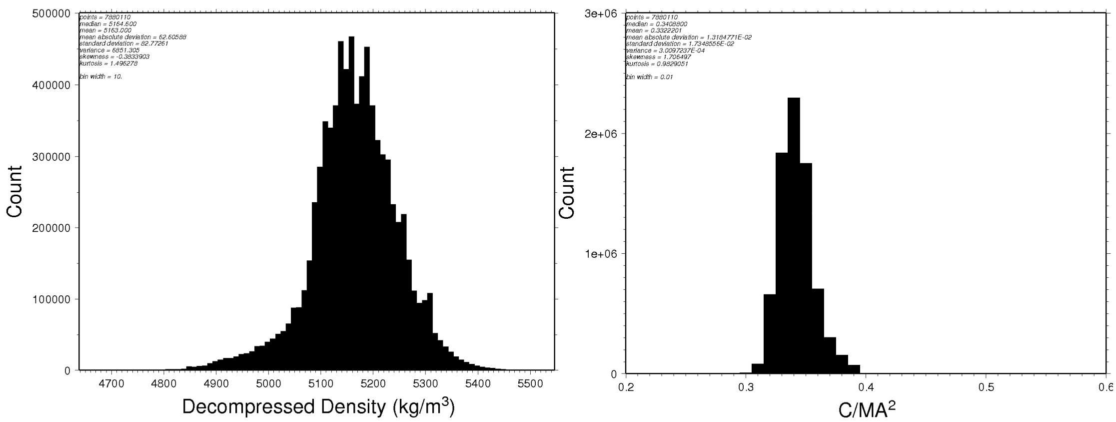
Revisiting models of the core of Mercury

C. R. Bina[1], M. A. Riner[2], and M. S. Robinson[2]
[1]Department of Earth and Planetary Sciences, Northwestern University, U.S.A.
[2]School of Earth and Space Exploration, Arizona State University, U.S.A.

Mercury is unique among the terrestrial planets for its relatively low mass and high average density, implying an unusual iron-rich bulk composition and so providing constraints on planetary formation and evolution. Previous density models of Mercury's interior have considered cores composed of a single solid layer or a few constant-density solid layers. In light of the recent detection of a partially molten Mercurian core [Margot et al., 2007], we model plausible interior density structures of Mercury using the thermoelastic properties of both solid and molten core materials.

Using planetary mass and radius as primary constraints, we apply Adam-Williamson-type self-compression along planetary adiabats (or other imposed hermeotherms), using Birch-Murnaghan finite strain equations of state, to generate a large suite of plausible models of Mercurian interior structure and composition. We analyze the distribution of various planetary properties (*e.g.*, decompressed density, moment of interia, inner/outer core radii) across the sample space of such models. We find, for example, that the expected value of decompressed density is smaller than values commonly quoted in the literature. We illustrate the importance of incorporating molten and/or layered cores (and of obtaining better measurements of thermoelastic properties of molten alloys) in accurately modeling Mercury's interior structure and composition, observations that will be important for interpreting anticipated geophysical observations by spacecraft.



[Fig.: Some statistics for a sample suite (#230607) of Mercurian models.]

[Ref.: Margot, J. L., S. J. Peale, R. F. Jurgens, M. A. Slade, and I. V. Holin (2007), Large longitude libration of Mercury reveals a molten core, *Science* **316**, 710–714.]