



On the True Nature of Uranus and Neptune

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The internal structures and compositions of Uranus and Neptune are not well constrained. The relatively large error bars on the gravitational coefficients as well as the uncertainty in rotation period and flattening result in a fairly large range of possible solutions.

While Uranus and Neptune are similar in mass (about 14.5 and 17.1 Earth masses, respectively) they differ in other physical properties such as thermal emission, obliquity, and atmospheric enrichment.

We present new interior models of Uranus and Neptune using various approaches; using the Voyager 2 rotation periods it is found that the major difference between Uranus and Neptune in terms of internal structure is that Neptune requires a non-solar envelope, while Uranus is best matched with an envelope of solar composition. We also find that it is possible to fit the gravitational moments of the planets without sharp compositional transitions (i.e. density discontinuities). However, when the uncertainty in rotation period and flattening of the planets is included, the derived internal structures of Uranus and Neptune can differ substantially. We suggest that Uranus and Neptune may not be "twin planets", and that it is possible that each planet represents a different "class" of planets in this mass range in terms of composition, internal structure, and possibly, formation mechanism.