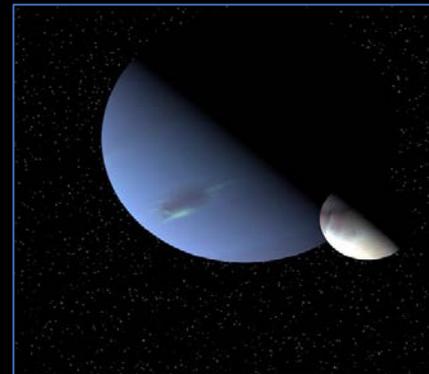


Outer Solar System Exploration: A Compelling & Unified Dual Mission Decadal Strategy

Exploring Uranus, Neptune, Triton, Dwarf Planets and Smaller KBOs



A Compelling and Unified Strategy For Outer Solar System Exploration

Objectives:

- ✓ Establish a robust and scientifically rich Outer Planets Program in the next Planetary Decadal Survey.
- ✓ The two missions for the coming decade are an ice giant orbiter and an ice giant/multi-KBO Dwarf Planet flyby mission.
- ✓ These two missions will together revolutionize scientific understanding of solar system, ice giant, and dwarf planet origins, the processes that shape the evolution of planets, their satellites, and KBOs, and shed new light on the nature of exoplanets.

Why?

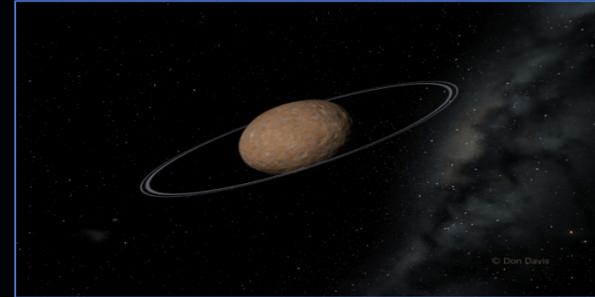
This combined mission strategy achieves multiple high-priority Vision and Voyages (V&V) Decadal Survey objectives:

- Accomplishes the ice giant orbiter and atmospheric probe in V&V.
- Accomplishes next-gen comparative studies of both ice giants.
- Accomplishes next-gen comparative studies of KBOs (Centaur, classical KBOs, and KB dwarf planets).
- Advances Ocean Worlds, heliophysics, and exoplanet objectives.
- Achieves high-priority outer solar system science not otherwise achieved.

These two missions, when combined with current Ocean Worlds efforts, achieves the highest priority science objectives for all bodies in the outer solar system.

Flagship Neptune Orbiter and Probe

- Centaur flyby en route to Neptune.
- Orbit Neptune.
 - 2-4 years
 - >10 Triton flybys
 - Satellite/magnetosphere tour
 - Neptune atmospheric probe
- Cost Based on 2017 NASA/JPL
Ice Giant Study: ~\$2.6B.



New Frontiers or Mini-Flagship Uranus-Dwarf Planet Flyby Tour

- Uranus flyby en route to a Dwarf Planet in the Kuiper Belt.
- KBO Flybys:
 - A KB dwarf planet is the prime KB target to explore KB DP diversity relative to Pluto system.
 - Additional small-intermediate sized KBO flybys pre-or post this flyby.
- New Frontiers cost class: ~\$1B
- Stretch Goal: Uranus entry probe as a foreign contribution.



Combined Decadal Approach

- **Two outer planet missions.**
 - Combined with Europa Clipper, Saturn system NF, (and possibly even Discovery) dramatically advances our understanding of the outer solar system.
- **Cost approx. same as MSL.**
- **Net Exploration Return:**
 - **Both ice giants**
 - One orbited w/probe
 - One flyby
 - **An ocean world**
 - **Two dwarf planets**
 - **One Centaur**
 - **At least one “MU69” KBO.**

