

Saturn Probe

Saturn Probe obtains in situ measurements of the atmosphere from an entry probe. Understanding the initial conditions in the protosolar nebula requires measurements of each of the giant planets' elemental and isotopic compositions. Constraining giant planet formation mechanisms is particularly dependent on knowing when and where Saturn formed, over how long, and if its orbit has migrated over time to stop Jupiter's inward movement. Noble gas abundances are also crucial for determining if helium rain has prolonged Saturn's thermal evolution. Additionally, comparisons of what governs the diversity of giant planet climates, circulation, and meteorology require constraints on the vertical temperature and wind profiles, as well as vertical circulation. Although some measurements may be obtained via remote sensing, many of the science objectives require in situ sampling.

Saturn Probe Science Objectives:

- Determine the in situ noble gas, elemental, and isotopic abundances to understand conditions in the protosolar nebula, as well as constrain Saturn's formation, evolution, and migration.
- Determine the in situ tropospheric temperature-pressure profile to quantify Saturn's heat transport and convective stability.
- Determine the in situ vertical wind shear to characterize Saturn's tropospheric circulation and meteorology.
- Constrain vertical mixing in Saturn's troposphere to bound transport from the deeper interior. The mission shall address all four objectives.