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Small Next-generation Atmospheric Probe (SNAP)

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Abstract

A concept is presented for a small, atmospheric probe that could be added to a future ice giant mission as a secondary payload. The main scientific objectives of the Small Next-generation Atmospheric Probe (SNAP) are to determine the vertical distribution of clouds and cloud-forming chemical species, thermal stratification, and wind speed as a function of depth. As a case study, the advantages, cost and risk of adding SNAP to a future Uranus Orbiter and Probe flagship mission are considered. In combination with the mission's main probe, SNAP would perform atmospheric in situ measurements at a second location and thus enable and enhance the scientific objectives recommended by the 2013 Planetary Science Decadal Survey and the 2014 NASA Science Plan to determine atmospheric spatial variabilities. The mission concept study demonstrates that the science objectives can be achieved with a ~0.5m diameter and 30-kg entry probe (less than 10% the mass and half the size of the Galileo probe) that would reach a pressure level of 5 bars pressure and uses the Carrier spacecraft as a relay for data return to Earth. The probe would carry an Atmospheric Structure Instrument (ASI) to measure temperature, pressure, and entry accelerations, a carbon nanotube-based NanoChem atmospheric composition sensor, and an ultrastable oscillator (USO) to enable measurements of atmospheric dynamics via a Doppler Wind Experiment.