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Comparative Examination of Plasmoid Ejection at Mercury, Earth, Jupiter, and Saturn

James A. Slavin (1), Caitriona M. Jackman (2), and Marissa F. Vogt (3)

(1) Heliophysics Science Division, NASA Heliophysics Science Division, Greenbelt, MD 20771, United States (james.a.slavin@nasa.gov, 001-301-286-1648), (2) Physics Department, University College London, Dorking, UK , (3) Department of Earth and Space Sciences, University of California, Los Angeles, California, USA.

The onset of magnetic reconnection in the near-tail of Earth, long known to herald the fast magnetospheric convection that leads to geomagnetic storms and substorms, is very closely associated with the formation and down-tail ejection of magnetic loops or flux ropes called plasmoids. Plasmoids form as a result of the fragmentation of pre-existing cross-tail current sheet as a result of magnetic reconnection. Depending upon the number, location, and intensity of the individual reconnection X-lines and how they evolve, some of these loop-like or helical magnetic structures may also be carried sunward. At the inner edge of the tail they are expected to "re-reconnect" with the planetary magnetic field and dissipate. Plasmoid ejection has now been observed in the magnetotails of Mercury, Earth, Jupiter, and Saturn. These magnetic field and charged particle measurements have been taken by the MESSENGER, Voyager, Galileo, Cassini, and numerous Earth missions. Here we present a comparative examination of the structure and dynamics of plasmoids observed in the magnetotails of these 5 planets. The results are used to learn more about how these magnetic structures form and to assess similarities and differences in the nature of magnetotail reconnection at these planets.