



Substorms – a universal process at strongly magnetised planets?

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Abstract

The substorm has been studied for many decades by space- and ground-based observations of the Earth's magnetosphere and ionosphere and a detailed picture of its component phenomena and their inter-relations has been developed. The complexities have led to different physical interpretations and controversy or confusion as to whether a unifying model exists. Phenomena associated with substorms at Earth such as plasmoids and low frequency extensions (LFEs) of auroral kilometric radio emissions have also been observed at the strongly magnetised planets Jupiter and Saturn but whether they should be interpreted as evidence of substorms is controversial. In this presentation, we will synthesise the results of three studies to show that the recurrence of particle injections at Earth, plasmoids at Jupiter, and LFEs at Saturn can all be described within the common framework of an integrate-and-fire process, consistent with the general definition of the substorm as an intermittently recurring energy cycle that comprises a relatively sudden release of energy following a slower energy build-up. We will also identify differences in the corresponding dynamical equations and discuss how these likely relate to the different driving processes and magnetospheric properties at the different planets.