MESSENGER Observations of Reconnection and Its Effects on Mercury's Magnetosphere

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During MESSENGER's second and third flybys of Mercury on October 6, 2008 and September 29, 2009, respectively, southward interplanetary magnetic field (IMF) produced intense reconnection signatures in the dayside and nightside magnetosphere and markedly different system-level responses. The IMF during the second flyby was continuously southward and the magnetosphere appeared very active, with large magnetic field components normal to the magnetopause and the generation of flux transfer events at the magnetopause and plasmoids in the tail current sheet every 30 to 90 s. However, the strength and direction of the tail magnetic field was stable. In contrast, the IMF during the third flyby varied from north to south on timescales of minutes. Although the MESSENGER measurements were limited during that encounter to the nightside magnetosphere, numerous examples of plasmoid release in the tail were detected, but they were not periodic. Instead, plasmoid release was highly correlated with four large enhancements of the tail magnetic field (i.e. by factors > 2) with durations of ~ 2 – 3 min. The increased flaring of the magnetic field during these intervals indicates that the enhancements were caused by loading of the tail with magnetic flux transferred from the dayside magnetosphere. New analyses of the second and third flyby observations of reconnection and its system-level effects provide a basis for comparison and contrast with what is known about the response of the Earth's magnetosphere to variable versus steady southward IMF.