

Lunar Magnetic Anomalies and the Solar Wind Interaction

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The Moon, an airless body, lacks global magnetic field as well. However, there are certain regions having intense magnetic field, known as lunar magnetic anomalies (LMA). Typically, the strength of the field in the LMAs are in the range of few nano Tesla to few hundred nano Tesla. Solar wind, the continuous flow of supersonic magnetized plasma from the Sun, directly impinges on the Moon and interacts with the regolith. Whether the LMAs are strong enough to stand-off the solar wind to form a magnetosphere (similar to that of Earth where the global magnetic field blocks the solar wind) was an open question until the recent lunar missions such as Chandrayaan-1 and Kaguya. Observations from Chandrayaan-1 showed for the first time that LMA indeed form a small scale magnetosphere, known as mini-magnetosphere, and the solar wind is diverted to flow around the magnetosphere. Significant fraction of solar wind protons gets deflected from the LMAs with a high deflection efficiency of 50% over large and stronger anomalies. By these processes, LMAs shields the lunar surface from solar wind bombardment, a process known as space weathering. This reduced space weathering in the regions of LMAs is considered to be one of the potential mechanisms responsible for the high albedo feature on the lunar surface, known as swirls. Further, the solar wind protons deflected by LMAs move under the influence of interplanetary magnetic field and convective electric field of solar wind and contributes significantly to the plasma environment around the Moon. Recent studies have shown that such protons can access the nightside of the Moon as well. Thus, LMAs play vital role in the interaction of solar wind with the Moon and modifies the lunar plasma environment and the space weathering.