Mass-radius relation of massive terrestrial planets

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By combining the method that uses the Doppler shift in the parent star's motion and the method of transits, we can get both the planet's mass and radius. We examined mass-radius relation of various massive terrestrial planets, and investigated the information that can be inferred from the planet's mass and radius.

We calculated internal structures of planets with one to ten times the mass of the Earth (Super-Earths). To obtain pressure profiles and radii of radially symmetric Super-Earths, we assumed hydrostatic equilibrium and mass balance. We choosed the third-order Murnaghan-Birch equation of state(EOS) with a Debye thermal correction as the equation of state.

Low pressure phases of minerals and internal temperature have a little effect on internal structures of Super-Earths. The redox state of iron in a planet also do not have a great effect. We conclude that the key parameter to determine the mass-radius relation of Super-Earths is the bulk composition of planets, and the elemental abundance of Fe (irrespective of its redox state) controlls the round size of a massive terrestrial planet.