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MAVEN Observations of Magnetic Reconnection on the Dayside Martian Magnetosphere

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The Mars Atmosphere and Volatile EvolutioN (MAVEN) mission offers a unique opportunity to investigate the complex solar wind-planetary interaction at Mars. The Martian magnetosphere is formed as the interplanetary magnetic field (IMF) drapes around the planet's ionosphere and localized crustal magnetic fields. As the solar wind interacts with this induced magnetosphere, magnetic reconnection can occur at any location where a magnetic shear is present. Reconnection between the IMF and the induced and crustal fields facilitates a direct plasma exchange between the solar wind and the Martian ionosphere. Here we address the occurrence of magnetic reconnection on the dayside magnetosphere of Mars using MAVEN magnetic field and plasma data. When reconnection occurs on the dayside, a non-zero magnetic field component normal to the obstacle, B_N, will result. Using minimum variance analysis, we measure B_N by transforming Magnetometer data into boundary-normal coordinates. Selected events are then further examined to identify plasma heating and energization, in the form of Alfvénic outflow jets, using Solar Wind Ion Analyzer measurements. Additionally, the topology of the crustal fields is validated from electron pitch angle distributions provided by the Solar Wind Electron Analyzer. To understand which parameters are responsible for the onset of reconnection, we test the dependency of the dimensionless reconnection rate, calculated from B_N measurements, on magnetic field shear angle and plasma beta (the ratio of plasma pressure to magnetic pressure). We assess the global impact of reconnection on Mars' induced magnetosphere by combining analytical models with MAVEN observations to predict the regions where reconnection may occur. Using this approach we examine how IMF orientation and magnetosheath parameters affect reconnection on a global scale. With the aid of analytical models we are able to assess the role of reconnection on a global scale to better understand which factors drive these dynamics in the space environment of Mars.