



MESSENGER observations of substorm activity in Mercury's near magnetotail

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MESSENGER magnetic field and plasma measurements taken during crossings of Mercury's magnetotail from 2011 to 2014 have been examined for evidence of substorm activity. A total of 32 events were found during which an Earth-like growth phase was followed by clear near-tail expansion phase signatures. During the growth phase, the lobe of the tail loads with magnetic flux while the plasma sheet thins due to the increased lobe magnetic pressure. MESSENGER is often initially in the plasma sheet and then moves into the lobe during the growth phases. The averaged time scale of the loading is around 1 min, consistent with previous observations of Mercury's Dungey cycle. The dipolarization front that marks the initiation of the substorm expansion phase is only a few seconds in duration. The spacecraft then abruptly enters the plasma sheet due to the plasma sheet expansion as reconnection-driven flow from the near-Mercury neutral line encounters the stronger magnetic fields closer to the planet. Substorm activity in the near tail of Mercury is quantitatively very similar to the Earth despite the very compressed time scale.