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Small-Scale Irregularities in Equatorial Spread-F[1] YAKOV DIMANT, MEERS OPPENHEIM, Boston Univ — Equatorial Spread-F is a spectacular plasma phenomenon that reshapes the nighttime ionosphere and disrupts GPS navigation and radio communication. Current computer models simulate the evolution of large-scale spread-F phenomena (1000km-to-kilometer), but they do not explain what causes the meter-scale irregularities observed by radars and spaceborne instruments. Our recent particle-in-cell (PIC) simulations of weakly collisional plasma have demonstrated that large-scale plasma density gradients and related electric fields may drive local plasma instabilities, although only for a limited set of parameters. Motivated by these PIC simulations, we have revisited the linear theory of this instability, employing a novel and sophisticated eigenmode analysis. This method identified eigenmode wave structures in regions having strong plasma density gradients. These wave structures are not linearly unstable, but are not damped either. This means that small-scale fluctuations provided by an external source (e.g., by a nonlinear spectral cascade from longer-wavelength spread-F turbulence) can be resonantly amplified and may explain radar observations without invoking linear instability.

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