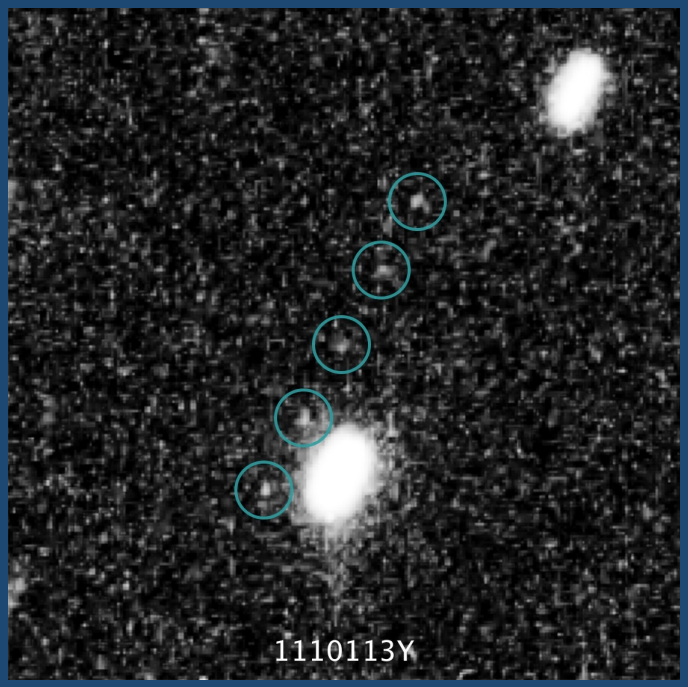
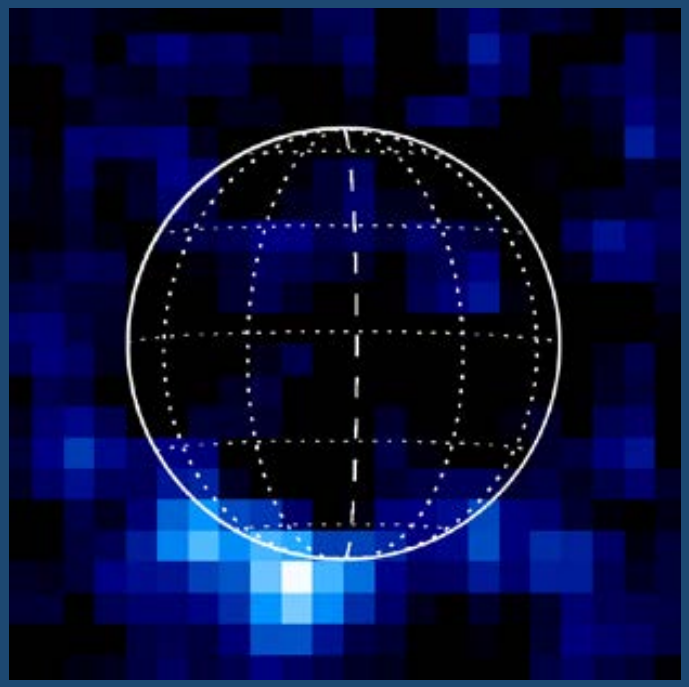
Aperture Drivers for Solar System Studies with LUVOIR





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Solar System and LUVOIR

Enabling Areas

1) Inventory Completion: (Missions cannot visit everything!)

2) Pathfinder Measurements: (Future target reconnaissance)

3) Mission capabilities: (Spectral resolving power)

4) Organization, Composition, and Structure: (Echo of Formation)

5) Expand Detectable Frontier: ('Planet 9', Small Centaurs, Volatility)

Challenges:

1) Visible detection dominated by reflected solar continuum and resonance scattering.

2) Energetic processes driven by solar wind and internal plasmas.

3) Volatile production strong function of blackbody equilibrium temperature with Sun.

4) Solar driven processes attenuated with distance.

-Solar wind reduced volumetrically

-Photon fluxes are double diluted

-Volatility a strong function of temperature

5) There is crosstalk between dilution factors.

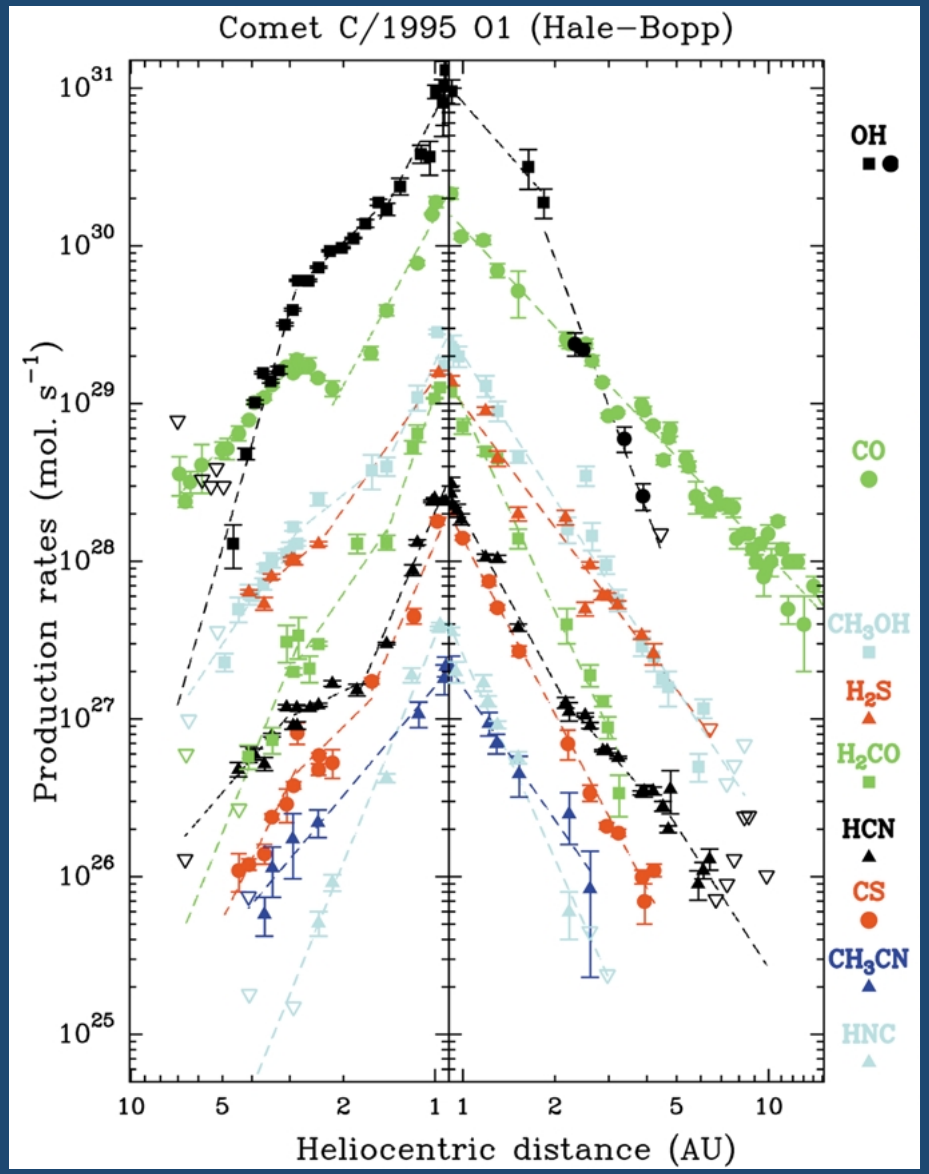
Challenges:

Example: Comet gas production.

-Primary volatile changes at ~3 AU from CO to H_2O.

-Gas production drops by ~10^5 1-10 AU heliocentric distance.

-Detectable emissions dominated by double diluted scattered solar continuum.



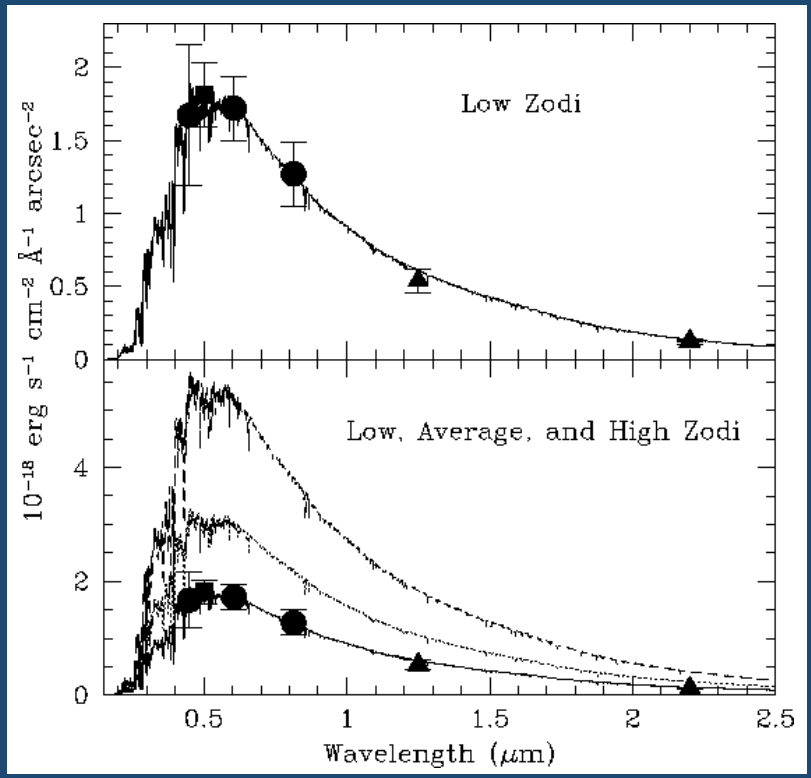
Challenges:

LUVOIR will be background limited, but several magnitudes fainter than any projected ground-based telescope.

Many signals are weak, and spectroscopic sensitivity per resol is fixed.

0.01 to 0.12 ph/hr-resol-R

Smaller resols = higher SNR for unresolved features.



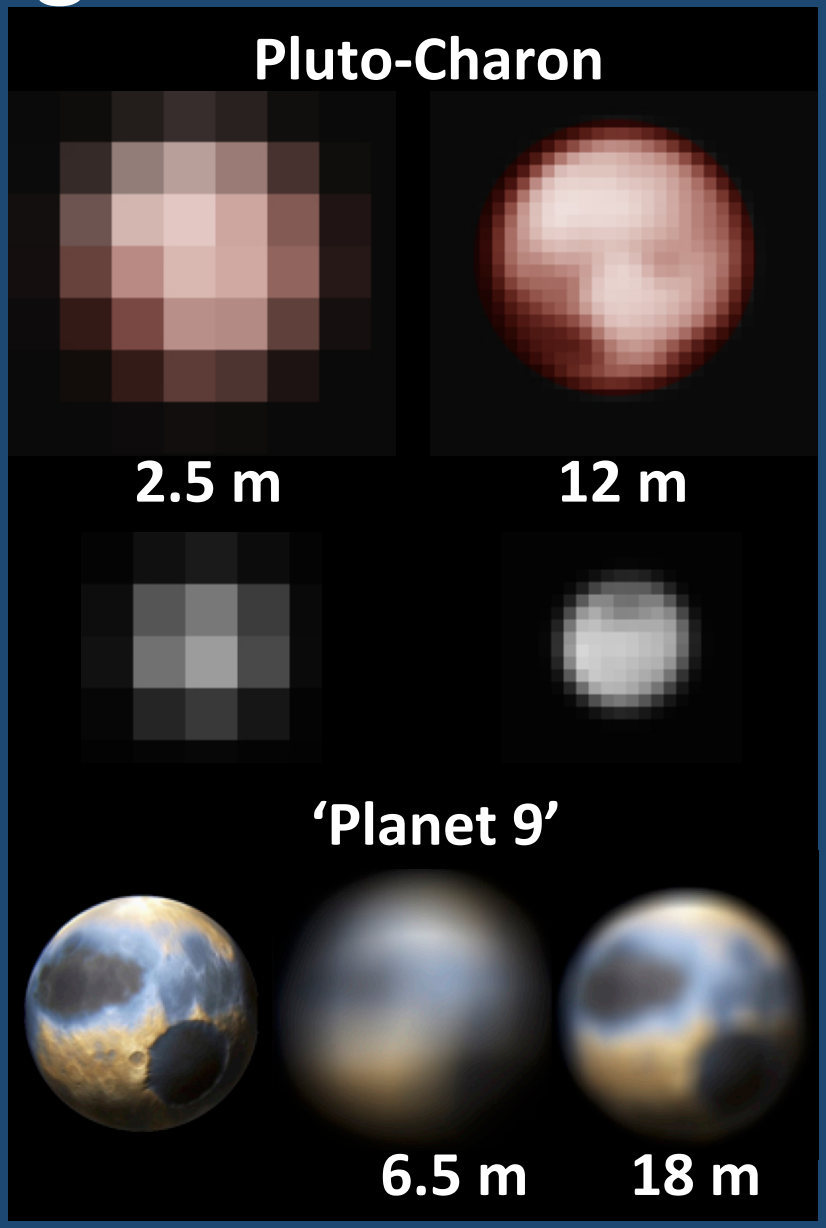
Challenges:

Diffraction limit ties to aperture and wavelength.

A 12 m LUVOIR would provide

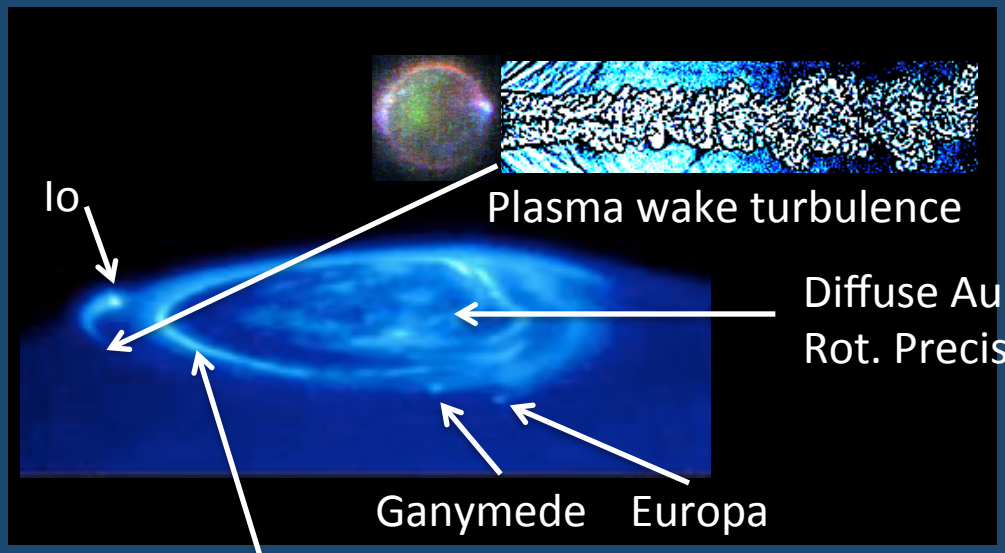
15 km/Nyquist-px @ 5 AU

90 km/Nyquist-px @ 30 AU

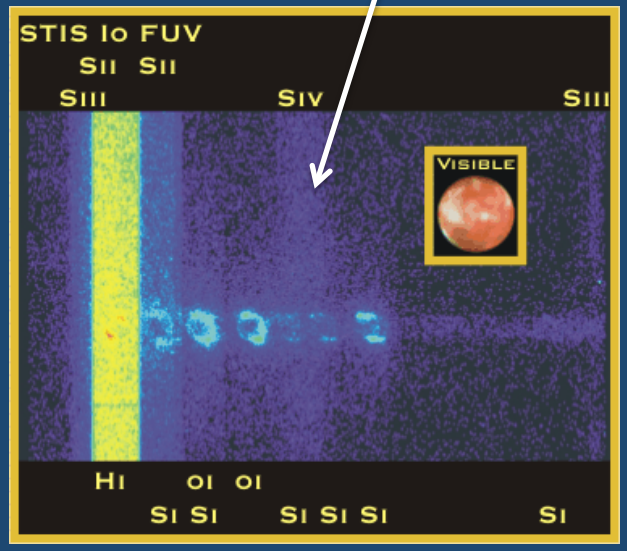


Example: Energetic Emissions

LUVOIR can enable monitoring of characterized systems with new capabilities.

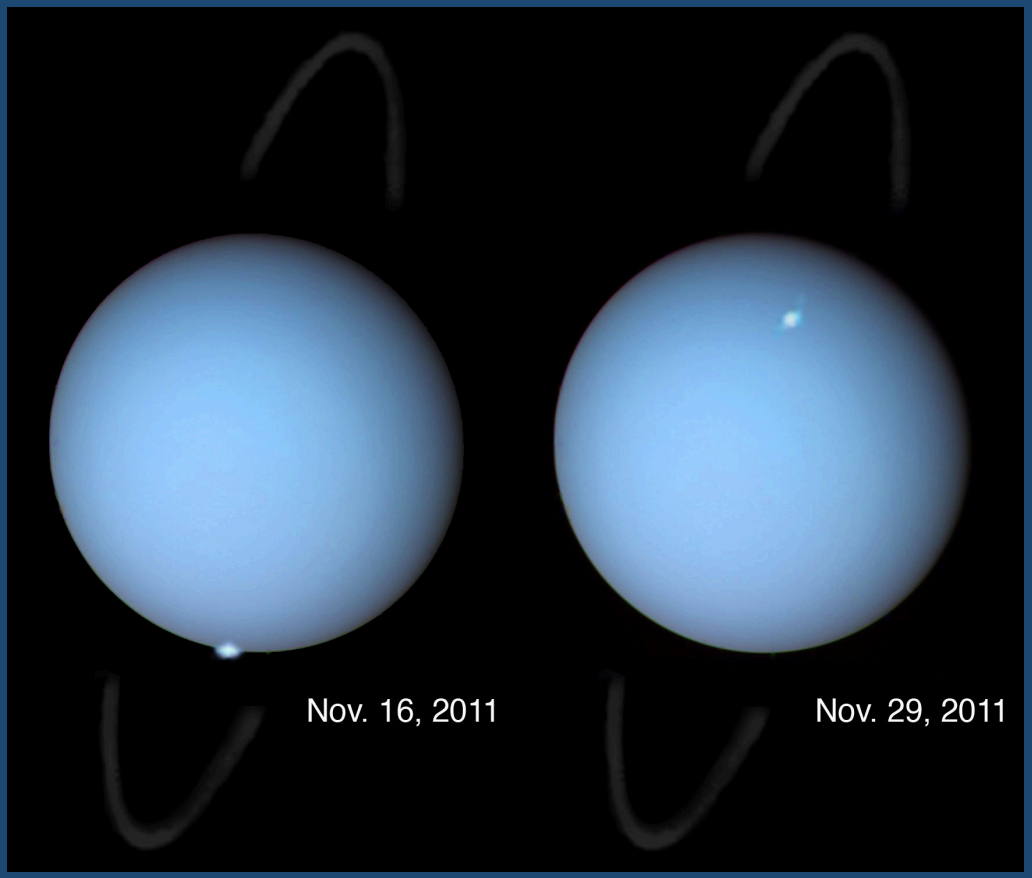


Torus Temp, Pitch Angle Scattering



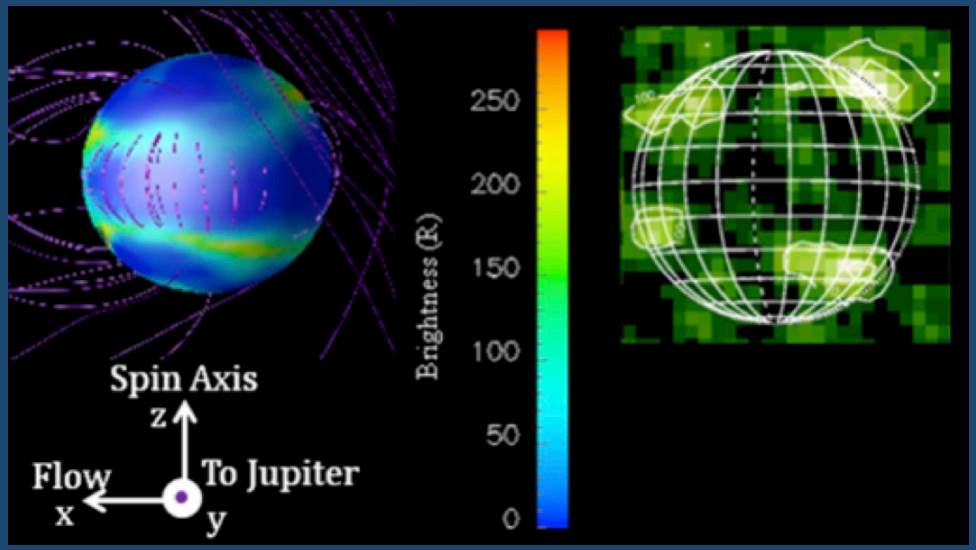
Example: Energetic Emissions

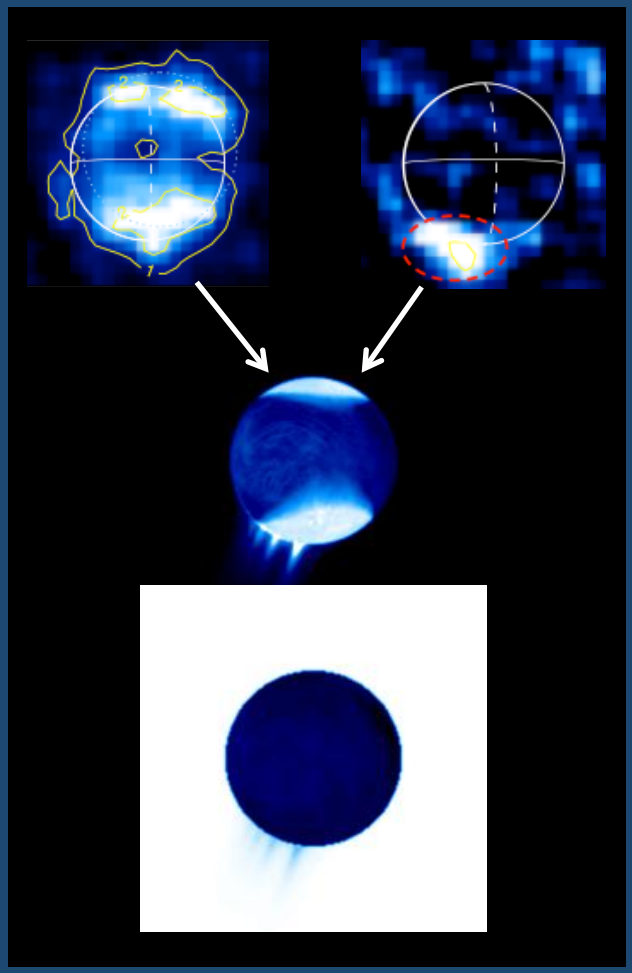
Ice giant auroral processes are currently below detection. Missions are beyond the LUVOIR time frame.



Example: Atmospheric Emissions

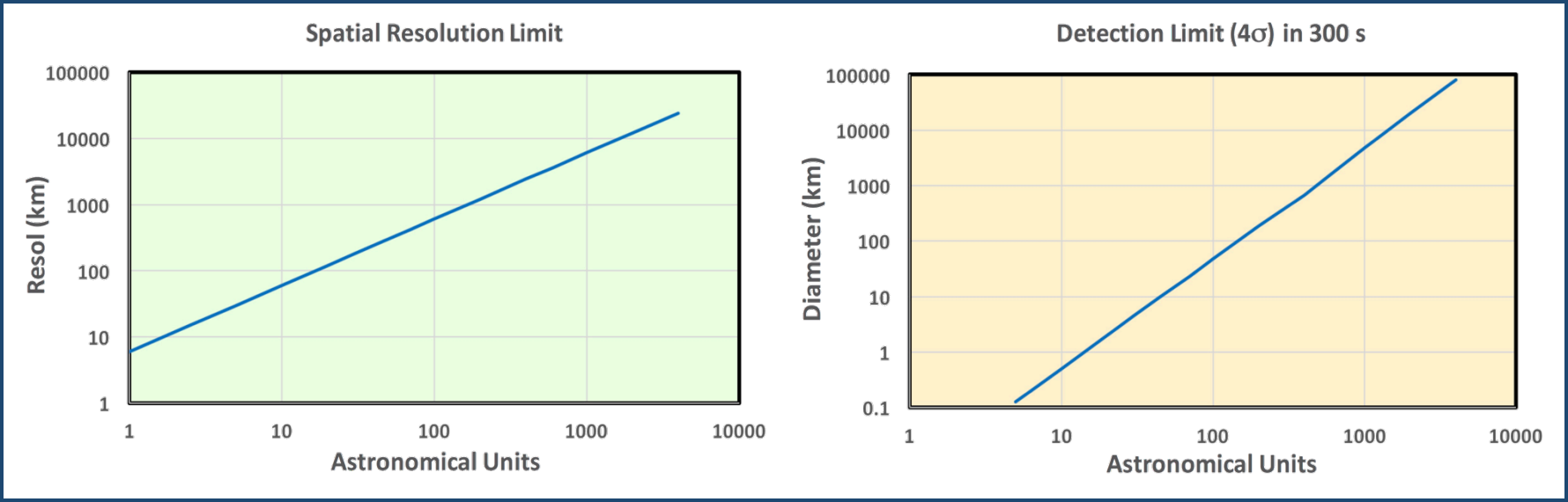
Resols and aperture enable detection of satellite emissions.





Example: Small Body Surveys

Aperture and Field of View translate to survey space.



Key metric 1: 12m LUVOIR + 5 arcmin (radius) FOV maps objects to 40 km diameter out to 50 AU over the MU66 search field in 100 s.

Key metric 2: 12m LUVOIR + 5 arcmin (radius) FOV maps objects to 40 km out to 50 AU over ecliptic +/- 20^{o} in 8 months.

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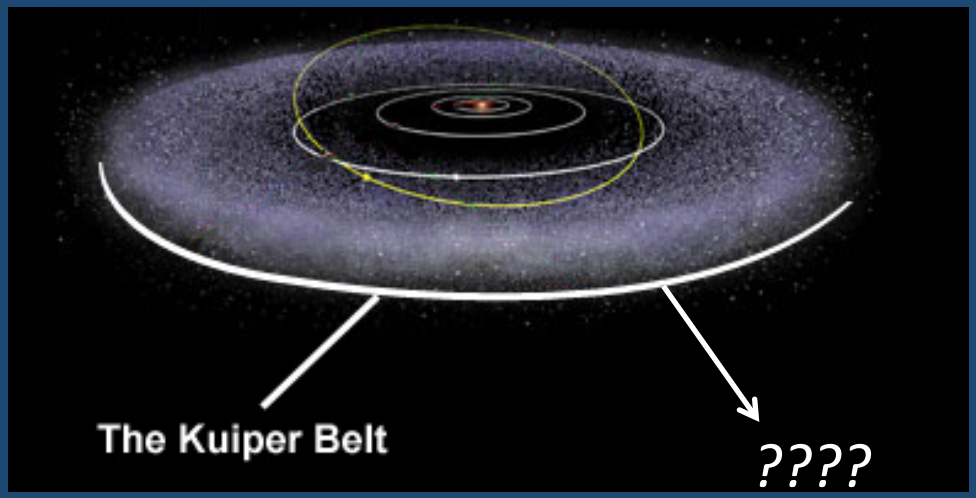

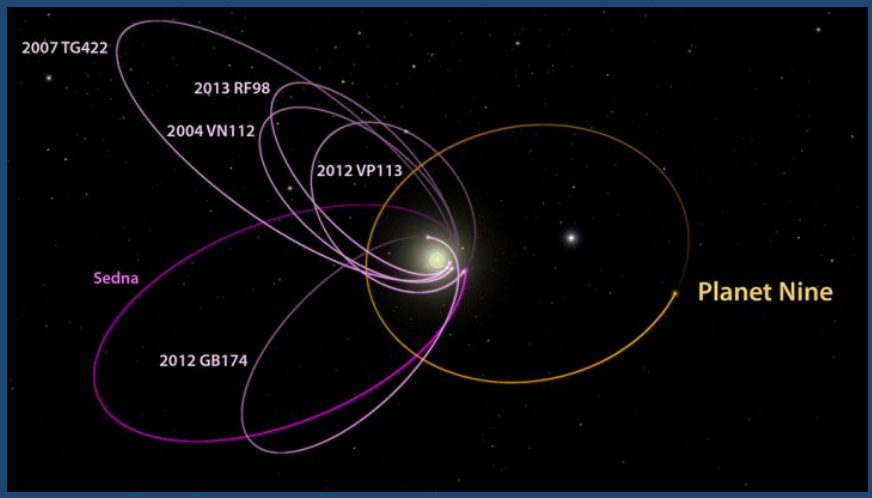

Key metric: 12 m LUVOIR = Detection of 1000 km diameter at 1000 AU (Sedna) in 1 hour.

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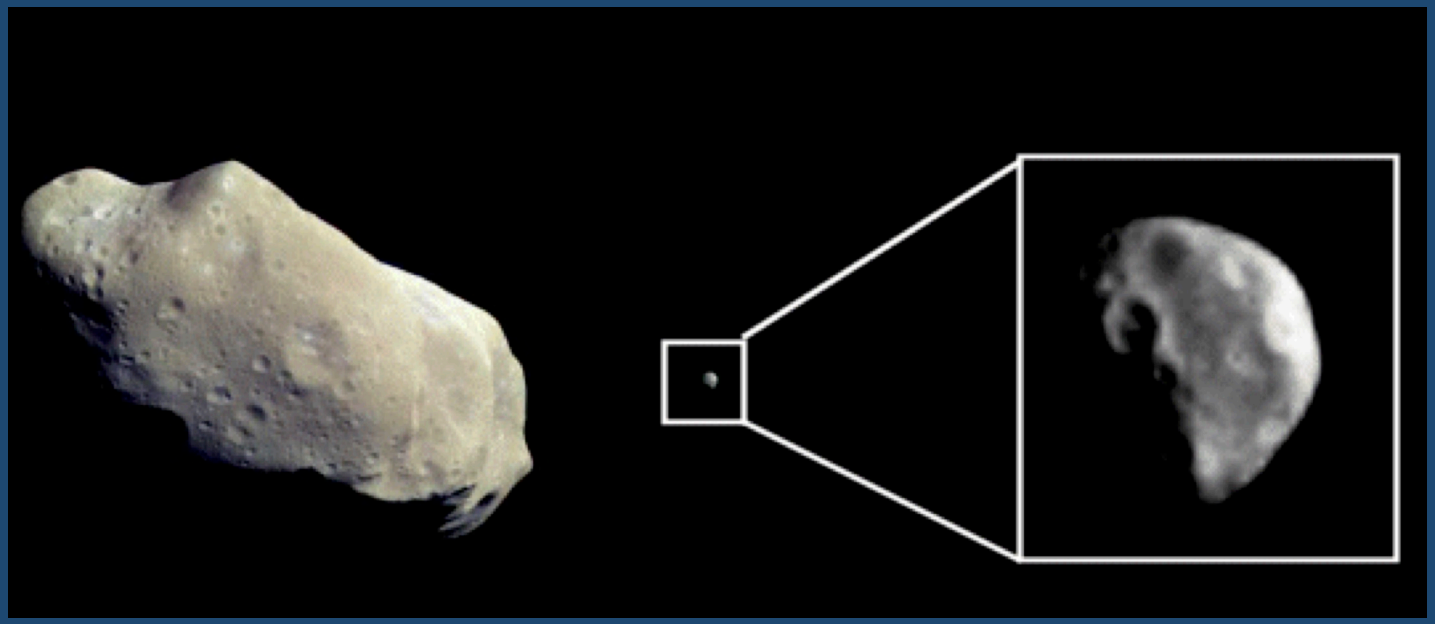

Example: Small Body Composition

Differential surface reflectance of smaller KBOs