

## Key Issues in Substorm Onset and Expansion

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Some key issues for understanding substorms are (1) substorm onset mechanism that includes the structure of growth phase magnetosphere, the structure and breakup of auroral onset arcs; and the structure of Pi2 waves and associated instabilities; (2) substorm expansion that includes depolarization and cross-tail current disruption and associated energetic particle injections in the ring current region. Observationally there has been much progress in the last few years on the pressure profile and magnetic field structure in the cross-tail current region, the structure of bright spots along the breakup arc, and the structure of Pi2 waves in the cross-tail current region and under the onset arcs, magnetic field dipolarization, and energetic particle injection. In this talk we present key features of substorm onset observation and their theoretical explanation. We will also discuss the possible mechanism of current disruption, magnetic field dipolarization and energetic particle injection during the substorm expansion phase.

Keywords: substorm, ring current, energetic particle injection, dipolarization, current disruption