

THE MOON'S MOLTEN CORE, TIDES, AND ENERGY DISSIPATION

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Analyses of accurate laser ranges to the moon permit variations of lunar rotation and tidal displacement to be monitored. These variations are influenced by the internal properties of the Moon. a) Determination of the second-degree potential Love number k_2 is significantly influenced by any fluid core ellipticity. From a solution with a weak detection of core ellipticity, $k_2 = 0.025 \pm 0.003$. The displacement Love numbers are also detected, with $h_2 = 0.033 \pm 0.015$. b) Four rotational dissipation terms are detected. These are consistent with tidal dissipation, using a frequency-dependent tidal Q, plus dissipation at a liquid-core/solid-mantle interface. For the above k_2 the tidal Q is 32 at one month period and 53 at one year. c) The core radius is ≤ 352 km for molten iron and ≤ 374 km for the Fe-FeS eutectic. d) The two dynamical sources of power generation are minor heat sources at present, but early in the lunar history they may have rivaled radiogenic power. These sources may have powered core convection and a dynamo.

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