

The Lunar Mascons Reconsideration

Takayuki Sugano[1], Kosuke Heki[2]

[1] Dept. of Math. and Phys. Sci., Grad. Univ. Advanced Studies, [2] Div. Earth Rotation, National Astron. Obs.

The Lunar Prospector extended mission with low altitude (10- to 40-km) provides higher resolution gravity model (100th-degree and -order) than historical models. Recently, the LOS gravity data have become open to the public via internet. It is a good opportunity for us to reconsider the formation/support mechanism of lunar mascons.

The gravity model for the Moon was dramatically improved by two U.S. space crafts, Clementine and Lunar Prospector (LP), that were launched in 1990's. The LP data were combined with Lunar Orbiter (LO)-1 to -5, Apollo-15, -16 subsatellites, and Clementine data. It resulted in a 75th-degree and -order spherical harmonic gravity model [Konopliv et al., 1998]. The gravitational potential is expressed in terms of the spherical harmonics. The high degree harmonics reflect small gravitational objects on the Moon.

The positive gravity anomalies associated with the mare fill circular basins have been discovered by LO-5 [Muller and Sjogren, 1968]. This excess mass concentrations are called mascons. The formation hypotheses can be categorized into two schemes: (1) passive formation models state that molten basalt was caused by global heating of the Moon, and then flooded the basins. (2) Active formation models relate mascon formation directly to the effects of the impacts on the Moon. The support mechanism hypotheses are also categorized into two schemes, the elastic support models and viscous decay models [Arkani-Hamed, 1998]. The mascons preserve important information about past thermal history and evolution of the Moon.

The LP extended mission with low altitude (10- to 40-km) provides higher resolution gravity model (100th-degree and -order) than historical models. Recently, the LOS (Line-Of-Sight) gravity data have become open to the public via internet. It is good opportunity for us to reconsider the formation/support mechanism of mascons.