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Interplanetary magnetic field capture and release in planetary magnetospheres: contrasting slowly and rapidly rotating planets

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We review the capture and release of interplanetary magnetic flux by planetary magnetospheres, through the action of magnetic reconnection. At Earth, this results in the well-known Dungey cycle, the circulation of magnetospheric and ionospheric plasma and the formation of an extended magnetotail. Observations of the expanding/contracting polar cap allow quantification of the reconnection rates at the dayside magnetopause and in the magnetotail, and these are used in conjunction with a time-dependent model of the magnetotail to explore its dynamics. In the magnetospheres of rapidly-rotating planets the flux throughput is found to be heavily modified by twisting of the magnetotail magnetic field. This changes the order in which field lines are released by reconnection in the magnetotail, from a first-in-first-out paradigm, as at Earth, to a last-in-first-out system. The repercussions of this for the dynamics of the magnetotail and the flow in the ionosphere are discussed with particular emphasis on Saturn.