

Mercury

Mercury is the closest (0.39 AU) [planet](#) to the [Sun](#). It is one of the terrestrial planets, but differs somewhat from the others. It has, e.g., an exceptionally high density, a [magnetosphere](#) with unknown origin, and no permanent [atmosphere](#) or [ionosphere](#). An interesting point in Mercury is that since the ions from the surface (Na and K) found in the magnetosphere are so different from the [solar wind](#) ions, it will be possible to study the penetration of solar wind into a terrestrial type magnetosphere!

The magnetosphere - solar wind [interaction](#) must lead to the development of a magnetospheric current system, and magnetospheric [substorms](#) take place. Most features of substorms observed in [Earth](#) are also seen in Mercury: magnetic field dipolarization, [particle injections](#), [FACs](#), [plasma sheet](#) heating, and IMF Bz correlation. The substorms are very short-lived, only couple of minutes. Because of the absence of the Hermean ionosphere, comparison of substorms on Earth and Mercury would be useful: for example, the substorm [current wedge](#) (SCW, an important part of substorms in Earth) requires a tight coupling between the magnetospheric and ionospheric plasmas. Now, because of the missing ionosphere, the SCW is difficult to set up in Mercury, since there is no obvious place to close the current. Possibilities are to close it via

1. nightside lithosphere (surface)
2. dayside pickup ion sphere (sputtered from surface)

Note that some of the current substorm [models](#) invoke the ionosphere-magnetosphere coupling as a key element in the substorm development.

Mariner 10 made three flybys of Mercury in the 70s. For references, see e.g. Luhmann et al. (1998). Now ESA plans a new mission to the planet, called the Mercury Orbiter.

References

- Luhmann, J. G., C. T. Russell, and N. A. Tsyganenko, Disturbances in Mercury's magnetosphere: Are the Mariner 10 "substorms" simply driven, *J. Geophys. Res.*, 103, 9113-9119, 1998.

See also [Wikipedia on Mercury](#).