

The Hohmann-Parker Effect and its Consequences Measured by the Mars Science Laboratory on the Transfer from Earth to Mars

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We show that a spacecraft launched from Earth towards Mars following a Hohmann minimum energy transfer trajectory has a strong tendency to remain well-connected magnetically to Earth, in the early phase of the transfer, or to Mars in the late phase, via the Parker spiral magnetic field. On the return trip, the spacecraft would remain reasonably well-connected first to Mars and later to Earth. Moreover, good magnetic connectivity occurs on all Hohmann transfers between neighboring planets in the inner solar system out to Mars. We call this hitherto unnamed circumstance the Hohmann-Parker effect. We show consequences of the effect by means of simultaneous cosmic radiation proxy observations made near Earth, near Mars, and at the Mars Science Laboratory on the transfer from Earth to Mars in 2011/2012. We support the observations with simulations of the large-scale magnetic field of the inner heliosphere during this period and compare the results with our predictions. The implications of the Hohmann-Parker effect are discussed.