THE COMPLEMENTARY ASPECTS OF ORBITER AND PROBE MEASUREMENTS FOR A FUTURE URANUS MISSION

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Uranus is key to understand planets with hydrogen atmospheres [1,2]. Its atmosphere is active and believed to be fueled by methane condensation which is both extremely abundant and occurs at low optical depth [3]. This means that mapping temperature and methane abundance as a function of position and depth will inform us on how convection organizes in an atmosphere with no surface and condensates that are heavier than the surrounding air, a general feature of gas giants. The methane cloud layer is also subject the local moist convection inhibition criterion [4] therefore raising crucial questions on the planet's deep interior structure [5,6]. Using this information will be essential to constrain the interior structure of Uranus and Neptune themselves, but also of Jupiter, Saturn, and numerous exoplanets with hydrogen atmospheres [8,9]. Owing to the spatial and temporal variability of its atmospheres, an orbiter is required. A probe would provide a reference profile to lift ambiguities inherent to remote observations. It would also measure abundances of noble gases which can be used to reconstruct the history of planet formation in the Solar System [10,11,12]. Finally, mapping the planets' gravity and magnetic fields will be essential to constrain their global composition, structure and evolution [13].

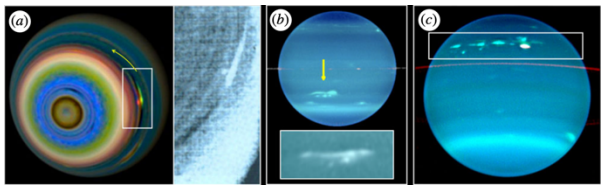

Figure 1. Candidate features to moist convection in Uranus: (a) A plume-like feature observed by Voyager 2 in 1986 in Uranus' Southern Hemisphere. The arrow signals the direction of rotation and the inset shows details from; (b) The Berg feature observed in 2007 (arrow) with details in the inset; (c) The active northern band with multiple spots observed in 2004 (From [3], and references therein).

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