Summary of Paper **PDP-10** Th (W) Ex(W)

Chirping in Plasmas; test of criterion for chirping onset & simulation of explosive chirping

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1. Considers two issues: (A) How to predict whether experimental configurations with energetic particles causing Alfvenic instabilities, is likely to chirp.
(B) Numerical simulation and theory of chirping avalanche using reduced modelling equations.
2. In investigation (A), quantitative refinement of Lilley, Sharapov, and Breizman (2009)) equation used to classify likelihood for energetic particles, causing Alfvenic instability, to induce frequency chirping. Input parameters taken from TFTR, NSTX and D-III-D data.
3. Agreement between the theoretical classification and experimental data obtained only if detailed phase space dependence of physical parameters taken. For D-III-D, inclusion of diffusion of energetic particles due to background turbulence essential for agreement.
4. Demonstration of chirping suppression in D-III-D when background turbulence suppresses.
5. In investigation B, reduced theory model developed based on perturbing drift average equilibrium orbits due to excitation of Alfvenic waves.
6. Model simulates TAE and EPM instability.
7. Simulation shows time evolution of spectrum for increasing hot particle beta β_{EP} first exciting the limited chirp TAE and then the EPM with rapid long range chirping (see figure).
8. Analytic theoretical description of chirping, caused by phase space clump moving outwardly across field lines achieved. Perhaps qualitative description achieved for chirping avalanche observed in NSTX