

Magnetic lines of force due to lunar magnetic anomalies observed by the Lunar Magnetometer onboard SELENE (Kaguya)

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The Moon does not possess its intrinsic global magnetic field at the present, but magnetic anomalies on the lunar surface have been found through the magnetic field observation around/on the Moon so far. The Lunar Magnetometer (LMAG) onboard the SELENE (Kaguya) spacecraft also observed the magnetic field around the Moon at a nominal altitude of 100 km, and global maps of the vector magnetic field due to lunar magnetic anomalies were successfully obtained. Such maps are useful for studying electromagnetic environment around the Moon with respect to behavior of plasmas, interaction between the lunar magnetic field and the solar wind, and so on. However, it is occasionally inconvenient to use such maps, because each map can give information on only one component of the magnetic field. Hence we attempt to express the magnetic field due to lunar magnetic anomalies in terms of magnetic lines of force.

The lunar crustal magnetic field can be expressed in terms of any magnetic field sources. We here use the EPR (Equivalent Pole Reduction), which is one of equivalent source methods; that is, we put magnetic monopoles on the lunar surface as the equivalent source, and determine their values from magnetic field data obtained by the LMAG. Thus the EPR enables us to calculate a potential magnetic field above the lunar surface using the distributed monopoles. Then it is possible to trace respective field lines. Typical distance between poles is about 15 km, so that the magnetic field due to the monopoles at an altitude higher than 15 km is well represented.

We draw magnetic lines of force at altitudes between 30 km and 400 km. It should be noted, however, that there exists an external field in reality, and that the magnetic field is not static but dynamic due to interaction between the field and the solar wind. Nevertheless, such representation of the lunar crustal magnetic field could give insights on electromagnetic environment about the Moon, and therefore it is informative and valuable.

Keywords: lunar magnetic anomaly, SELENE (Kaguya), LMAG, magnetic lines of force