Lunar magnetic anomalies in the solar wind: A possibility of mini-magnetosphere

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The moon does not have the large-scale magnetic field like the earth. However, it is well known that local magnetic anomalies exist on the lunar surface though their cause has not been revealed.

Lin et al.(1998) suggest from the Lunar Prospector (LP) observations that a mini-magnetosphere was formed in the solar-wind downstream of the strong magnetic anomaly in the Imbrium antipodal region. Harnett et al.(2000, 2002) demonstrate the presence of lunar mini-magnetospheres with MHD and particle simulations. If the solar wind plasma is deflected by the mini-magnetosphere, this role of a barrier could produce high-albedo regions around magnetic anomalies (e.g. Hood.et.al.2001; Richimond et al.2003). Such area may be one of the candidates for the future lunar base.

Thus, the presence of lunar mini-magnetospheres is interesting from not only a scientific but also a practical standpoint. Hence, we investigate magnetic anomaly fields in the solar wind using the LP low-altitude (15-40 km) data (Level 1).

In this study, magnetic anomalies were mapped from the observation data in the tail lobe, the moon wake and the solar wind, and were compared with each other. We analyzed three representative anomaly regions: Crisium antipodal region (122W, 18S), Descartes region (16E, 12S), and Reiner Gamma region (58W, 8N). In particular, Crisium antipodal and Reiner Gamma regions show clear magnetic anomalies even in the solar wind. We further carried out a detailed analysis of three components of magnetic fields for Reiner Gamma region. As a result, some effects of the solar wind plasma on the magnetic field structure are recognizable for Reiner Gamma region and suggest the presence of mini-magnetosphere on this region.

We will also analyze correlation with magnetic fields, plasma density, and velocity of the solar wind and discuss the presence of lunar mini-magnetospheres.