EPSC Abstracts
Vol. 7 EPSC2012-660 2012
European Planetary Science Congress 2012

Uranus Pathfinder: Exploring the Origins and Evolution of Ice Giant Planets

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Abstract

The "Ice Giants" Uranus and Neptune are a different class of planet compared to Jupiter and Saturn. Studying these objects is important for furthering our understanding of the formation and evolution of the planets, and unravelling the fundamental physical and chemical processes in the Solar System. The importance of filling these gaps in our knowledge of the Solar System is particularly acute when trying to apply our understanding to the numerous planetary systems that have been discovered around other stars.

The Uranus Pathfinder (UP) mission [1] thus represents the quintessential aspects of the objectives of the European planetary community as expressed in ESA's Cosmic Vision 2015–2025. UP was proposed to the European Space Agency's M3 call for medium-class missions in 2010 and proposed to be the first orbiter of an Ice Giant planet. As the most accessible Ice Giant within the M-class mission envelope Uranus was identified as the mission target. Although not selected for this call the UP mission concept provides a baseline framework for the exploration of Uranus with existing low-cost platforms and underlines the need to develop power sources suitable for the outer Solar System.

The UP science case is based around exploring the origins, evolution, and processes at work in Ice Giant planetary systems. Three broad themes were identified: (1) Uranus as an Ice Giant, (2) An Ice Giant planetary system, and (3) An asymmetrical magnetosphere. Due to the long interplanetary transfer from Earth to Uranus a significant cruise-phase science theme was also developed. The science payload has a strong heritage in Europe and beyond and requires no significant technology developments.

In this paper we discuss this European effort to explore Uranus and outline ongoing developments of the mission concept.

References

[1] Arridge, C.S., et al.: Uranus Pathfinder: Exploring the origins and evolution of ice giant planets, Exp. Astron., doi: 10.1007/s10686-011-9251-4, 2012.