

Magnetospheres of the Solar System: Status after 46 Years

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Following the discovery of Earth's magnetosphere by Van Allen et al (1959), there was intense speculation on the potential presence of magnetospheres in other solar system planets. Missions to Venus (Mariner 2, 1962) and Mars (Mariner 4, 1965) only managed to establish upper limits to the magnetic moments of both ($M/M_E \leq 10^{-4}$) and showed that magnetic fields are not necessarily a universal planetary property. The Pioneer missions to Jupiter revived interest in magnetospheres, and the discovery of a magnetic field on Mercury (Mariner 10, 1975) proved a surprise to many, given the results at Venus and Mars. Following the Voyager encounters with Jupiter, Saturn, Uranus, and Neptune, we now know that magnetospheres are the rule rather than the exception in solar system planets. The only unknown at this time is investigation of Pluto's interaction with the solar wind, and we will know the answer by ~2016 following the encounter with the New Horizons spacecraft. There are many similarities but also big differences among planetary magnetospheres, ranging from presence/absence of radiation belts, internal/external plasma sources and energy, and evidence for substorm activity, to upstream particle escape/acceleration in the vicinity of the planetary bow shock, among many others. A review of some of the principal characteristics will be presented and discussed in the context of current theoretical models.