GLOBAL ALFVENIC INTERACTION

YAN SONG1, Robert L. Lysak1

1. School of Physics and Astronomy, University of Minnesota, 116 Church Street, S.E., Minneapolis, MN 55455, USA, email: yan@fields.space.umn.edu,

Based on a new dynamical theory of the generation of parallel electric fields, we propose that the breakdown of the frozen-in condition at current sheets and the generation of auroral electric fields are caused by Alfvenic interactions independent of diffusive or resistive terms. We suggest that substorm onset is the result of Alfvenic interactions in the global current system including the tail and magnetopause current sheets as well as the auroral field-aligned current system.

During the growth phase, Alfvenic interaction between the solar wind and magnetosphere occurs in multiple localized regions throughout the magnetopause current sheets and stresses the tail current sheet, leaving it susceptible to further dynamical processes that often involve the generation of MHD waves and wave mode conversion. The decrease of momentum transfer from the solar wind into the magnetosphere due to changes in solar wind parameters leads to a force imbalance in the whole magnetotail which may cause plasma flows and excite fast mode waves. These waves interact with the stressed current sheet and cause the breakdown of the frozen-in condition and the perturbations of fields and flows in multiple localized regions throughout the tail current sheet. During these processes and the further reconfiguration of the plasma sheet, Alfven waves carrying field aligned currents can be generated which lead to the subsequent auroral substorm development in the global M-I coupling system seen in the expansion phase.

There is a preconditioning time period from the decrease in momentum transfer to the substorm onset. The time scale for the preconditioning stage is determined by the external driven conditions, the inertial time scale for earthward moving of the tail plasma and the Alfvén transit time for the M-I coupling. We will discuss the characteristics of the signatures in space and on the ground given by the Global Alfvenic Interaction scenario. This Global Alfvenic Interaction scenario suggests that substorm onset results from coupled dynamical processes covering a broad range of temporal and spatial scales in a driven system that may follow a complicated temporal sequence.

Alfvenic, current

YAN SONG1, School of Physics and Astronomy, University of Minnesota, 116 Church Street, S.E., Minneapolis, MN 55455, USA, email: HYPERLINK "mailto:yan@fields.space.umn.edu" yan@fields.space.umn.edu