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Kinetic Ballooning/Interchange Instability in a Bent Plasma Sheet

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We use THEMIS and GOES observations to investigate the plasma sheet evolution on 28 February 2008 between 6:50 and 7:50 UT, when there developed strong magnetic field oscillations with period of 100 s. Using multi-spacecraft analysis of the plasma sheet observations and an empirical plasma sheet model, we determine both the large-scale evolution of the plasma sheet and the properties of the oscillations. We found that the oscillations exhibited signatures of kinetic ballooning/interchange instability fingers that developed in a bent current sheet. The interchange oscillations had a sausage structure, propagated duskward at a velocity of about 100 km/s, and were associated with periodical radial electron flows. We suggest that the observed negative gradient of the Z_{GSM} magnetic field component ($\partial B_Z/\partial X$) was a free energy source for the kinetic ballooning/interchange instability. Tens of minutes later a fast elongation of ballooning/interchange fingers was detected between 6 and 16 R_E downtail with the legnth-to-width ratio exceeding 20. The finger elongation ended with signatures of reconnection in an embedded current sheet near the bending point. These observations suggest a complex interplay between the mid-tail and near-Earth plasma sheet dynamics, involving localized fluctuations both in cross-tail and radial directions before current sheet reconnection.