Abstract Submitted
for the DPP12 Meeting of
The American Physical Society

**Nonlinear Frequency Chirping of beta-induced Alfven Eigenmode**

HUASEN ZHANG, Fusion Simulation Center, Beijing University, Beijing, 100871, China, ZHIHONG LIN, IHOR HOLOD, Deparment of Physics and Astronomy, UC-Irvine, CA92697, USA — Energetic particles produced by fusion reactions and auxiliary heating can excite various Alfven eigenmodes in fusion experiments such as ITER. Associated nonlinear wave-particle interactions can generate significantly enhanced levels of energetic particle transport that would degrade overall plasma confinement and damage fusion devices. Increased energetic particle transport by Alfven eigenmodes has been correlated with a fast frequency oscillation (chirping) with a submillisecond period that has been observed in many experiments. Here we report the first dynamic observation of fast and repetitive frequency chirping by massively parallel, first-principles kinetic simulations without sources and sinks in a realistic toroidal geometry. The chirping dynamics provides a conceptual framework for understanding the nonlinear wave-particle interaction underlying transport processes in collisionless plasmas. The interaction of energetic particles such as cosmic rays with Alfven turbulence is also an important issue in space and astrophysical plasmas.

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Date submitted: 12 Jul 2012 Electronic form version 1.4