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MESSENGER Observations of Magnetic Reconnection in Mercury's Magnetosphere

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The nature of magnetic reconnection in planetary magnetospheres may differ between various planets due to large differences in upstream solar wind conditions and internal planetary environments [1]. Mercury has a relatively weak magnetic field, with a planetary dipole moment about 3 orders of magnitude weaker than that of Earth [2]; on the other hand, as the innermost planet it experiences stronger solar wind forcing than Earth and other planets. The small and compressed nature of Mercury's magnetosphere [3,4] combined with the planet's lack of atmosphere and ionosphere provides a unique plasma laboratory in the solar system. The greater interplanetary magnetic field magnitude and higher Alfvén speed in the inner solar system than that at Earth makes magnetic reconnection play a dominant role in Mercury's magnetosphere [5,6]. Recent MESSENGER observations of reconnection-related structures and phenomenon, including substorm-like activity [7,8], dipolarization events or reconnection fronts [9,10], and the formation of magnetic flux ropes [11-14], show similar to that at Earth but with very compressed timescales. With no direct onsite detection of reconnection sites, the nature of magnetic reconnection in Mercury remains unclear. Here shows the detection of active reconnection region by the MESSENGER spacecraft in Mercury's space environment. The observations show the rapid and impulsive nature of the exceedingly driven reconnection in Mercury's magnetospheric plasma [15]. The common signatures of reconnection in Mercury's space environment will be compared with Earth.

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