Consequences of multi-stage core formation

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Terrestrial planet formation bridges the fields of astronomical and geological sciences. By combining concepts, models, and measurements from these fields, significant progress has been made in understanding how the construction of a planet like Earth in a protoplanetary disk determines the initial conditions that set each of the terrestrial planets down their disparate paths.

I will review results obtained from a planetary accretion and differentiation model that builds terrestrial planets from a astrophysical N-body simulation, determines the chemistry of the core and mantle using geochemical models established from high pressure laboratory experiments, and assesses the dynamical structure of the mantle and core using analytical geophysical fluid mechanics.

From this model, we discover the importance of the Moon-forming impact for the internal structure of the Earth (homogenous fully convective core, nearly homogenous and wet mantle) and we hypothesize the consequences of no late giant impact on the internal structure of Venus (stably stratified core, layered crust and dry mantle).