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Numerical and analytic models of spontaneous frequency sweeping for energetic particle-driven Alfven eigenmodes[1] GE WANG, H.L. BERK, Institute of Fusion Studies, University of Texas at Austin — The frequency chirping signal arising from spontaneous a toroidial Alfven eigenmode (TAE) excited by energetic particles is studied for both numerical and analytic models. The time-dependent numerical model is based on the 1D Vlasov equation. We use a sophisticated tracking method to lock onto the resonant structure to enable the chirping frequency to be nearly constant in the calculation frame. The accuracy of the adiabatic approximation is tested during the simulation which justifies the appropriateness of our analytic model. The analytic model uses the adiabatic approximation which allows us to solve the wave evolution equation in frequency space. Then, the resonant interactions between energetic particles and TAE yield predictions for the chirping rate, wave frequency and amplitudes vs. time. Here, an adiabatic invariant J is defined on the separatrix of a chirping mode to determine the region of confinement of the wave trapped distribution function. We examine the asymptotic behavior of the chirping signal for its long time evolution and find agreement in essential features with the results of the simulation.

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