# Lunar Gravity Field from LP LOS data (1) Nearside free-air gravity anomaly map

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Gravity field of the Moon is inferred from the frequency shift of the Doppler signal along the line-of-sight between a lunar orbiter and an Earth station. Two kinds of data sets are available from the Lunar Prospector mission, i.e., i) LOS acceleration data, and ii) 165th-degree and -order model (LP165P).

The LP165P is a global spherical harmonic model obtained by the LOS Doppler data using an orbit determination program (ODP). Such an ODP is complex and the full inversion needs a long calculation time. Nevertheless, the gravity model doesn't make full use of the LOS data because of the limited computer performance [Konopliv et al., 2001].

In contrast, by handling the LOS data directly, we can construct the model based on a simple physical model, and with a shorter computation time. LOS data are divided into two sets, 1 year nominal mission with an average height of 100 km, and a half year of extended mission with an average height of 30 km. It is empirically known that we can detect structure approximately as large as the s/c height. Therefore, by using the LOS extended mission data, we can draw higher resolution gravity map than past models.

In the analysis of LOS data, we took account of the parallax effect by lunar optical libration (less than 5 deg.). The lunar surface is divided into 20 degree x 20 degree blocks, and mass of each of the subblocks, about 1 degree x 1 degree, was simultaneously estimated for individual blocks. Thus we obtained a detailed lunar nearside gravity anomaly map, with the resolution equal to 200th-degree and -order spherical harmonic model, which enables us to see a smaller gravitational structure than ever seen.