



On the loss of Mercury's dayside magnetosphere

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Mercury's interaction with the solar wind is unique in our solar system due to its weak global magnetic field and the planet's proximity to the Sun. The magnetosphere of Mercury is therefore highly dynamic, especially during times of interplanetary coronal mass ejections (ICMEs), which travel at high speeds compared to the solar wind and carry mass and magnetic field from the Sun. It has been long hypothesized and modeled, but never observed, that the magnetic flux on Mercury's dayside may be completely eroded or compressed below the surface during extreme conditions. Such an event allows Mercury to temporarily act as an unmagnetized airless body, with the ICME plasma interacting directly with Mercury's surface, weathering the regolith and sputtering particles into the exosphere. We explore this possibility through ICME observations at Mercury by the MESSENGER spacecraft. The collapse of Mercury's dayside magnetosphere has important implications for exoplanets in the so-called "habitable zone" of magnetically active M dwarf stars, as such events are likely to be much more common in these systems. Loss of planetary magnetospheres could significantly contribute to planetary atmospheric loss, affecting habitability and the potential for emergence of life.