Ballooning instability with the magnetosphere-ionosphere feedback coupling

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The ballooning instability has been investigated as a possible mechanism for triggering the substorm in the magnetosphere. The ballooning mode is destabilized, when the interchange term provided with the pressure gradient and the magnetic curvature overcomes the line bending term causing the shear Alfven waves. In the magnetosphere-ionosphere (M-I) coupling system in polar regions, on the other hand, the shear Alfven waves (or the kinetic Alfven waves) can also be destabilized by the magnetospheric convection, if the ionospheric density change is taken into account with the feedback mechanism [1-3].
In the present study, we have investigated the ballooning and the feedback instabilities in the same theoretical framework. Our linear analysis demonstrates that, as the interchange term increases, the "unstable" shear Alfven waves with the opposite sign of the real eigenvalues in their lowest harmonic branch collide with each other and transit to the ballooning mode. It implies that competitions and/or interactions between the two instabilities may provide a plausible explanation of auroral breakup triggered through the M-I coupling.
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