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# The Measurement of the Lunar Gravity Field with the GRAIL Discovery Mission

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In Sept 2011 the GRAIL Discovery mission to the Moon will be launched to measure the lunar gravity field and to increase our understanding of the Moon's interior structure. Using 2 spacecraft in identical 50 km altitude near circular orbits GRAIL will measure the relative velocity of the two spacecraft, separated along-track by 50 to 200 km, to a few microns per second every 5 seconds. These relative velocity measurements are very sensitive to almost all wavelengths of the lunar gravity down to about 20 km, limited by the altitudes of the spacecraft. The data will provide an unprecedented gravity model for the Moon, more accurate than any so far obtained, and help answer questions about the Moon's origin and evolution. The primary objectives of the mission are: (1) Determine the structure of the lunar interior, from crust to core; and (2) Advance understanding of the thermal evolution of the Moon. The secondary objective is to: Extend knowledge gained from the Moon to other terrestrial planets. GRAIL has six specific science investigations: 1. Structure of the lunar crust and lithosphere; 2. Asymmetric thermal evolution; 3. Subsurface structure of impact basins and the origin of mascons; 4. Temporal evolution of crustal brecciation and magmatism; 5. Interior structure from lunar tides; and 6. Constraints on whether the Moon has an inner core. GRAIL will provide a gravity model to degree and order 270 with an accuracy of better than 10 mGal in a 1-degree square on a global length scale and to a precision of 0.1 mGal for a 1 degree square on local scale of 100 km.
The GRAIL spacecraft will arrive at the Moon on or about Jan 1, 2012 and begin a 2-month orbit and spacecraft alignment and checkout process. This will be followed by a 3 month observation period during which the very high accuracy inter-satellite tracking data will be obtained.