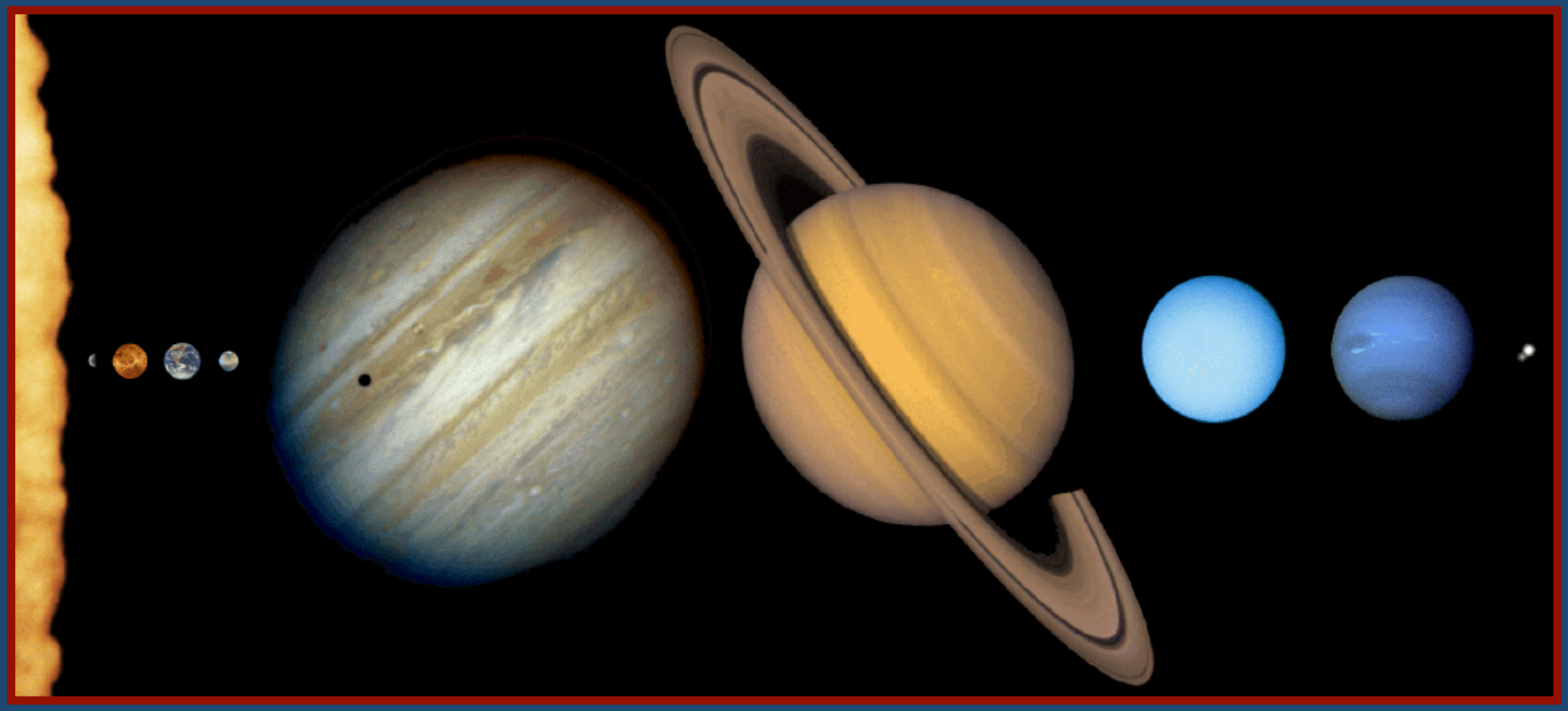
UV-Visible Solar System Astronomy with HDST



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COPAG/SIG2: June 25, 2015

Science Focus

Grand Questions:

1)How does the interaction with the Sun and Solar Wind affect the movement of mass, momentum, and energy across boundaries in a planetary system?

2)How do solar driven energetic processes affect atmospheric structure, composition, dynamics, and evolution?

3)How does the solar driven Earth system compare with the other planets?

4)What was the initial volatile composition of planets, their satellites, and other small bodies and how have they changed with time?

5)What are the characteristics of the solar wind and neutral interplanetary medium and how do they change with time and location in the heliosphere?

Why the UV-Visible?

1) Solar continuum scattering dominates the light output from most objects.

2) MHD processes (aurora, recombination, co-rotation, currents) produce signatures in the UV that can be observed without continuum.

3) UV absorption at upper atmospheric regions of photochemical and photo-ionization processes occur.

4)Scattering of solar UV emission isolates upper atmospheric structure, the heliosphere, and near-space environments (exospheres and magnetospheres).

5) Important atomic (H, C, O, N, Ar) and molecular (CO, H_2, NH_3, CS, S_2, etc.) emissions and absorption isolated to UV.

Why A Space Telescope?

1) There are more objects to monitor than can be visited with robotic spacecraft.

2) Even extended in situ missions typically offer only localized measurements and 'snapshot' encounters (e.g. Europa Fly-By).

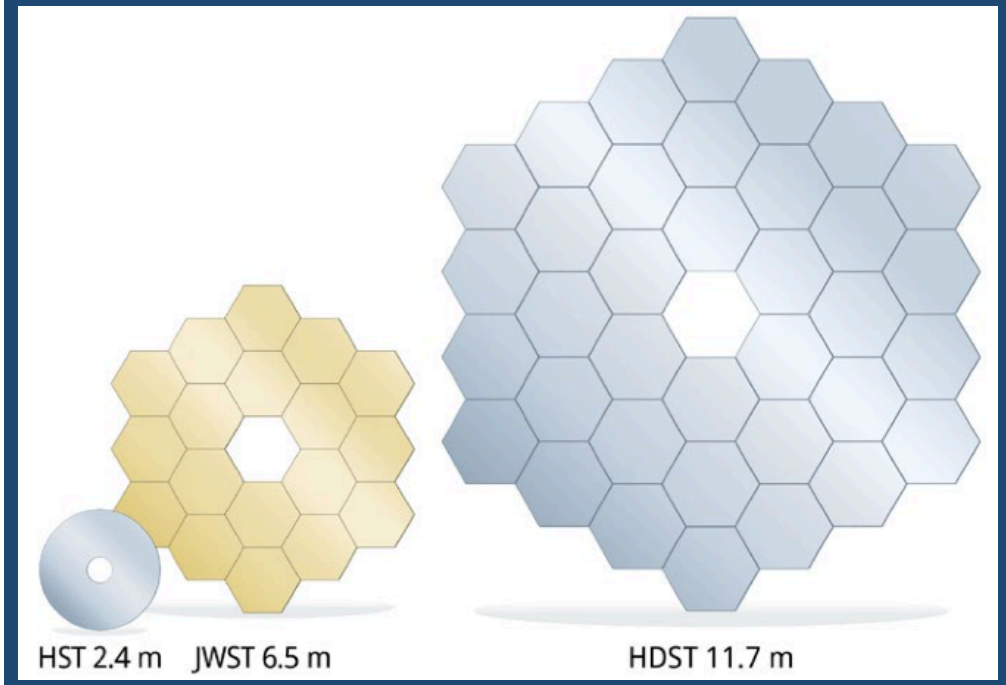
3) Short duration encounters (e.g. New Horizons, Deep Impact) provide only partial spatial coverage and very limited temporal coverage.

4) Instrumental limitations restrict capabilities (e.g. rapidly changing perspectives, small volumes).

5) Temperatures T<1000-10000 K and Velocities V<100 km dominate. Resolving Power R>30000 (rarely used on probes) is the entry point for detecting dynamics, separating sources within systems, and isolating lines in molecular bands.

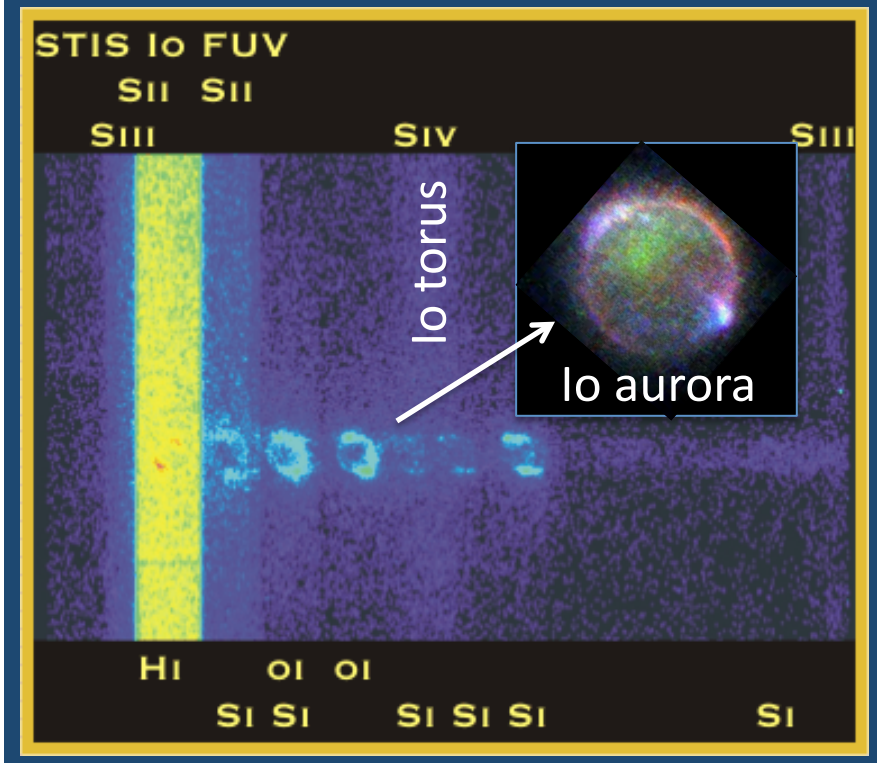
6) Low background enables searches for small, remote bodies.

Starting Point (HDST):

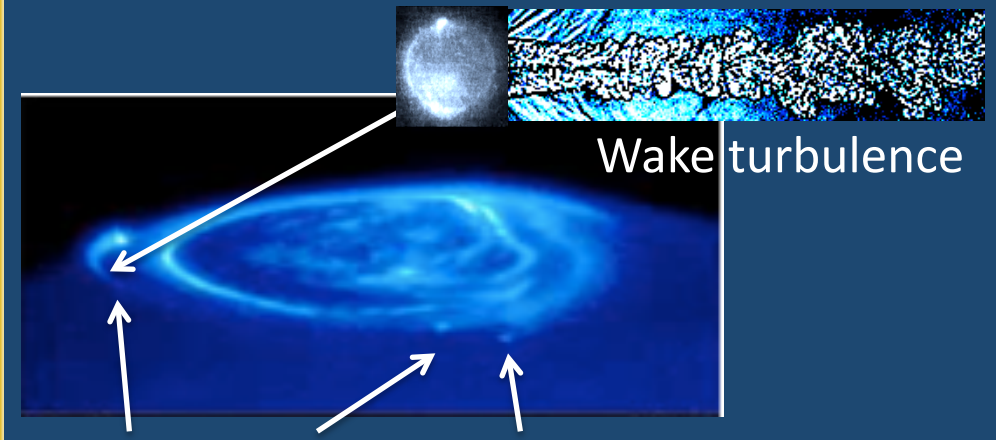


- 12 m Aperture
- Diffraction Limit (0.5 µm)
- Wide-Field (6 arcmin)
- Broadband (0.11-5 µm)
- High Resolving Power ($R>10^5$)

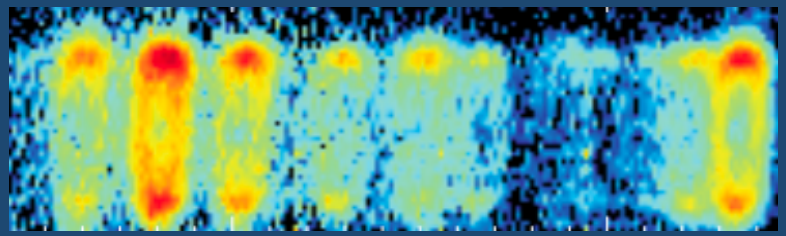
Plasma Processes:



More than 30x HST throughput enables detection of aurora and airglow.



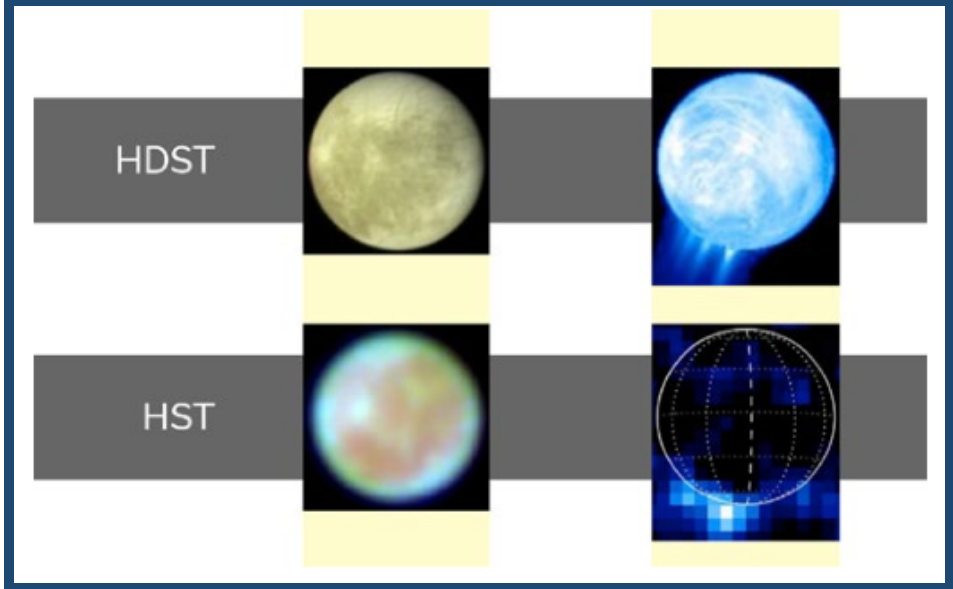
Io Ganymede Europa at 20% resolution



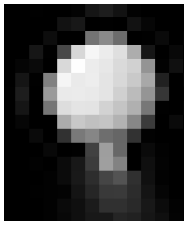
Io torus

Jupiter aurora at HDST resolution

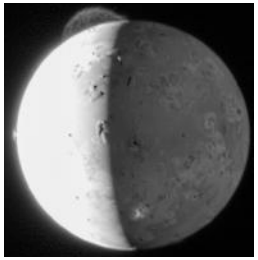
Surfaces and Activity:



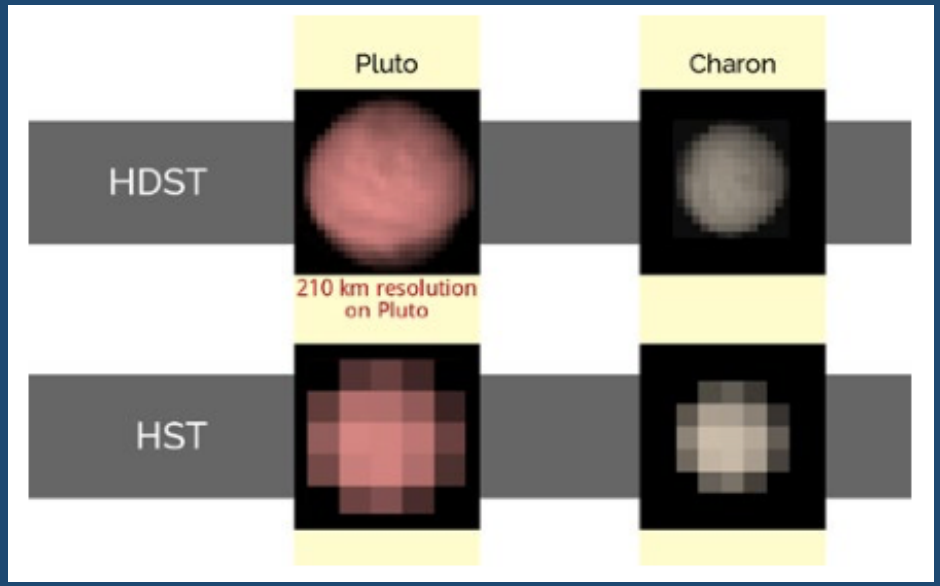
35 km to 300 km spatial resolution from Jupiter to Pluto.



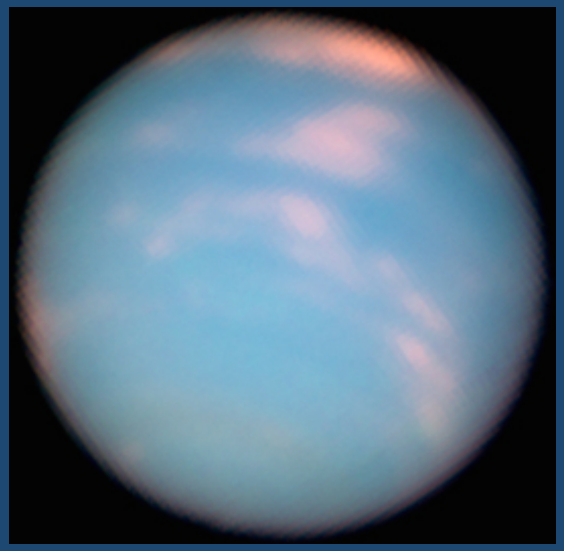
Enceladus

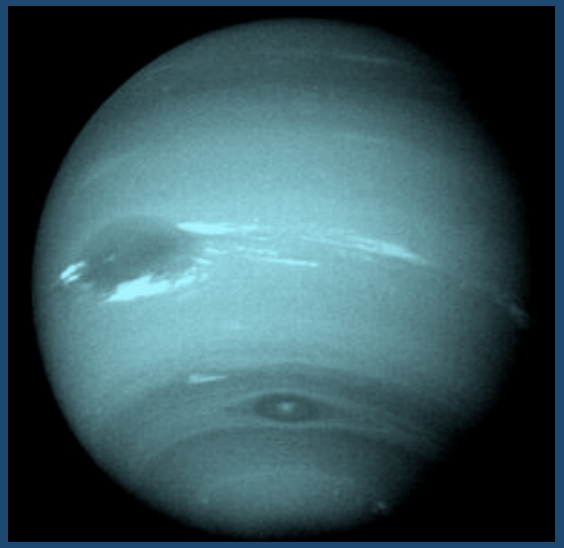


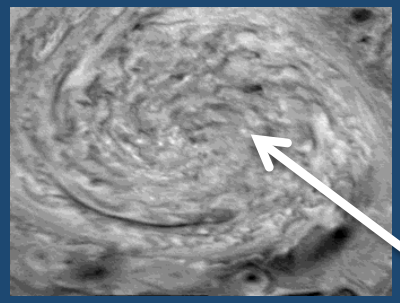
Io

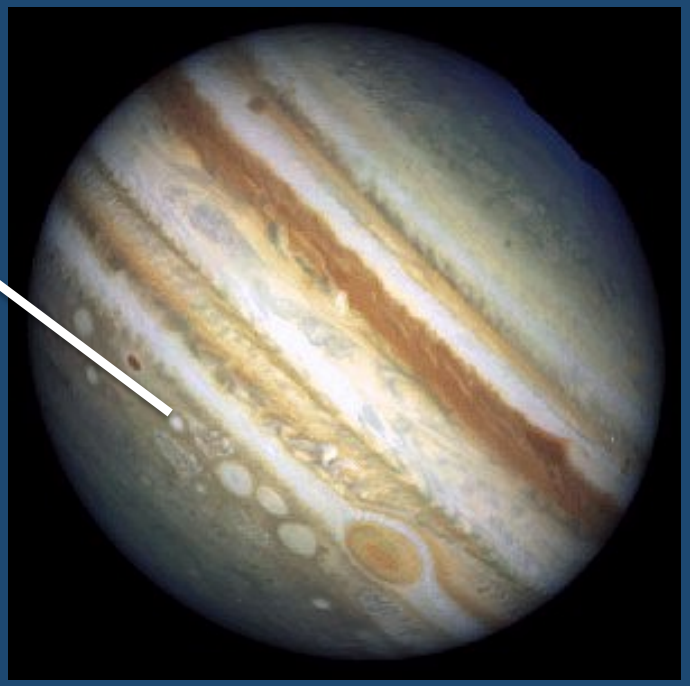


Atmospheric Dynamics:







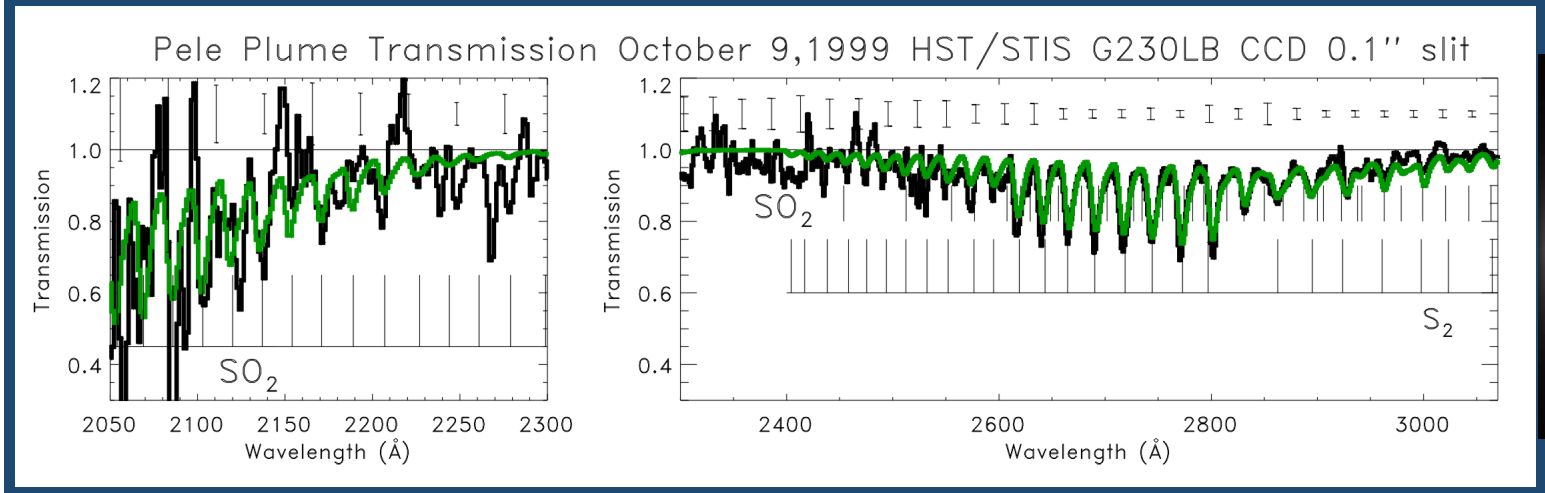


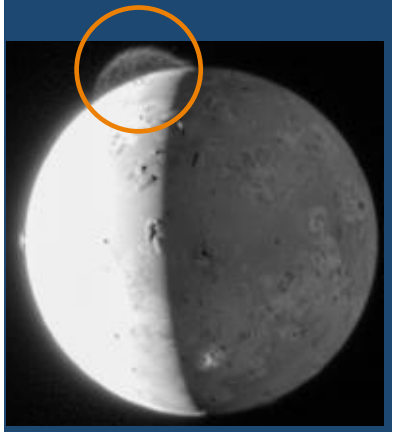
35 km to 300 km spatial resolution from Jupiter to Pluto.

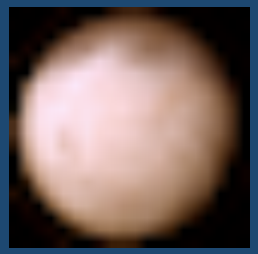
The equivalent of Voyager imaging everywhere in the Solar System.

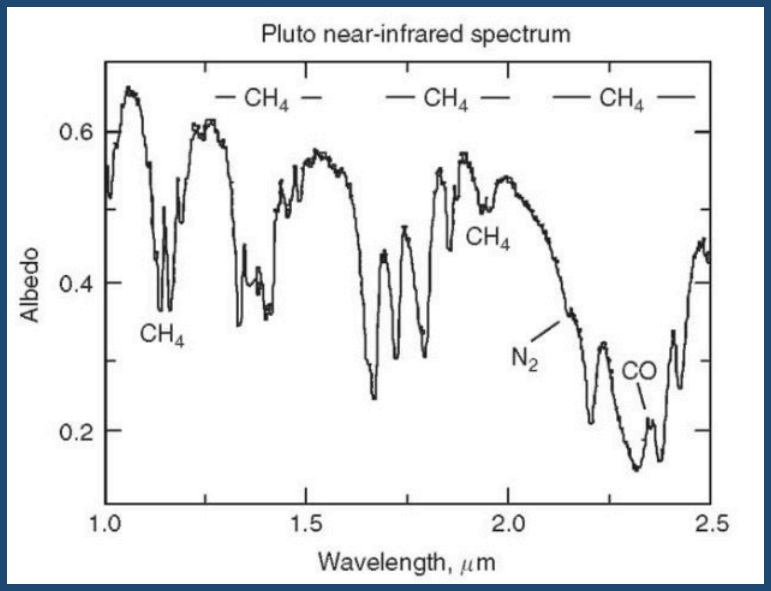
Surface Composition:

Frost, Condensation, and Plumes



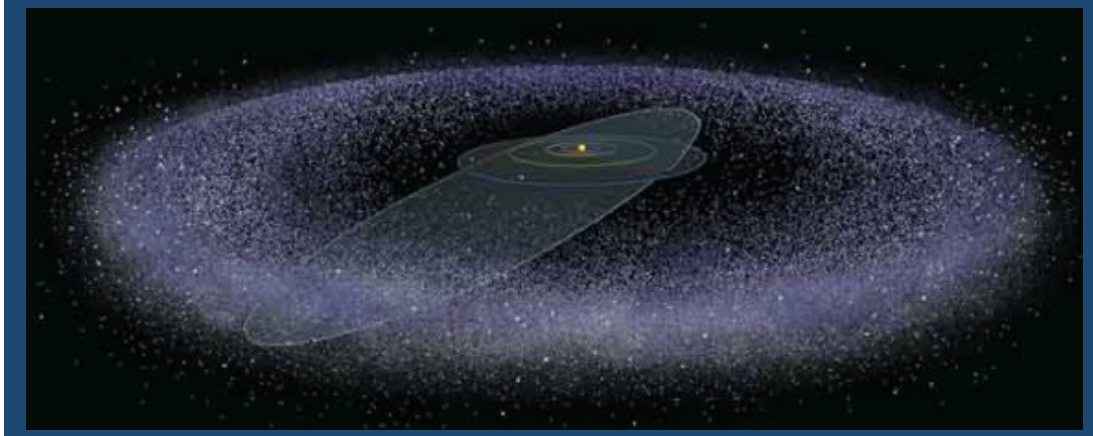






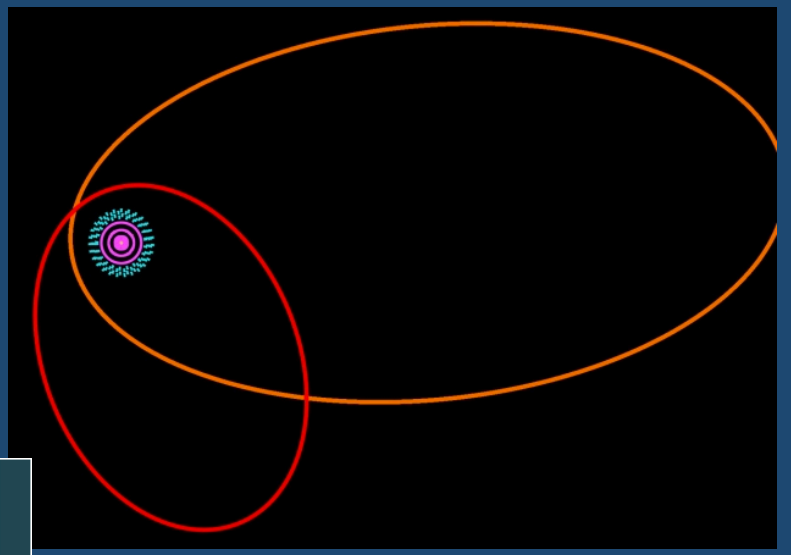
Ice Composition of TNOs and Comets

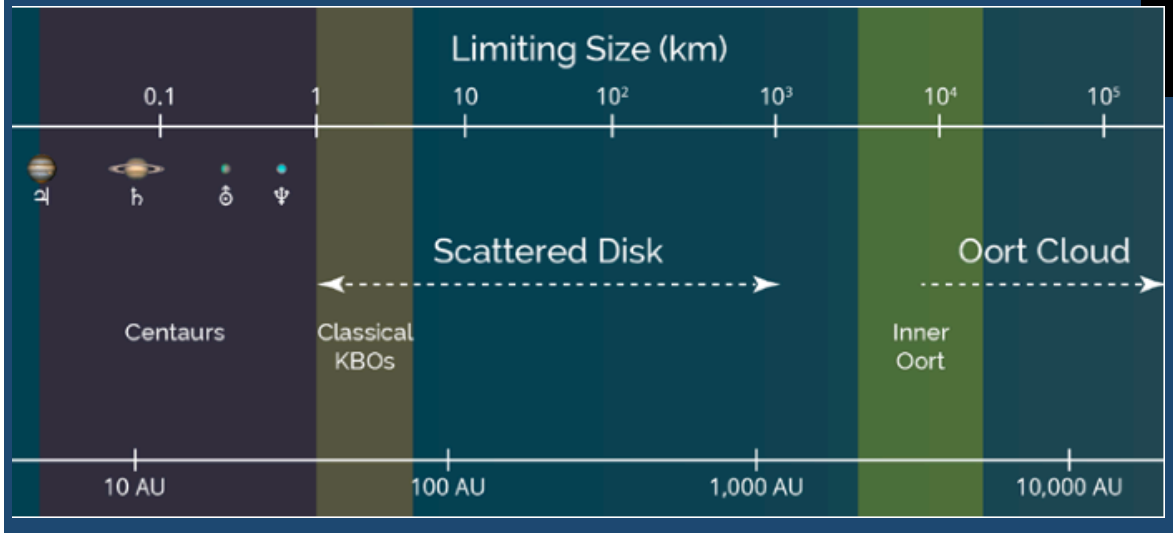
Outer Solar System Inventory:



Detection of Sedna-class TNOs
Over Full Orbital Range.

Detection Limit to 1 km
Across the Full Classical Disk





Non-thermal Detection of
Super-Earth to Neptune
Sized Objects from
3500-7500 AU.

Questions?