

Space Studies of the Earth-Moon System, Planets, and Small Bodies of the Solar System (B)
Mercury: Visiting an Elusive Planet (B07)

TOPOGRAPHY AND GRAVITY FROM THE MESSENGER FLYBY OF MERCURY ON JAN 14, 2008

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During the first flyby of Mercury by the MESSENGER spacecraft on January 14, 2008, observations were acquired by the laser altimeter and by the radio tracking system as the spacecraft passed within 201 km of the planet's surface. These were the first new observations of Mercury by a spacecraft since the third encounter by Mariner 10 in 1975. MESSENGER acquired altimeter data for a period of nearly ten minutes along a 3300-km-long profile between longitudes 14° and 93°E and between the equator and latitude 5°S. The altimetry revealed a rough, cratered surface with a full dynamic range of slightly over 5 km and a root-mean-square roughness of 900 m. The profile also exhibits a downward, west-to-east-trending slope of approximately 0.1° that may be a fundamental feature of the equatorial shape of the planet.

The Doppler tracking data showed an increase in spacecraft velocity as it approached the planet of nearly 1.3 km/s and a change in the direction of the spacecraft in the equatorial plane of approximately 20.1°. The spacecraft was occulted from Earth for approximately 48 minutes until approximately 2 minutes prior to closest approach. From an estimation of the trajectory of MESSENGER for the 9 days around the flyby, a variation in residual velocity of 1.65 to -2.16 cm/s was observed from the time of acquisition of the Doppler signal after occultation

through the subsequent 5 minutes around closest approach to the planet, which occurred at 37.8°E and 4.2°S. The existence of this residual is believed to be evidence that the model for the gravity field of Mercury derived from the Mariner flybys can be improved with the addition of the MESSENGER tracking data, indicating that the new data can provide significant new information about Mercury that could reduce the current uncertainty regarding the state of Mercury's core.