

Observations by GRAIL and LRO of the Orientale Impact Basin

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Abstract

The twin spacecraft GRAIL gravity mission of the Moon have obtained unprecedented observations of the Moon's gravity field and during the final few days of the mission were just a few km above the surface in the region of the Orientale Basin. These observations have enabled a very close look at the mass and density variations across the basin.

Orientale basin

Orientale is the youngest major lunar impact basin with an estimated age of ~3.8Ga. Figure 1 shows the topography (top) and the free-air gravity field (bottom) showing the clear correlation between gravity and topography. Nearly every feature seen in the topography also has a gravity signal. The spatial resolution of the gravity is an average of approximately 5 km over the basin but is finer under the ground track of the 2 spacecraft during their final few orbits.

The Bouguer gravity, developed by removing the gravity potential of the LOLA topography from the GRAIL free-air gravity of the local region, provides insight into the variations in crustal density across the basin. A zonal profile of the gradient of the Bouguer potential through the center of the Orientale depression at 263E correlates with almost every feature seen in the topography of the basin, including the edges of the inner depression, the inner and outer Rook rings, and cordillera ring.

The crustal thickness under the inner depression is estimated to be about 4 km and under the outer rings is about 40 km, comparable to the global average crustal thickness for the non-mare regions of the Moon. We will present our current interpretation of the structure of the basin from the gravity observations.

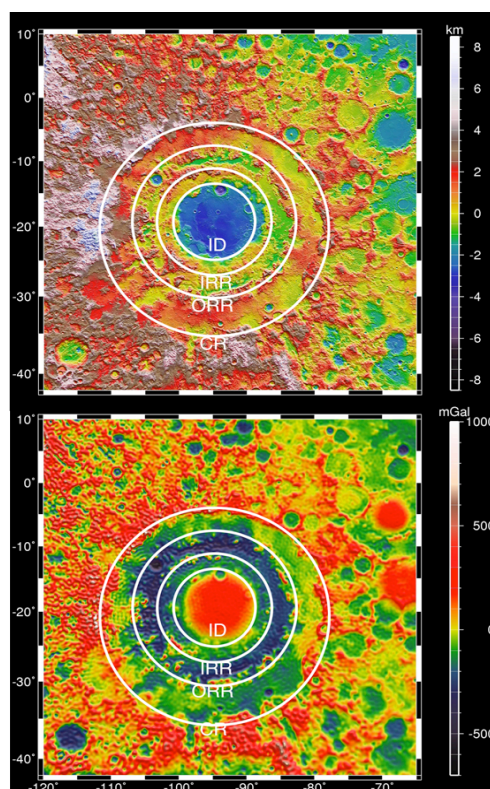


Figure 1: The topography (top) and free-air gravity (bottom) of the Orientale impact basin.

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