

First Observation of Magnetic Pulsations on Martian Surface

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Landed in the western Elysium Planitia on Mars on November 26, 2018, InSight is the first Mars surface mission that carries a magnetometer. One of the research topics that can be investigated by using the InSight FluxGate (IFG) magnetometer observations is ultra-low-frequency (ULF) magnetic pulsations. Past and ongoing Mars orbiter missions have observed several types of magnetic pulsations near the planet, but whether any of them can reach the Martian surface is an open question. We study the initial IFG data to examine whether and what types of magnetic pulsations are present on the Martian surface. We have found continuous pulsations (Pc) with frequencies at ~10 mHz occurring mostly near midnight. Pc at lower frequencies (of the order of 1 mHz) has also been found in the local morning. The data from the Temperature and Wind for InSight Subsystem (TWINS) confirm that these ULF oscillations in the IFG data are not caused by the wind-driven motion of the lander. Data from the Mars-orbiting MAVEN spacecraft show that the ~10-mHz magnetic pulsations observed by InSight are different from the upstream waves in the foreshock region but may be induced by the oscillations in the tail plasma sheet. The observed continuous pulsations on the Martian surface near midnight are distinct from what are typically observed on the Earth's surface at the same local hours. The different field and plasma environment at Mars raises interesting questions regarding how the magnetic pulsations in the induced magnetosphere propagate to the surface.

Keywords: Mars, NASA InSight mission, surface magnetic field, induced magnetosphere, solar wind interaction with Mars