DETERMINATION OF THE LUNAR k2 LOVE NUMBER FROM SATELLITE TRACKING DATA

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Tides are raised on the Moon by the gravitational attraction of the Earth and Sun. The Moon's elastic response to these tides is described by Love numbers, of which the second degree tides are the strongest. The influence on the gravitational potential due to these tides is described by the potential Love number k2. This Love number can help constrain models of the deep lunar interior, as it provides information about the state of the core, amongst others. For the Moon, the size and composition of the lunar core are not yet fully determined. Recent analysis indicates a molten core with the possibility of a solid inner core. The uncertainty in k2 however is currently close to what is required to distinguish between different mod-els of the deep lunar interior.

By taking the tidal potential into account in the processing of satellite tracking data, the value for k2 can be determined. This has been done in the past for Venus and Mars. For the Moon, the main means of de-termining the k2 value have come from lunar laser ranging, with recent solutions for k2 around 0.0210. Spacecraft-derived estimates also exist; analysis of Lunar Prospector data gave k2 = 0.026, while a recent re-analysis of these data showed a value more consistent with lunar laser ranging, k2 = 0.0213. This re-cent analysis consisted of processing all the historical tracking data with different parametrisations for the space-craft orbits in order to determine the variability of a spacecraft-derived lunar k2 Love number. The results of this analysis are presented here.

Furthermore, the SELENE (KAGUYA) mission, launched on September 14, 2007, will provide data to study the lunar interior. By means of 4-way Doppler tracking between the main and a relay satellite, the first global tracking data for the Moon will be obtained. A differential VLBI experiment is also carried out using the two subsatellites. Simulations show that the lower spherical harmonical degrees of the grav-ity field model expansion are expected to be improved up to one order of magnitude. This also means that the current estimate for k2 is expected to improve. Results for the estimation of k2 using SELENE tracking data are also discussed.