Modeling the internal structure and evolution of giant planets from Juno to Plato: Lessons and Challenges

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Observations from Juno have revealed that Jupiter is far more complex than initially envisioned: its central core, rather than being compact, appears diluted within the planetary envelope; observed zonal flows extend from the atmosphere deep into a significant fraction of that envelope; and convection inhibition impacts both the helium rain region and water storms in the atmosphere. Additionally, **the deep atmosphere is chemically heterogeneous** and may include regions stable against convection, defying standard assumptions.

Current interior models still struggle to reconcile gravitational and spectroscopic constraints, highlighting gaps in our understanding.

With **Plato's launch in early 2027**, we will gain the ability to precisely measure the radii, masses, and ages of giant planets in our cosmic neighborhood. **The complexity of interior and evolutionary models** will directly influence the derived compositions. The challenge is substantial: as demonstrated in *Plato WorkPackage 116100* ("Composition and formation of gas and ice giants"), model results can differ in radius by over 1% even under simplified assumptions.

This presents an opportunity to advance comparative planetology, bridging insights from Jupiter with future Plato data.