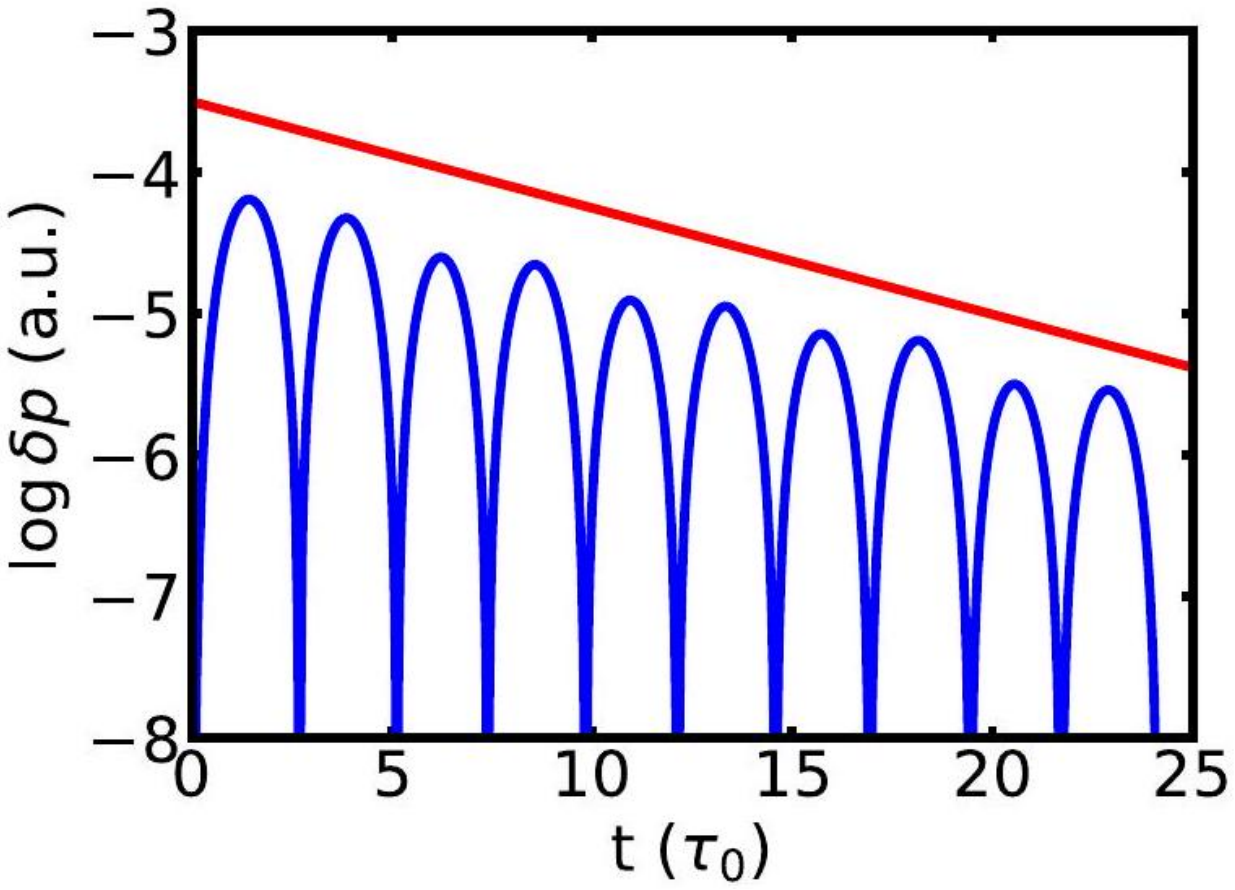

Figure 1: *Blue line is the time signal of δp_e from IAW simulation with $T_i = 0.2T_e$. Red line shows a mode damping trend with a rate calculated from (3.2). The time unit $\tau_0 = 1/\omega_0$.*

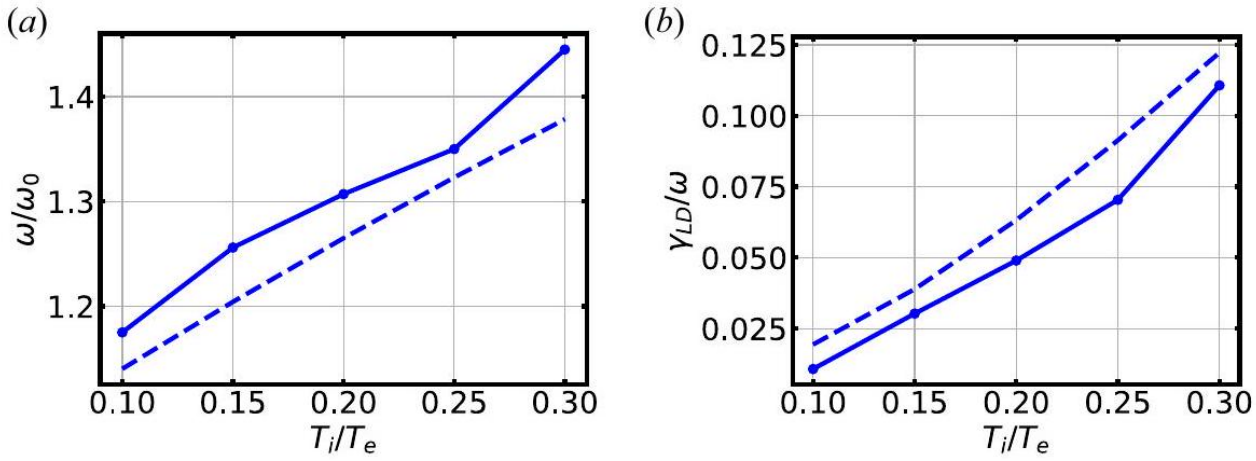

Figure 2: *Frequencies* (a) *and damping rates* (b) *from IAW simulation for different values of* T_i/T_e*. The dashed lines are the theoretical results calculated from (3.1) and (3.2).*

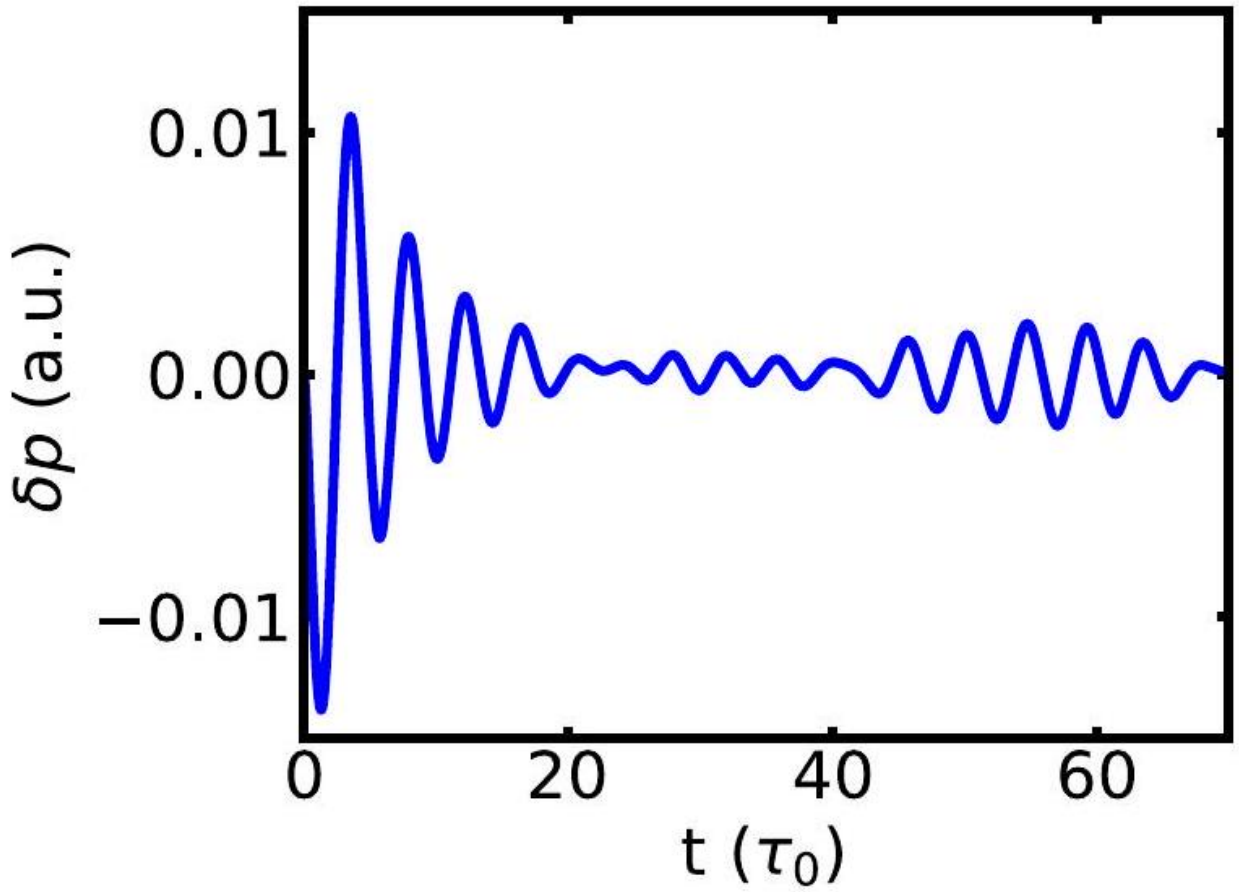

Figure 3: *Time evolution of* δp_e *from IAW simulation with* $T_i = 0.3T_e$*, showing echoes of oscillation after the mode is damped.*

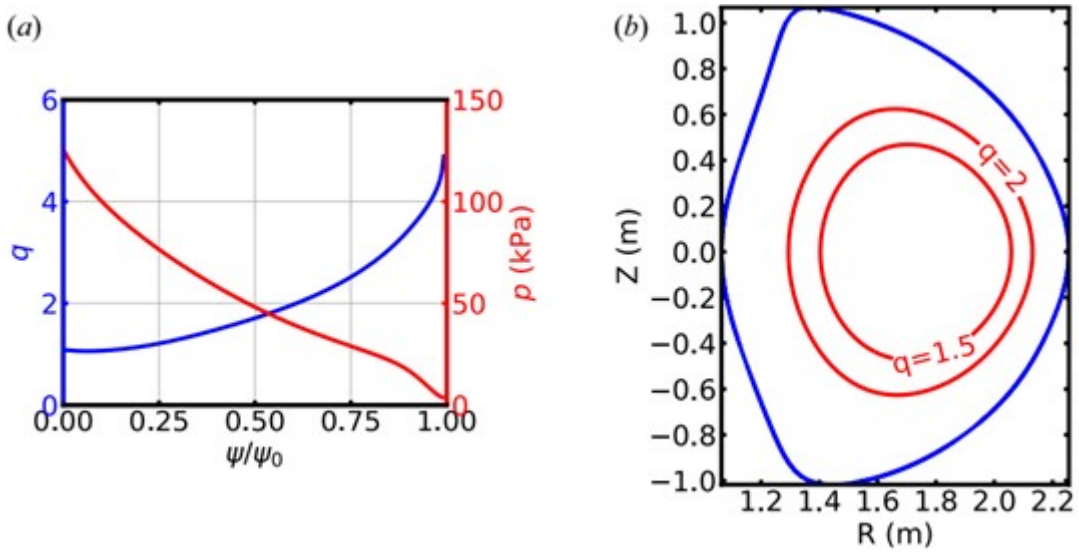

Figure 4: *(a) Profiles of q and total pressure of the equilibrium used in the DIII-D simulation. (b) Flux contours and mesh boundary used in the simulation.*

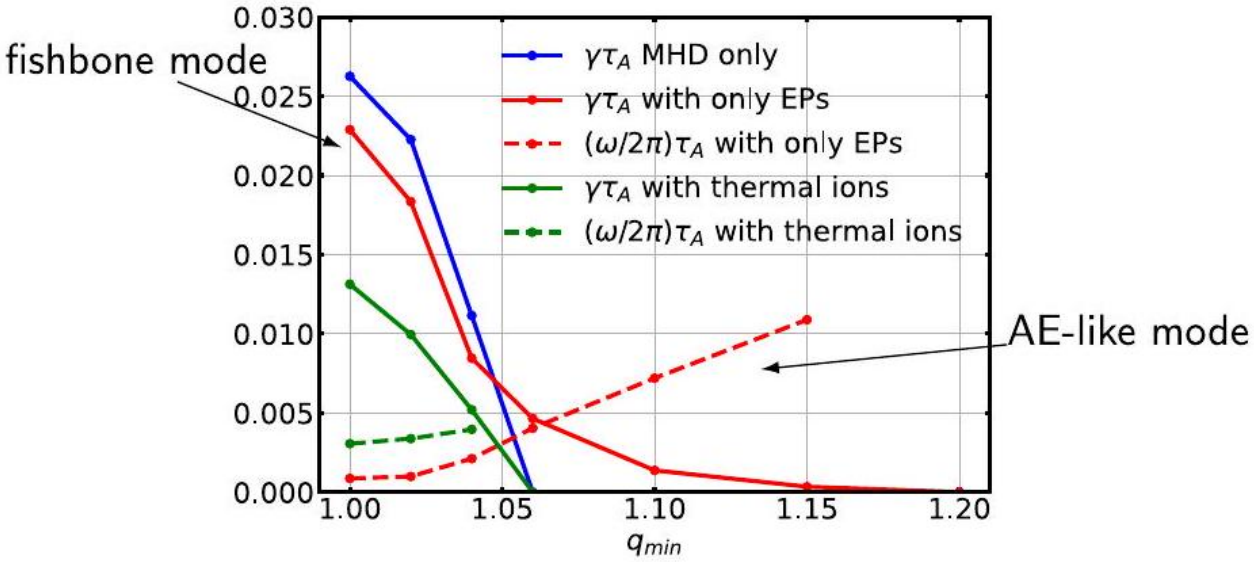

Figure 5: *Growth rates (solid lines) and frequencies (dashed lines) as functions of q_{min} of the $n = 1$ mode from M3D-C1 linear simulations with DIII-D equilibrium. The blue line shows the MHD-only result. The red lines show the kinetic-MHD results with only fast ions. The green lines show the results with both thermal and energetic ions.*

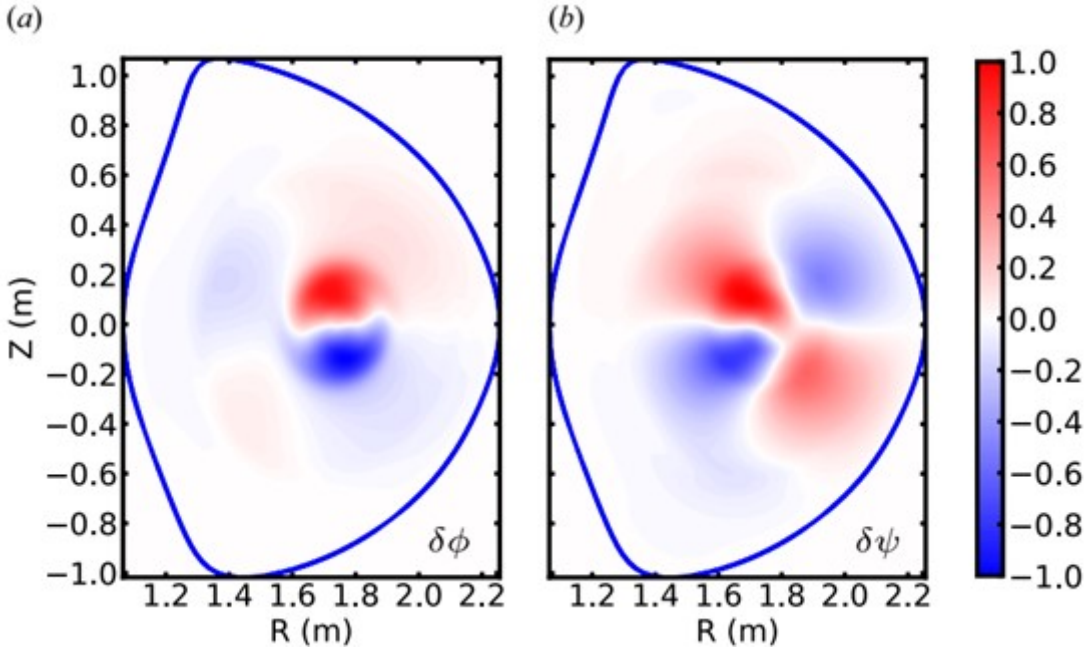

Figure 6: *Two-dimensional structure of $\delta\phi(a)$ and $\delta\psi(b)$ from DIII-D $n = 1$ linear simulation of the $q_{min} = 1.04$ case with thermal ions.*

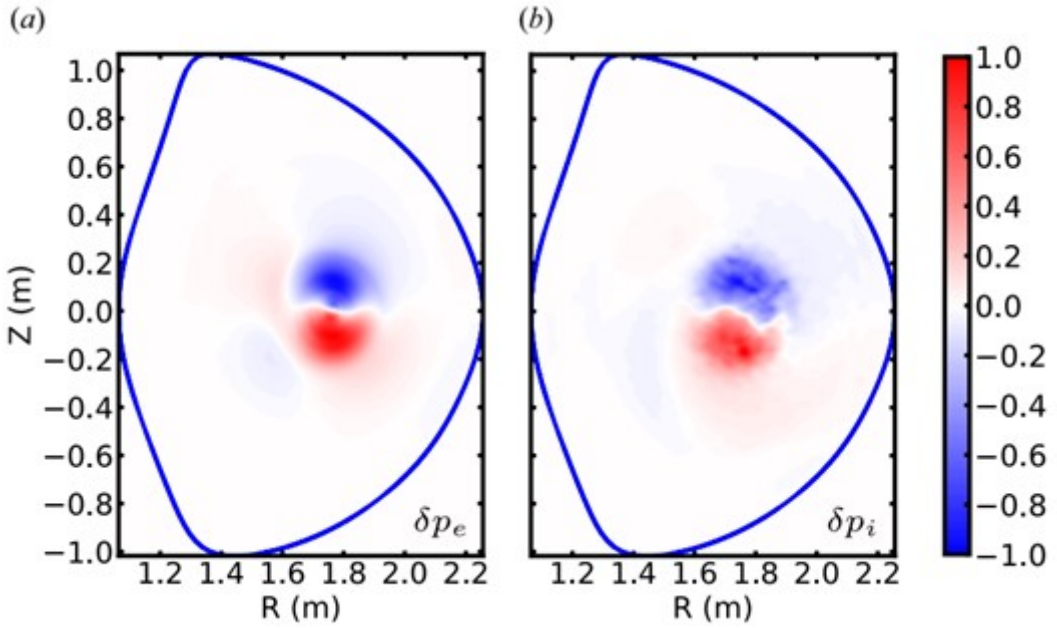

Figure 7: *Two-dimensional structure of perturbed electron pressure $\delta p_e(a)$ and thermal ion pressure $\delta p_i(b)$ from the linear simulation of the $q_{\min} = 1.04$ case with thermal ions.*

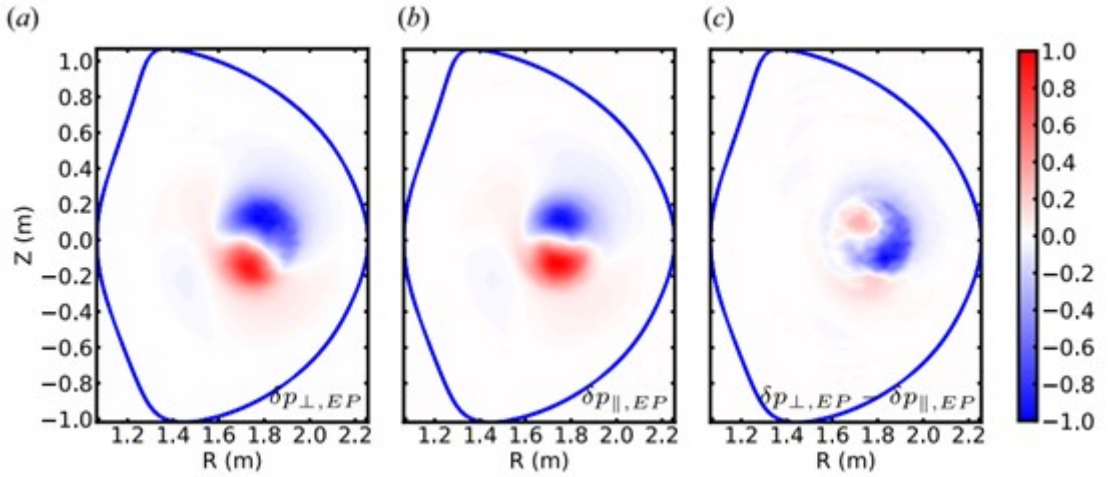

Figure 8: *Two-dimensional structure of perpendicular (a) and parallel (b) fast ion pressurefrom the linear simulation of the* $q_{\min} = 1.04$ *case with thermal ions, and the difference betweenthe two (c).*

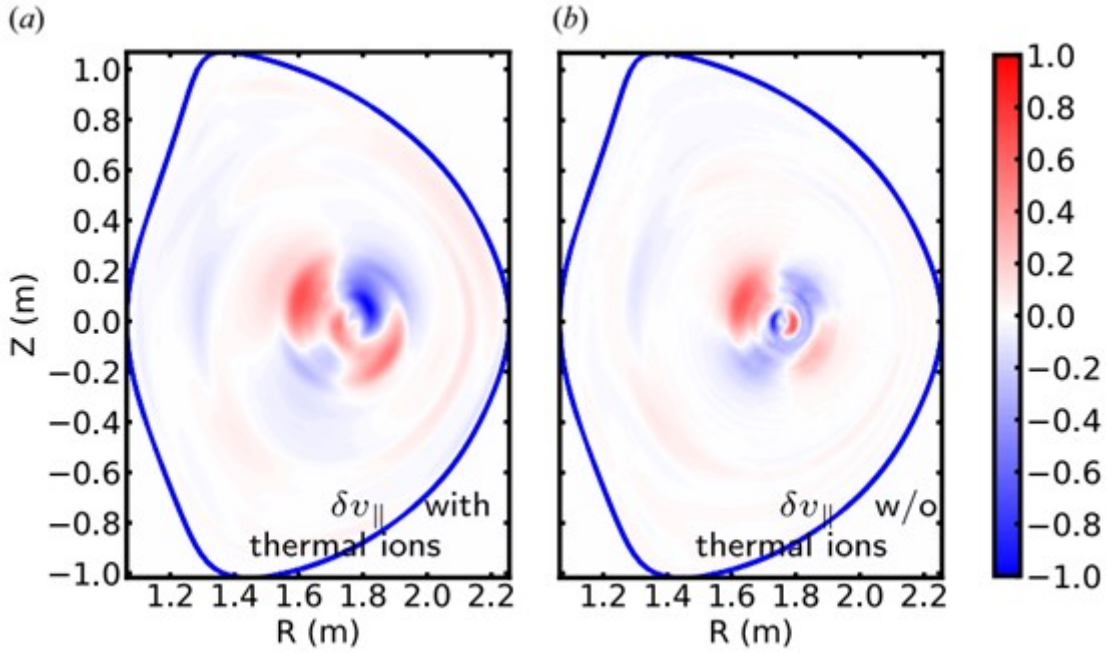

Figure 9: *(a) Structure of* $v_{\parallel}$*from the linear simulation of the* $q_{\min} = 1.04$ *case with thermal ions and synchronization of* $v_{\parallel}(2.20)$*. (b) Structure of* $v_{\parallel}$*from the linear simulation with only fast ions using the MHD equation (2.23).*

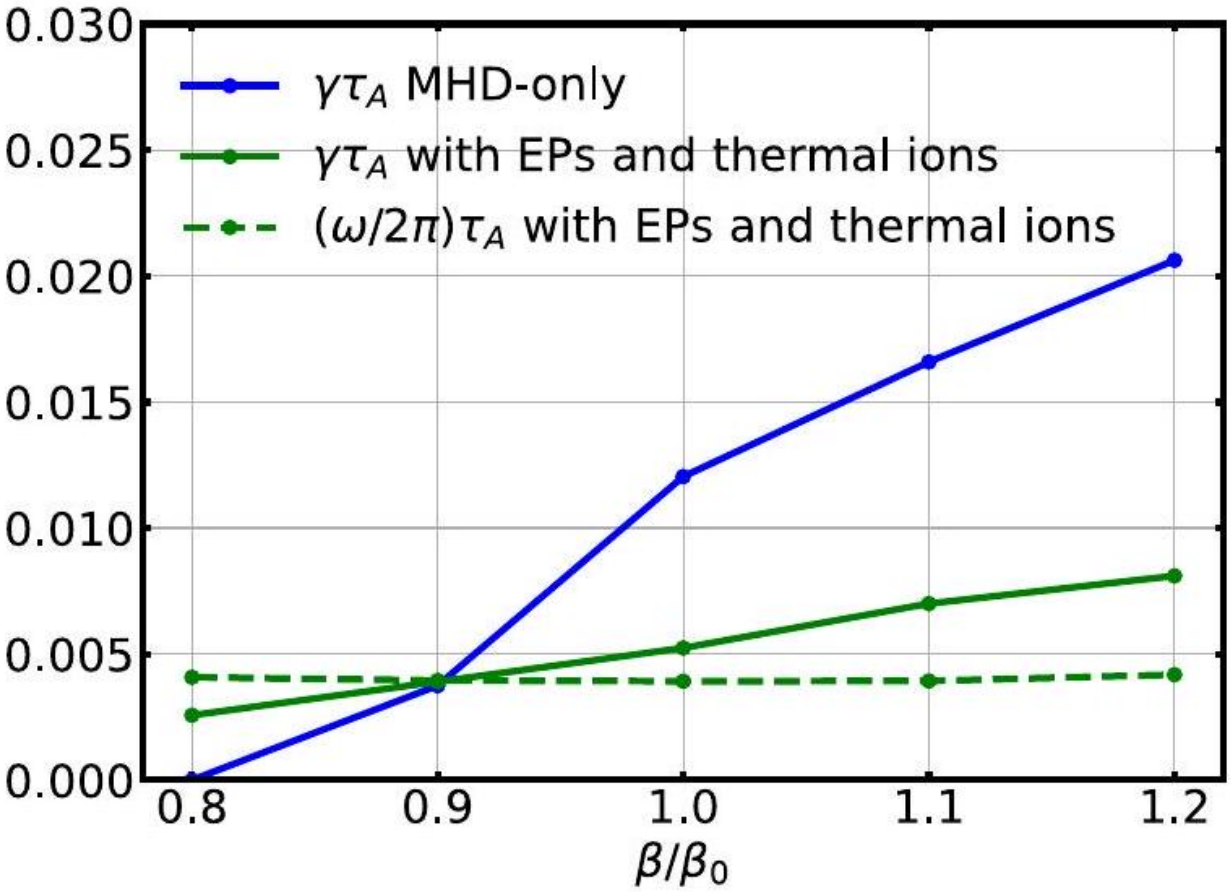

Figure 10: *Growth rates (solid lines) and frequencies (dashed lines) of the $n = 1$ mode with different plasma β (β_0 is the experimental value) and a fixed q profile. The blue line shows the MHD-only result. The green lines show the kinetic-MHD results with fast and thermal ions.*

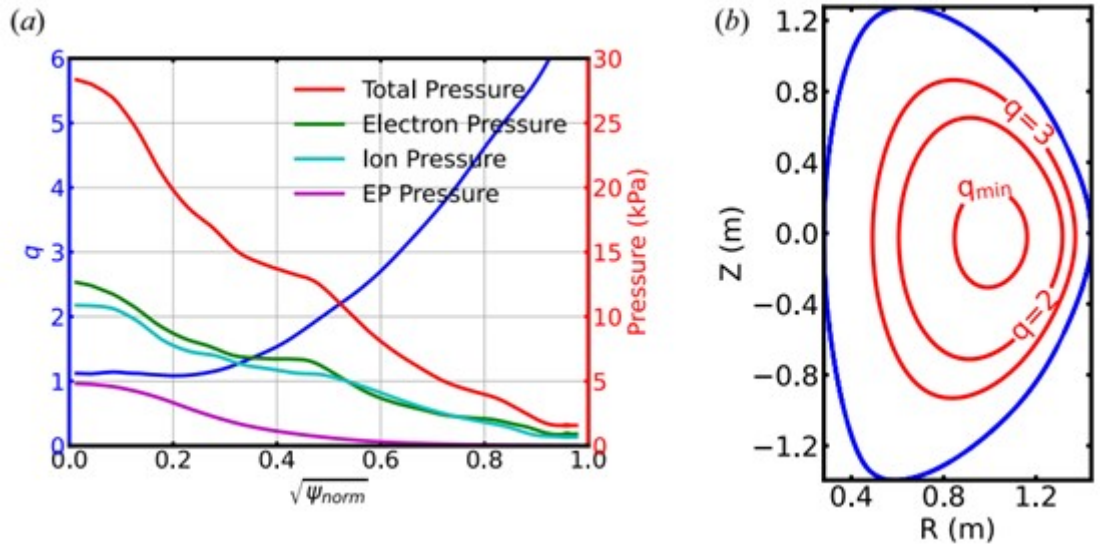

Figure 11: *(a) Profiles of q and pressure of different particle species of the equilibrium used in the NSTX simulation. (b) Flux contours and mesh boundary used in the simulation.*

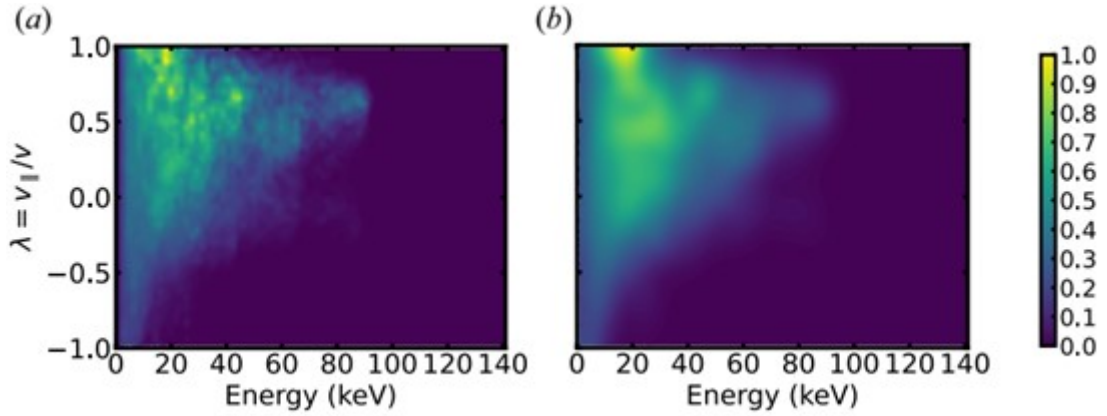

Figure 12: *(a) The original EP distribution of energy and pitch angle near the magnetic axis from NUBEAM. (b) The smoothed EP distribution that was used in M3D-C1-K simulations.*

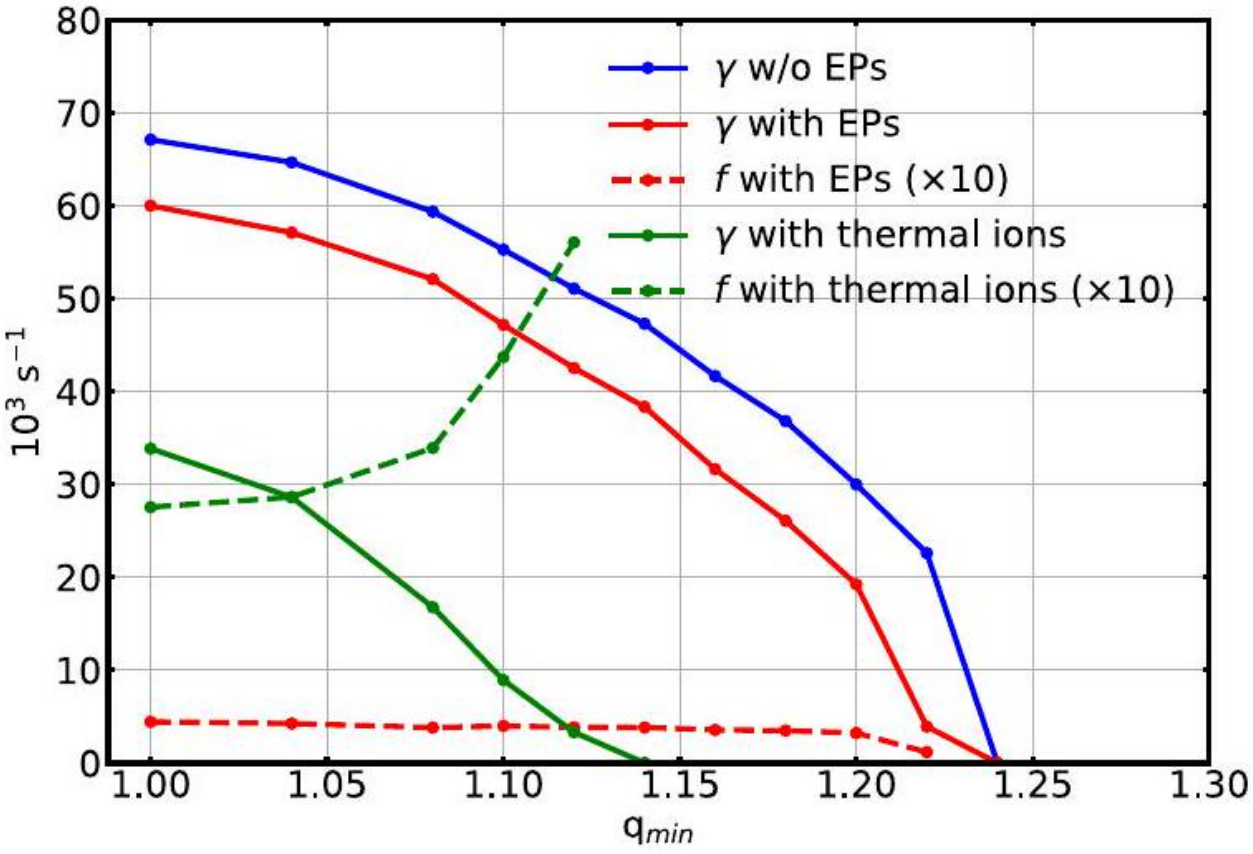

Figure 13: *Growth rates γ (solid lines) and frequencies f (dashed lines) as functions of q_{min} of the $n = 1$ modes from M3D-C1 linear simulation with NSTX equilibrium with fixed β. The blue line shows the MHD-only result. The red lines show the kinetic-MHD results with only fast ions. The green lines show the results with both thermal and energetic ions.*

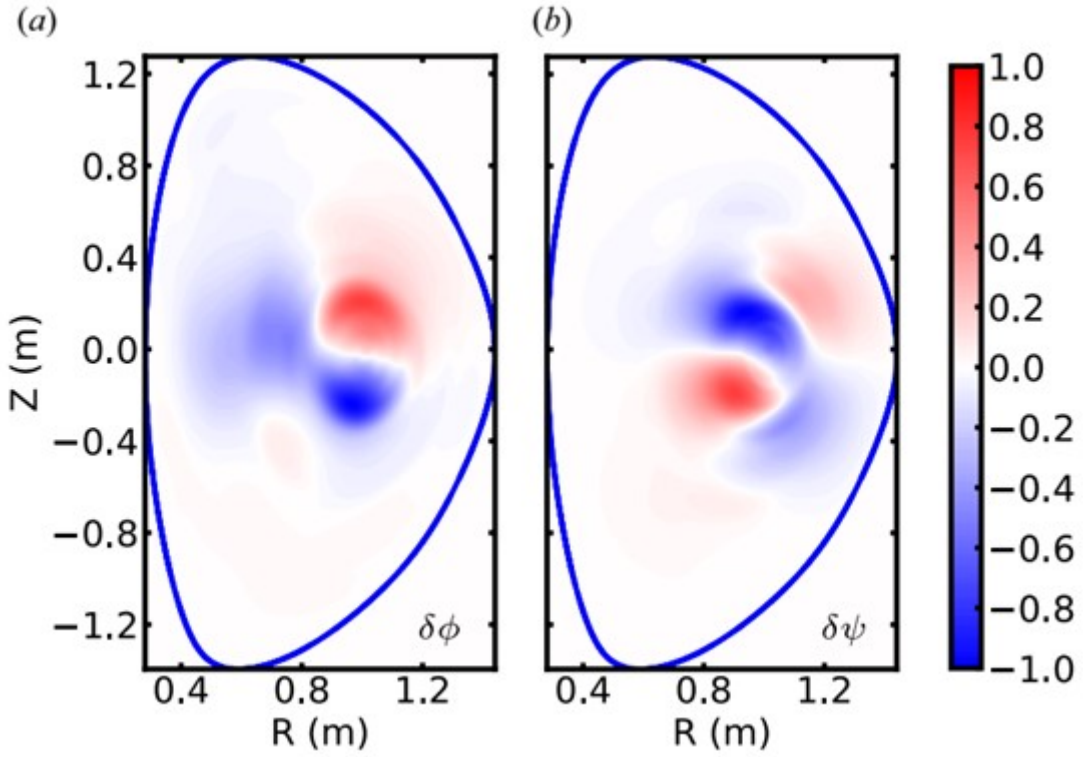

Figure 14: *Two-dimensional structure of $\delta\phi(a)$ and $\delta\psi(b)$ from NSTX $n = 1$ linear simulation of the $q_{min} = 1.08$ case with thermal ions.*

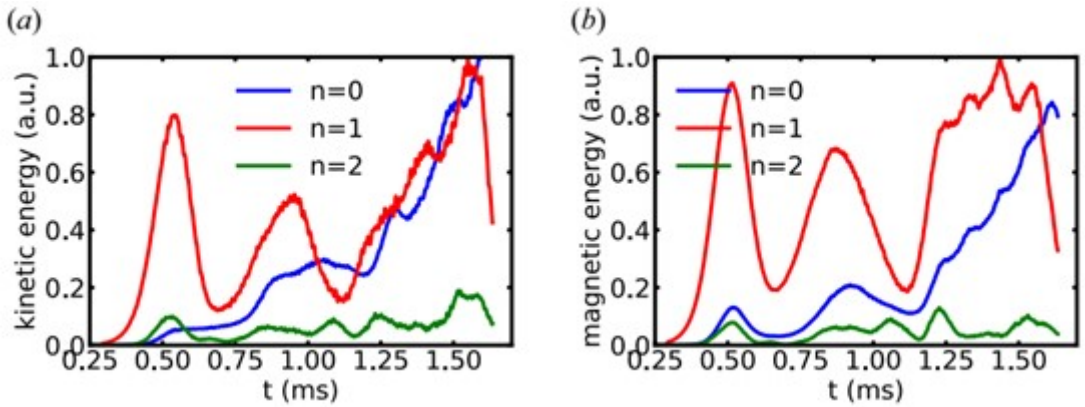

Figure 15: *Time evolution of kinetic energy (a) and magnetic energy (b) of different toroidalharmonics from NSTX nonlinear simulation of the $q_{min} = 1.08$ case with thermal ions.*

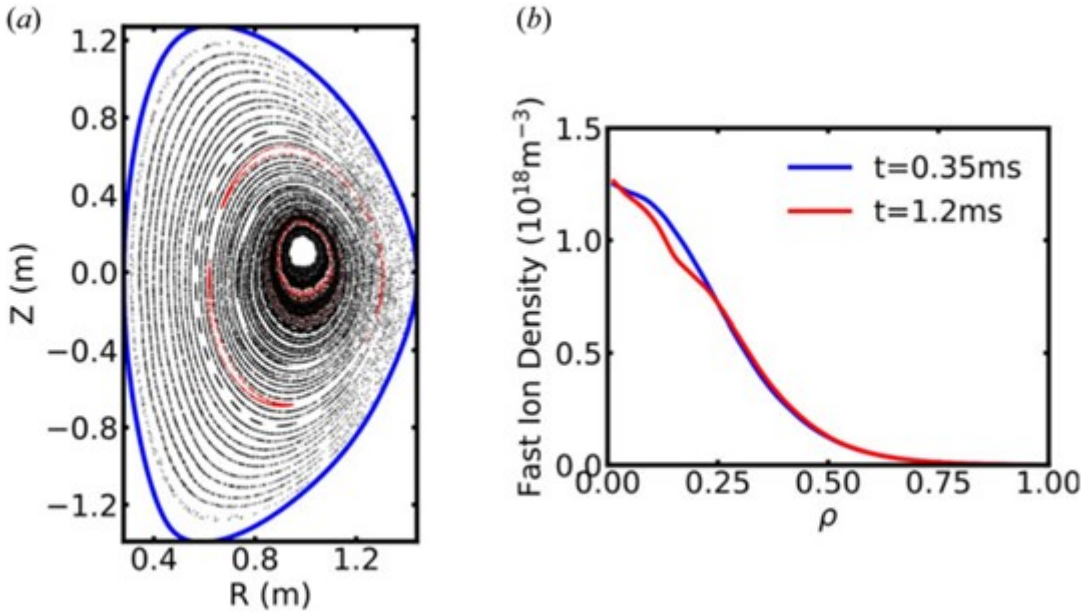

Figure 16: *(a) Poincaré plot of magnetic flux surfaces at* $t = 1.2$ ms*. The (1,1) and* $(2,1)$ *islands are marked as red. (b) Change of fast ion density profile in the nonlinear simulation of* $q_{min} = 1.08$ *due to mode excitation.*