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The Interior Structure of Mercury

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Depth-dependent interior structure models of Mercury have been calculated for several plausible chemical compositions of the core and of the mantle. The core is assumed to consist mainly of iron and an unknown amount of sulfur. We considered a plausible range in sulfur concentration and constructed Mercury models in different phases of its core evolution, from entirely liquid to entirely solid cores. In order to determine the position of the boundary between the solid inner core and the liquid outer core, we have derived a melting law for the iron sulfur system from recent laboratory data. Mantle compositions consistent with the observed low surface FeO and corresponding to different formation histories have been used to construct mantle mineralogy models. The models have been calculated for two different mantle temperature profiles of thermal evolution models.

Large advances in our knowledge of Mercury's interior are expected from geodetic observations of the gravity field, the rotation, and the tides of Mercury. Both ground-based facilities and the space missions MESSENGER and BepiColombo will contribute to the determination of the polar principal moment of inertia of the entire planet and of the mantle and the tidal Love numbers. We have studied the sensitivity of these data to key interior parameters and show that large improvement in our knowledge of Mercury's interior can be expected from geodetic observations.