



## **The GRAIL Discovery Mission for Launch Sept 2011**

Maria T Zuber, David E Smith, Michael Watkins, and the GRAIL Science Team  
MIT, Dept of EAPS, Cambridge, United States (zuber@mit.edu, 617-253-8298)

The GRAIL Discovery mission is a twin-spacecraft lunar gravity field mapping mission that has two primary objectives: to determine the structure of the lunar interior, from crust to core; and to advance understanding of the thermal evolution of the Moon. These two broad objectives will be addressed by mapping the gravity field of the moon to provide the structure of the crust & lithosphere, help understand the Moon's asymmetric thermal evolution, determine the subsurface structure of impact basins and the origin of mascons, ascertain the temporal evolution of crustal brecciation and magmatism, and place constraints on the deep interior structure from tides, and place limits on the size of the possible inner core.

As a secondary objective, GRAIL observations will be used to extend our understanding of the internal structure and thermal evolution of other terrestrial bodies.

GRAIL will place two twin spacecraft in a low-altitude (50 km), near-circular, polar lunar orbit to perform high-precision range-rate measurements between them using a Ka-band payload. Subsequent data analysis of the spacecraft-to-spacecraft range-rate data will provide a direct measure of the lunar gravity, leading to a high-resolution (30x30 km), high-accuracy (<10 mGal) global gravity field. GRAIL's total mission duration of 270-days includes a launch in September of 2011, followed by a low-energy trans-lunar cruise for the dual-spacecraft, and insertion of the 2 spacecraft into lunar orbit on Dec 31, 2011 and Jan 1, 2012. A series of burns circularize the orbit, align the spacecraft into mapping configuration, followed by a 90-day gravity mapping Science Phase. An initial gravity field will be available about 30 days after the end of the 3-month data acquisition phase and will be delivered to NASA's Planetary Data System (PDS) no later than 3 months after the end of the Science Phase.