EGU21-8203
https://doi.org/10.5194/egusphere-egu21-8203
EGU General Assembly 2021

Interior of Jupiter in the context of Juno and Galileo: signature of a decoupling between the atmosphere and the interior

Florian Debras[1] and Gilles Chabrier[2]
[1]CNRS / IRAP, Toulouse, France (florian_debras@hotmail.com)
[2]CNRS / ENS de Lyon, Lyon, France

Juno's observations of Jupiter's gravity field have revealed extremely low values for the gravitational moments that are difficult to reconcile with the high abundance of metals observed in the atmosphere by both Galileo and Juno. Recent studies chose to arbitrarily get rid of one of these two constraints in order to build models of Jupiter.

In this presentation, I will detail our new Jupiter structure models reconciling Juno and Galileo observational constraints. These models confirm the need to separate Jupiter into at least 4 layers: an outer convective shell, a non-convective zone of compositional change, an inner convective shell and a diluted core representing about 60 percent of the planet in radius. Compared to other studies, these models propose a new idea with important consequences: a decrease in the quantity of metals between the outer and inner convective shells. This would imply that the atmospheric composition is not representative of the internal composition of the planet, contrary to what is regularly admitted, and would strongly impact the Jupiter formation scenarios (localization, migration, accretion).

In particular, the presence of an internal non-convective zone prevents mixing between the two convective envelopes. I will detail the physical processes of this semi-convective zone (layered convection or H-He immiscibility) and explain how they may persist during the evolution of the planet.

These models also impose a limit mass on the compact core, which cannot be heavier than 5 Earth masses. Such a mass, lower than the runaway gas accretion minimum mass, needs to be explained in the light of our understanding of the formation and evolution of giant planets.

I will finally detail the application of our work to Saturn, and what we can expect to learn about the interior of the giant planets in the years to come.