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Simulation Model of Rapid TAE Chirping GE WANG, H.L. BERK, U.Texas, Austin, IFS — Spontaneous nonlinear coherent frequency chirping structures can arise due to the resonant interaction of energetic particles with a discrete toroidal Alfven eigenmode (TAE). The initial development of a coherent structure is quantitatively described by a now standard hole-clump chirping theory. However, it is still unclear what conditions are needed for the TAE chirping frequency to deviate far from the bulk plasma eigenfrequency and enter the Alfven continuum. In our model, the linear TAE controlling equation is derived from the Berk-Mett quadratic form. The interaction is studied with the linear wave with the nonlinear response of energetic particles. For the present study we simplify the wave to a single symmetric couplet while a two-dimensional distribution is used to describe the energetic particles. In order to resolve the fine structure in the phase space, the numerical scheme integrates the Vlasov equation in the Fourier transformed phase space using a method developed by Breizman and Petviashvili. The simulation results show the saturated wave amplitude and square root law of the initial chirping are in accord with previous theory. We have found conditions where the chirping signal enters the Alfven continuum and a larger amplitude and more rapidly chirping signal then develops. Plots of the phase space structure can reproduce the shape of the separatrix structure that partitions the trapped and passing particles. We attempt to relate the portrait of the phase space structure with the measured wave amplitude and chirping frequency.

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