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Correlation between Substorm Onset Ground and Space Observations: Implication for Kinetic Ballooning Instability

Correlation between Substorm Onset Ground and Space Observations: Implication for Kinetic Ballooning Instability

Chio Cheng[1*], T. F. Chang[1]
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[1]Plasma and Space Science Center, National Cheng Kung University
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The observations of substorm onset phenomena in the magnetosphere and ionosphere are examined to study their correlation and understand the substorm onset mechanism. In particular, we examine the Pi2 wave structure, propagation, frequency and growth rate in the magnetosphere observed by the THEMIS satellites and the structure and dynamics of the substorm auroral onset arcs. We show the correlation between the substorm onset arcs and the Pi2 pulsations in terms of wave structure, propagation, and the exponential growth of arc intensity and Pi2 wave amplitude. The correlation between the ground and space phenomena strongly supports the kinetic ballooning instability (KBI) as the cause of substorms. We demonstrate that KBI is most unstable in the strong cross-tail current region magnetic field lines and the KBI parallel electric field accelerates electrons along the magnetic field lines into the ionosphere to produce the substorm onset arc.

キーワード: substorm, kinetic ballooning instability, magnetospheric dynamics, magnetospheric structure
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