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Interior of Mars from InSight geodesy

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Within the INSIGHT mission, the radioscience experiment aims at obtaining the rotation and interior structure of Mars. It is called for that reason RISE (Rotation and Interior Structure Experiment). It does not uses an instrument stricto sensus but uses the spacecraft X-band communication system.
The parameters that will be determined from the rotation and orientation observation (i.e. from length-of-day variations, precession (long-term changes in the rotational orientation), and nutations (periodic changes in the rotational orientation)) are the angular momentum of the atmosphere, the moments of inertia of the whole planet and of the core. This will allow to constrain the interior models of Mars.
The Doppler effect on the radio signal is related to the variations of the rotation and orientation of the planet Mars. When measured for a time longer than the seasonal timescale, the observation can provide values for the moments of inertia. The mean moment of inertia is a strong constraint on the core size and density, core temperature and mantle mineralogy. The size of the core has major consequences for internal structure and planetary evolution. For example, a large core makes a perovskite-bearing lower mantle impossible, due to insufficient pressure at the base of the mantle. The endothermic phase transition spinel-perovskite has a strong effect on mantle convection. The size and composition of the core are also important in the history of the magnetic dynamo, which in turn has important consequences for the retention of the atmosphere and the possible habitability of the surface early in Mars' history.