

THE RADIUS OF THE LUNAR CORE ESTIMATED FROM THE INDUCED MAGNETIC MOMENT OF THE MOON MEASURED BY SELENE (KAGUYA)

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Observationally constrained size of the lunar core is informative to investigate the thermal history of the moon by discussing how the lunar magnetism was generated by probably a small core, how the core was cooled, and when the lunar dynamo ceased to generate its magnetic field. There are several estimates of the size of the lunar core by information obtained by geodetic observations such as the moment of inertia and the Love numbers of the moon, and a small core of radius smaller than 450 km was suggested. Magnetic field data obtained by Apollo 15, 16 and Lunar Prospector, when the moon was in the Earth's magnetosphere, were used to estimate the size of the lunar core by assuming that observed induced magnetic moment was entirely due to the induction in the highly conducting core. The estimated sizes of the core by these magnetic field measurements are smaller than 400 km, which are consistent with those obtained by the geodetic information. We estimated the size of the core using the magnetic field data obtained by LMAG on board SELENE. Two methods, a stacking method and a constrained spherical harmonic expansion, were employed to estimate the induced moment and core size.

We obtained that the induced magnetic moment of the lunar interior is $(-1.9 \pm 9.5) \times 10^{22}$ Gauss-cm³ per Gauss of the external field by the stacking method, and slightly larger induced moment was obtained by the spherical harmonic expansion. If the induced moment is entirely due to highly conducting core, the radius of the core is 335 km.

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