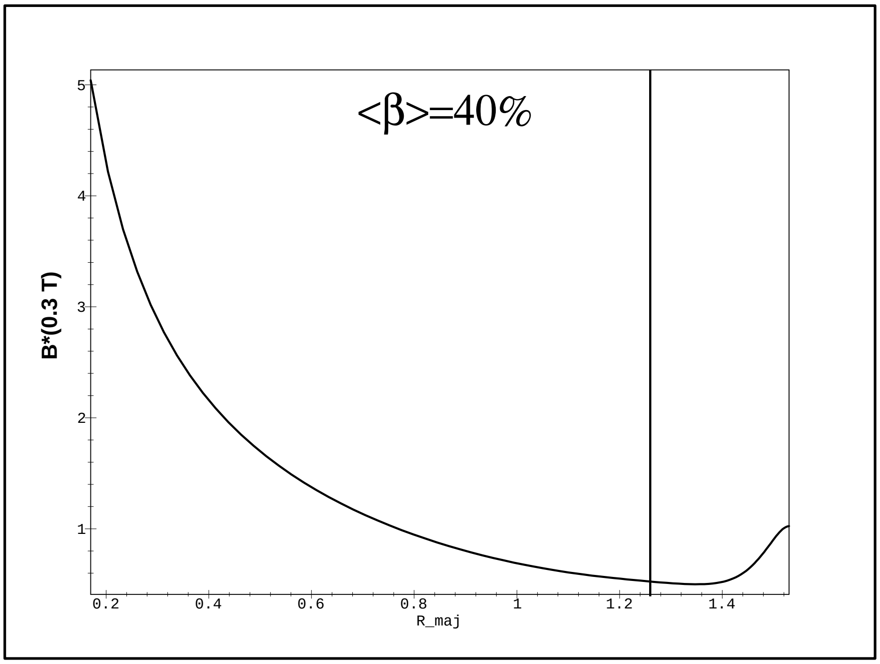

Sawtooth effects on trapped particles in TFTR

Collective energetic particle behavior

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Fast particle effects on MHD stability: $m = 1$ is stabilized in TFTR (J. Manickam, N. Gorelenkov).

Ion Cyclotron Emission was seen in

What is Ion Cyclotron Emission - ICE?

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ICE is generated by Magnetosonic Cyclotron Instability.

Some facts about ICE in tokamaks:

- ity. Td(in)Tj 2l- Kinetic

generedge:y

byCyclopan 6le ET O -20 T0 --25m(Whaut)mp Tiudev

Why study ICE?

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Spherical tokamaks:

- $v_A \simeq 10^8 cm/s \;\; c \Rightarrow \mathcal{E}_{\parallel}(v_A) = 10k \;\; V$
  $\Rightarrow$ ICRF, NBI, plasma ions tail are

ICE Eigenproblem

(Gorelenkov & Gorelenkova to be publihsed)

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- Dispersion for Magnetosonic Waves

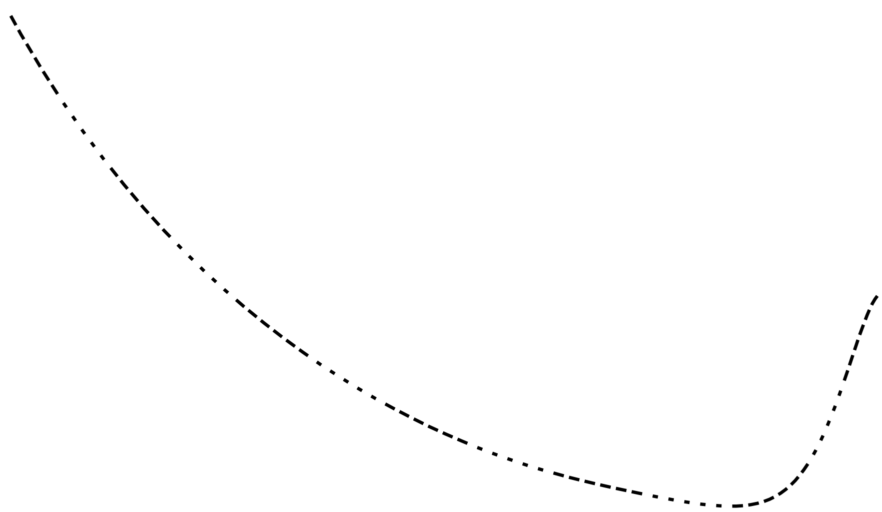
$$k_\perp^2 = \frac{\omega^2}{v_A^2}.$$

An assumption $\omega^2 \gg \omega_{ci}^2$ was used.

[redacted]

[redacted]

ICE Eigenfunctions



TAE Study in NSTX

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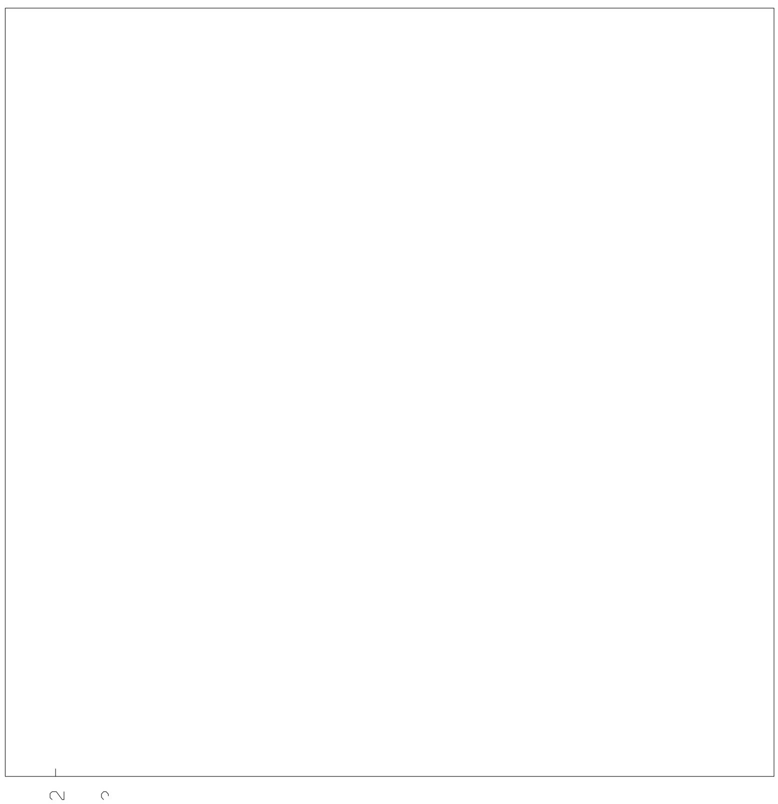
Equilibrium in NSTX at $\beta = 10\%$:



TAE properties in NSTX

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- Alfven continuum gap is large in NSTX plasmas due to strong toroidal coupling effects.
- For each n there are TAE modes.
- TAEs been shown to exist for many n and there to be no upper n limit.
- TAEsbroad
- TAEs exist in high β ($\beta = 40\%$) NSTX plasmas.

Continuum Gap of Alfven waves

TAE Eigenstructure,

The Higher $<\beta>$ The Higher Number of TAE's

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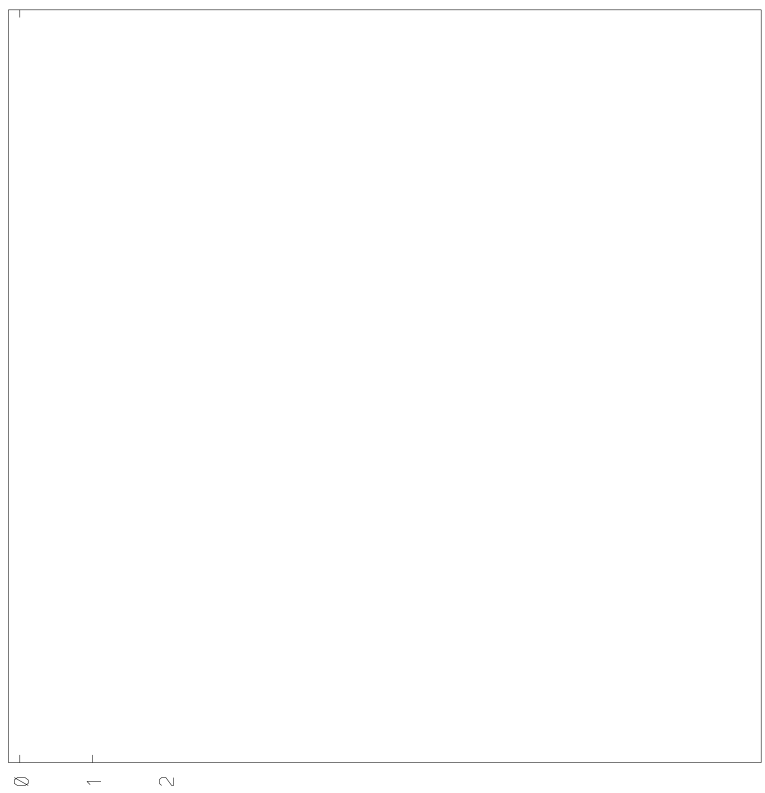

TAE Eigenstructure, $<\beta>=40\%,\ n=1$

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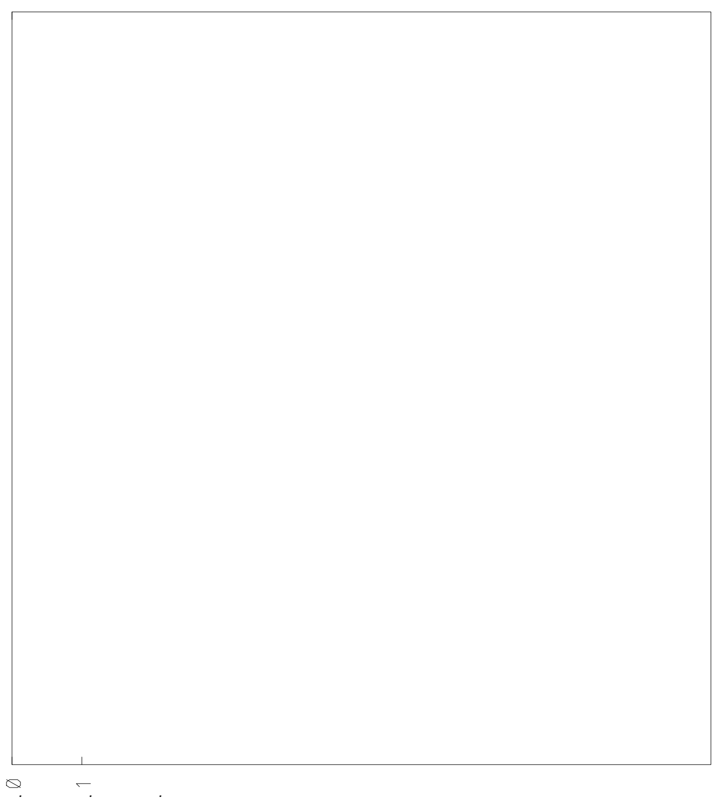
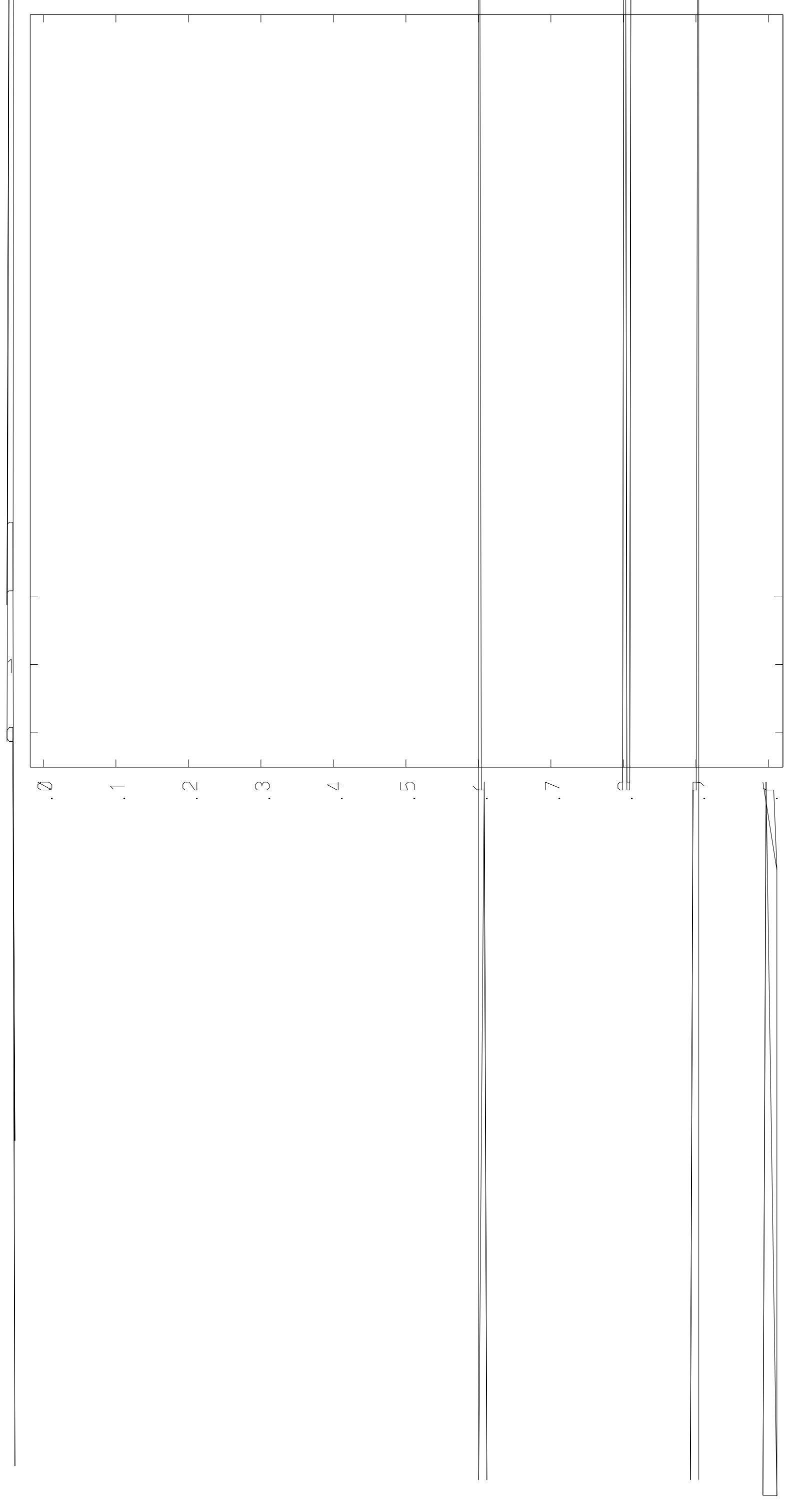


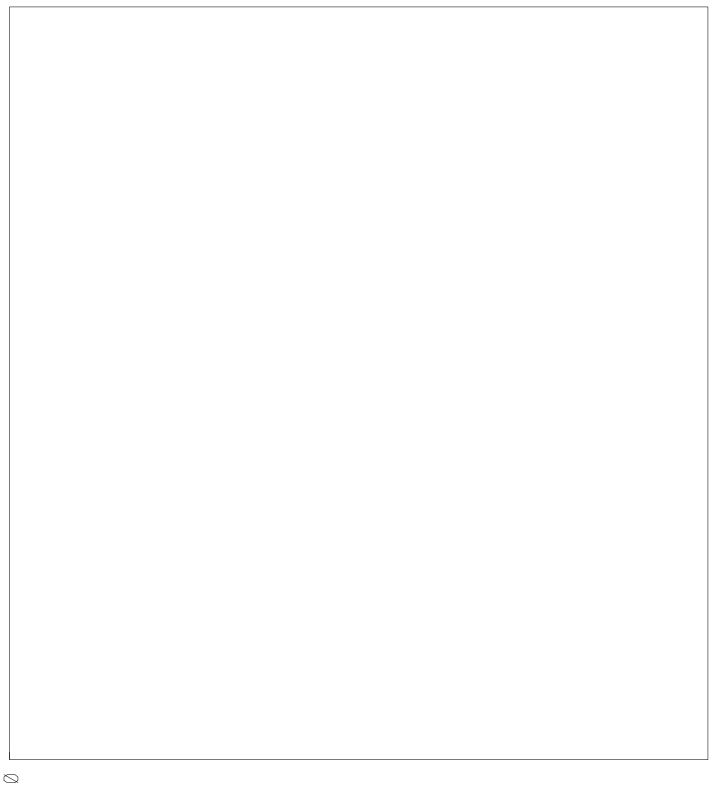
$< \beta >= 40\%,\ n = 2$

PPPL



TAE Eigenstructure, $< \beta >= 40\%,\ n = 2$

$PPPL$



TAE Stability for $\beta = 10\%$ NSTX Plasma

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D-beam $E = 80$ [illegible] V, $_e(0) = 1.3$ [illegible] v, $_i(0) = 1.3$ [illegible] v,

$n_e(0) = 3 \times 10^{13} cm^{-3}$, V [illegible]

Summary