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# Linking atmospheres and interiors of Uranus and Neptune: Lessons from Juno

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## Abstract

Although they played a very important role in the formation of the Solar System and may be the most frequent type of planets in the Universe, little is known of the "ice giants" Uranus and Neptune. They have been visited by Voyager II but never by orbiting spacecrafts. The composition and dynamics of their atmosphere is poorly known. Their interior structure and magnetic fields are complex but constrained by very few measurements. Linking measurements pertaining both to the interior and atmosphere is key to any mission to these planets.

The Juno mission (currently in orbit around Jupiter) brings us important lessons to consider when preparing the journey to these planets. The interior structure and magnetic fields can be well measured by a close-in orbiting spacecraft, but even in the case of Jupiter and more so for Uranus and Neptune, their complexity will require many measurements. Jupiter's atmospheric composition measured by Juno and from ground-based radio observations reveals a very inhomogeneous interior, indicating that we should expect condensing species to have non-uniform abundances to great depth. This will apply to chemical species that dissolve into condensing species as well. For these species, redundant, deep measurements must be made.

I will thus put in parallel what we know and what we think we know of Jupiter with the questions to be addressed by a Uranus/Neptune mission.

**Keywords:** Uranus, Neptune, Jupiter, Planetary interiors, Planetary atmospheres, Planet formation, Giant planets

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