

BIG BANG TO BIOSIGNATURES: THE LUVOIR MISSION CONCEPT



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What is LUVOIR?



LUVOIR-A: 15-m primary, LUVOIR-B : ~9-m primary
Serviceable and upgradable design

High sensitivity



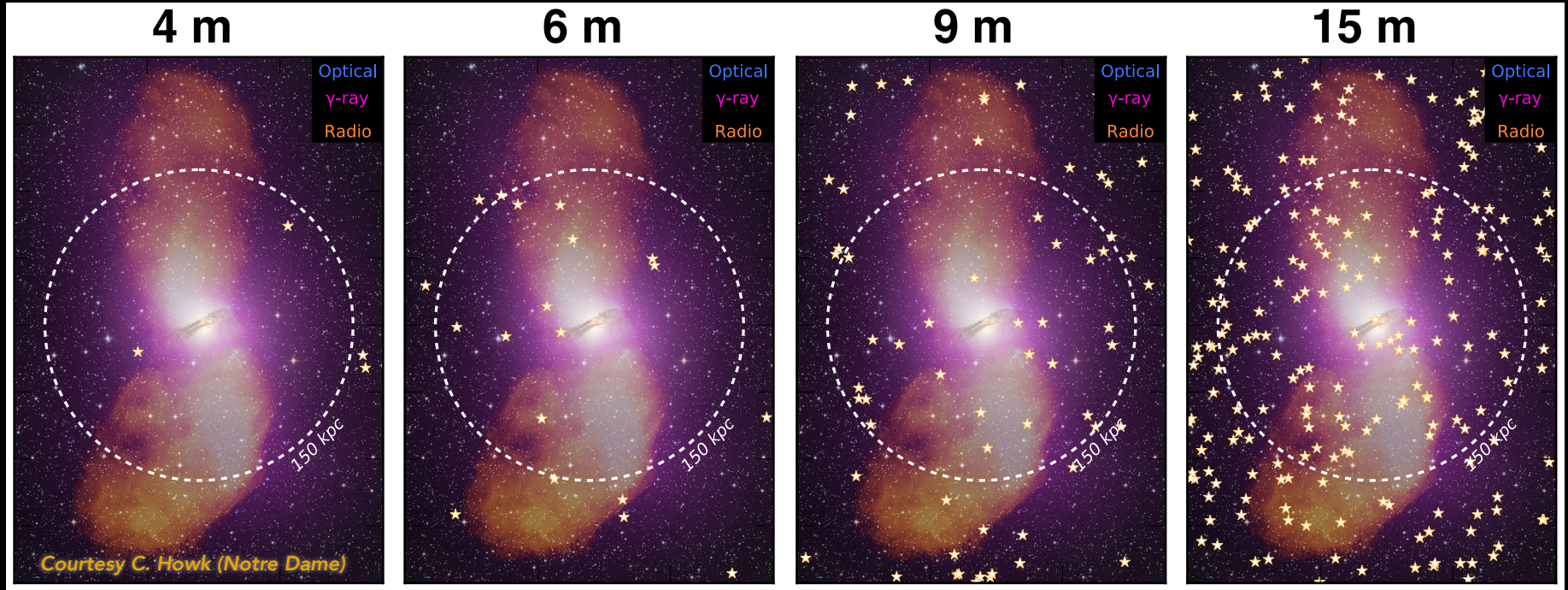
Low-mass galaxy at $z = 2$
with HST



Low-mass galaxy at $z = 2$
with LUVOIR-A

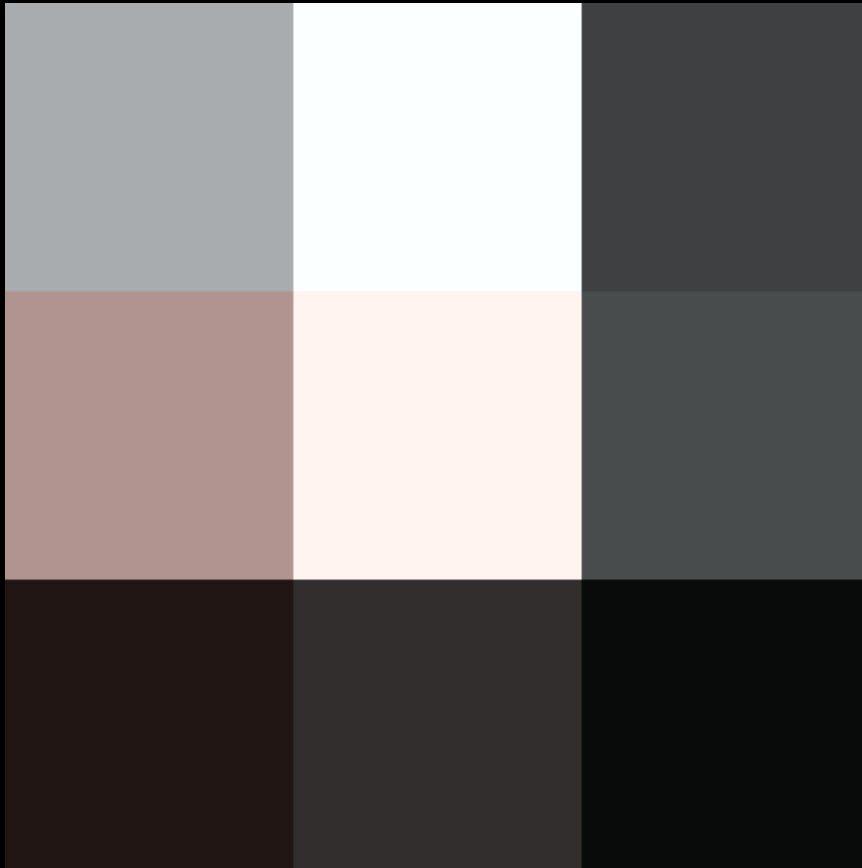
Credit: G. Snyder (STScI)

High sensitivity



Background quasars for UV spectroscopy with
LUV O I R-A of the CGM around Cen A

High resolution



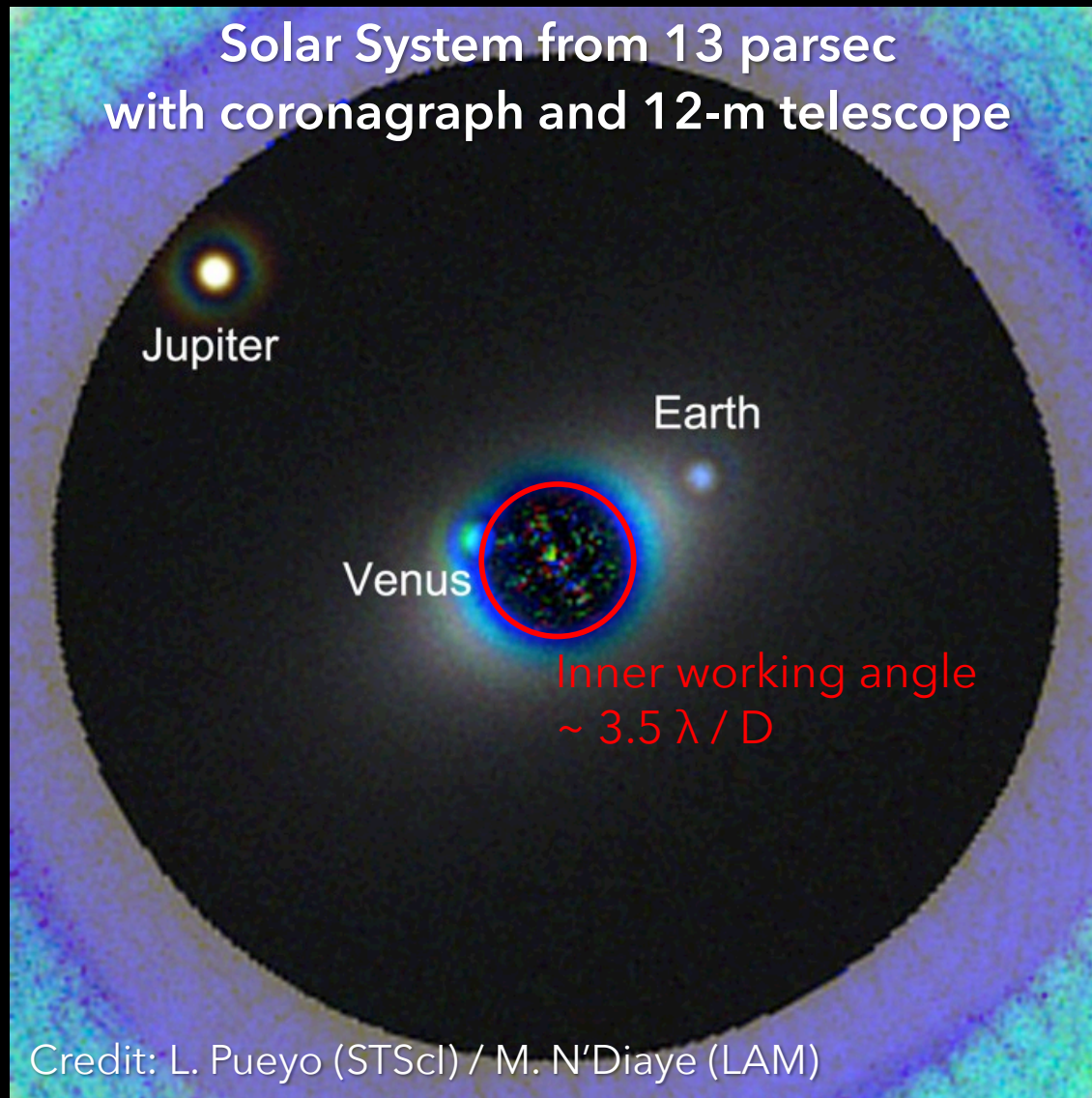
Pluto with HST



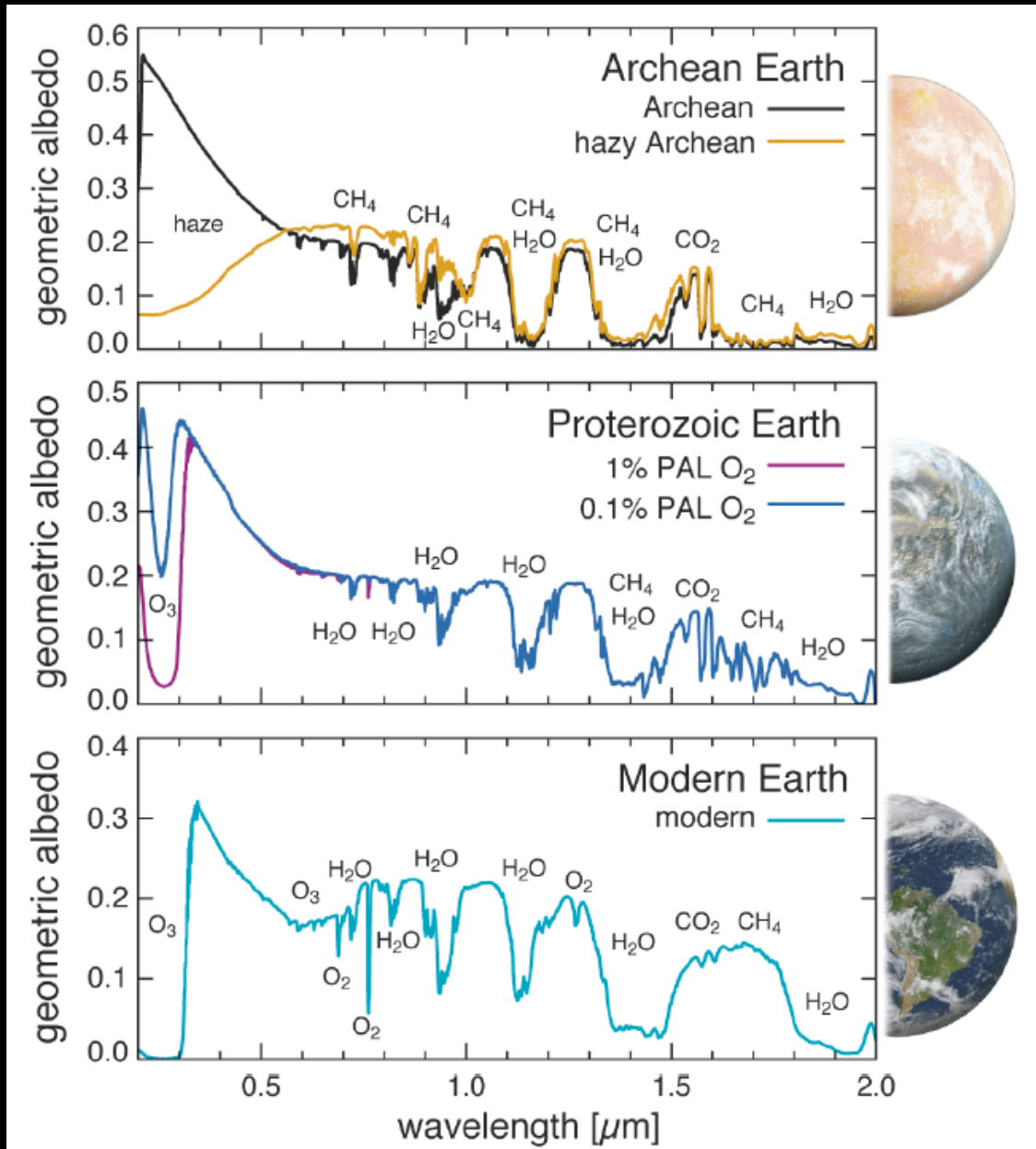
Pluto with LUVOIR-A

Credit: NASA / New Horizons / R. Parramon (NASA GSFC)

High contrast



The inhabited Earth through time

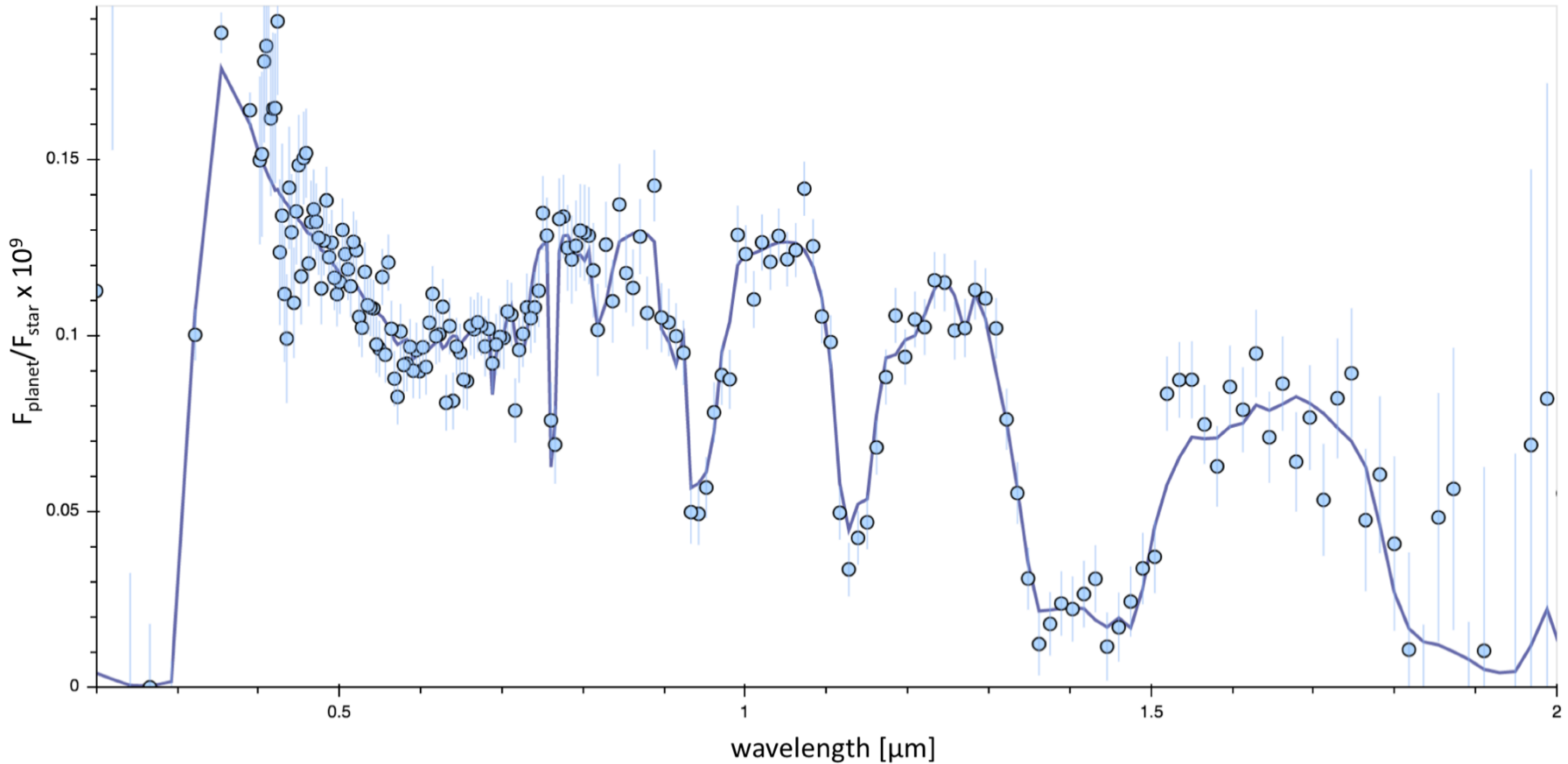


Credit: LUVVOIR Tools / G. Arney (NASA GSFC)

Modern Earth with LUV0IR-A

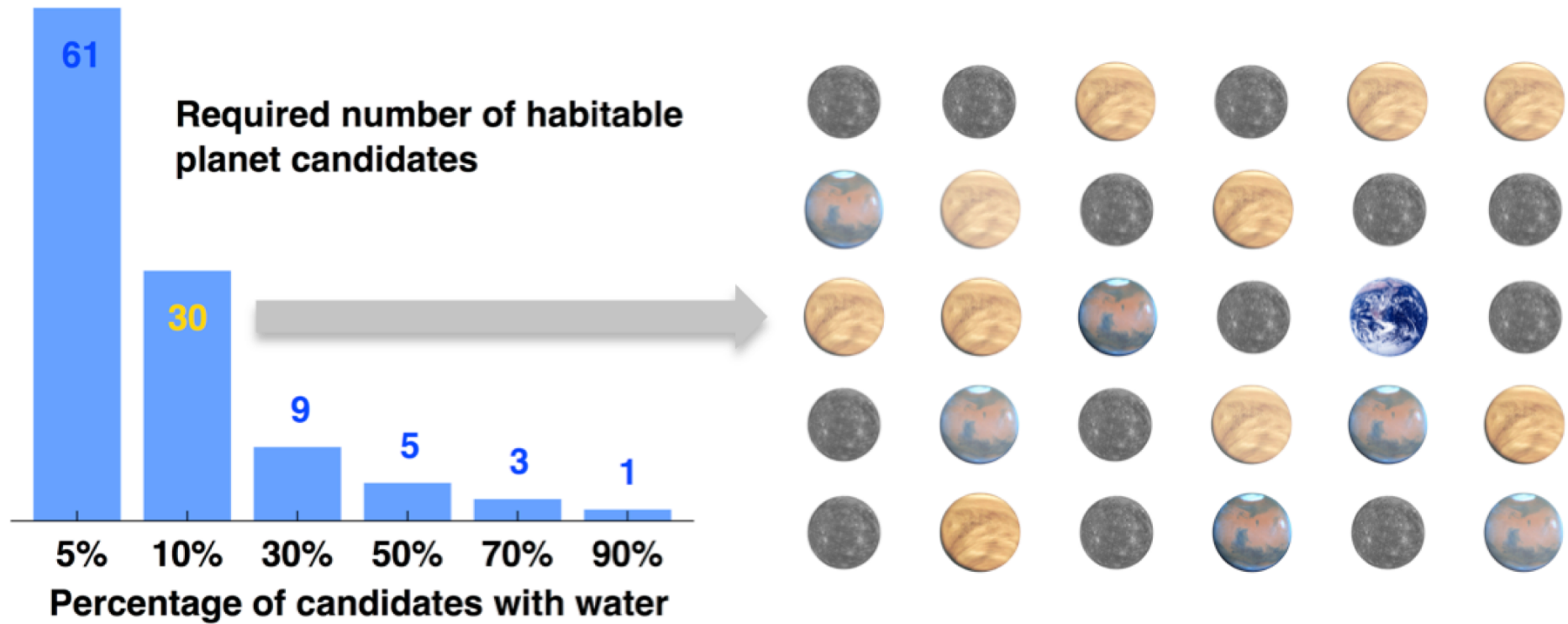


Earth twin at 5 pc with LUV0IR-A, 50 hours per coronagraphic bandpass



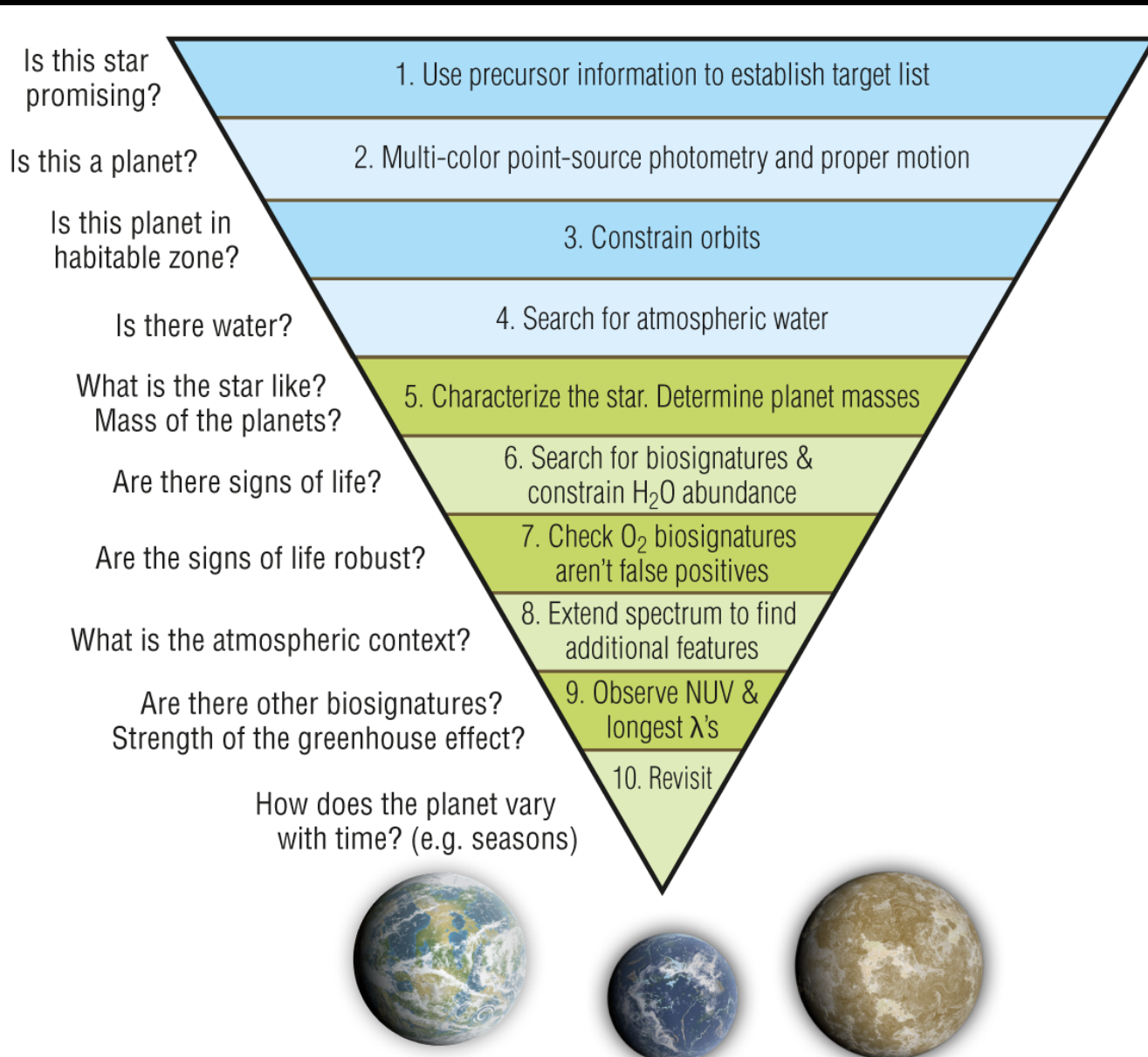
Credit: LUV0IR Tools / T. Robinson (NAU) / G. Arney (NASA GSFC)

How many exoEarth candidates do we need to constrain the frequency of habitable conditions?



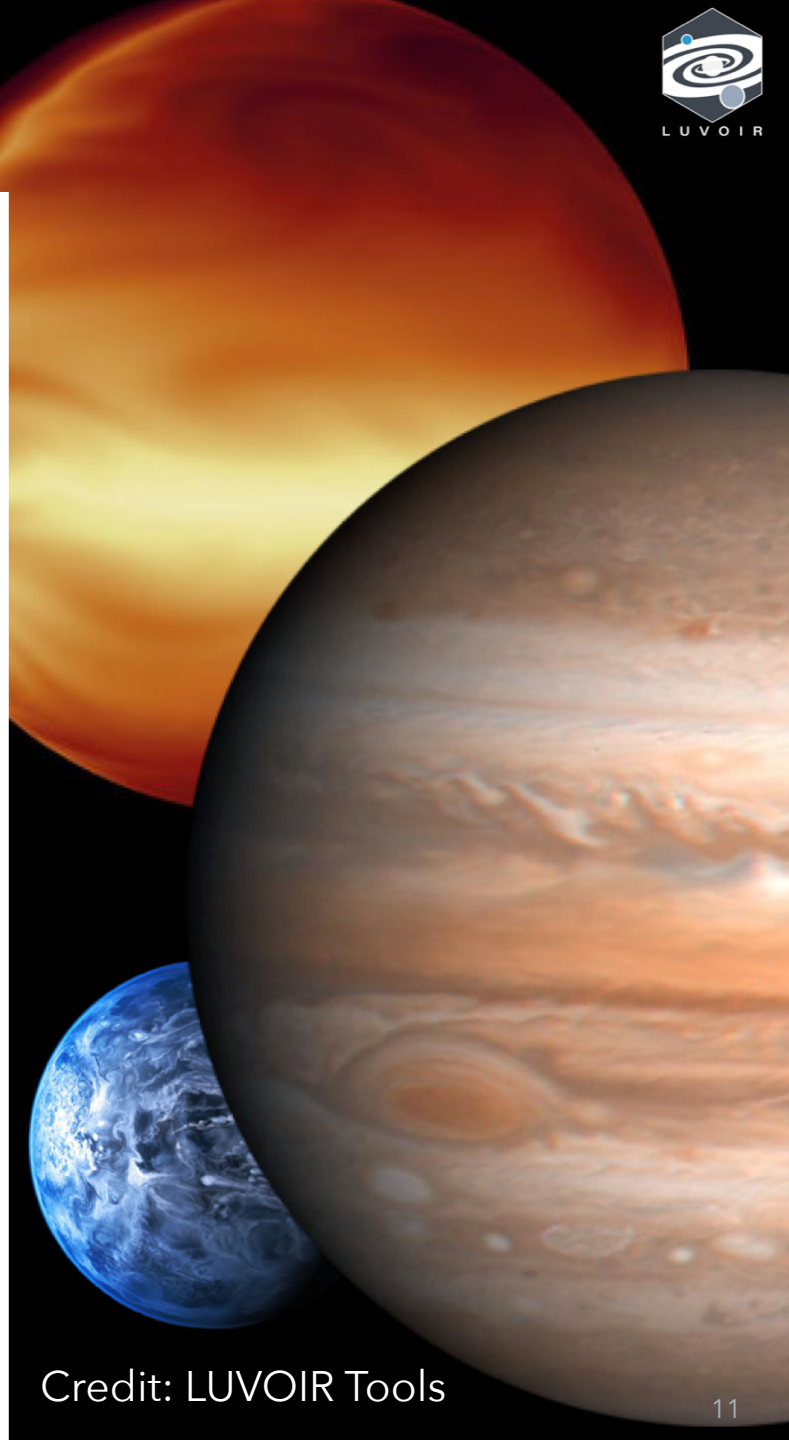
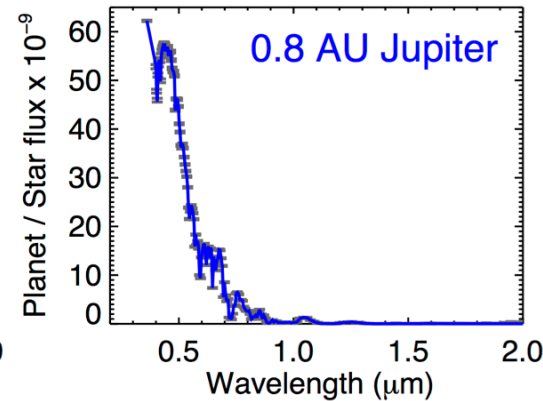
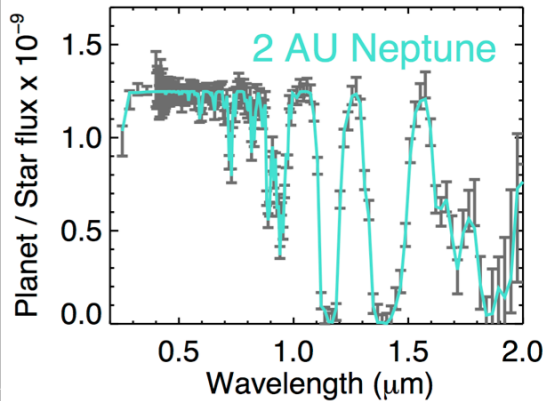
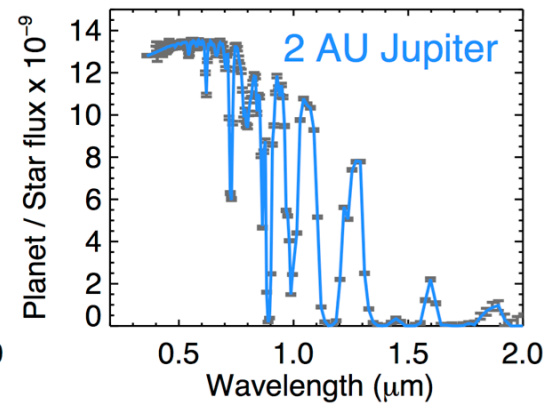
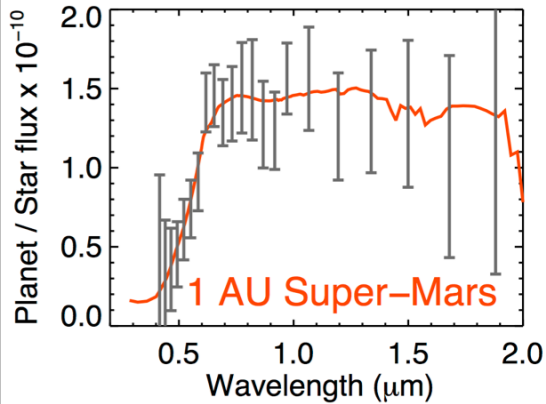
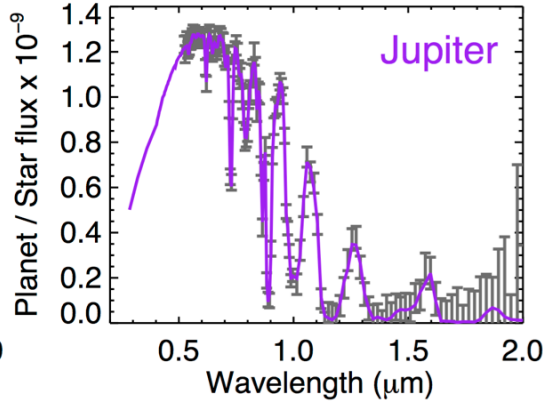
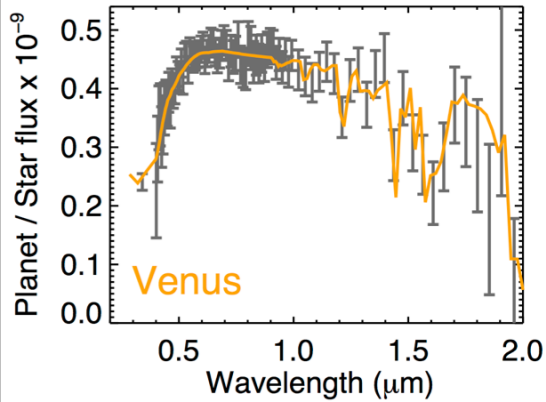
Credit: C. Stark (STScI) / A. Roberge (NASA GSFC)

Strategy for habitable exoplanets



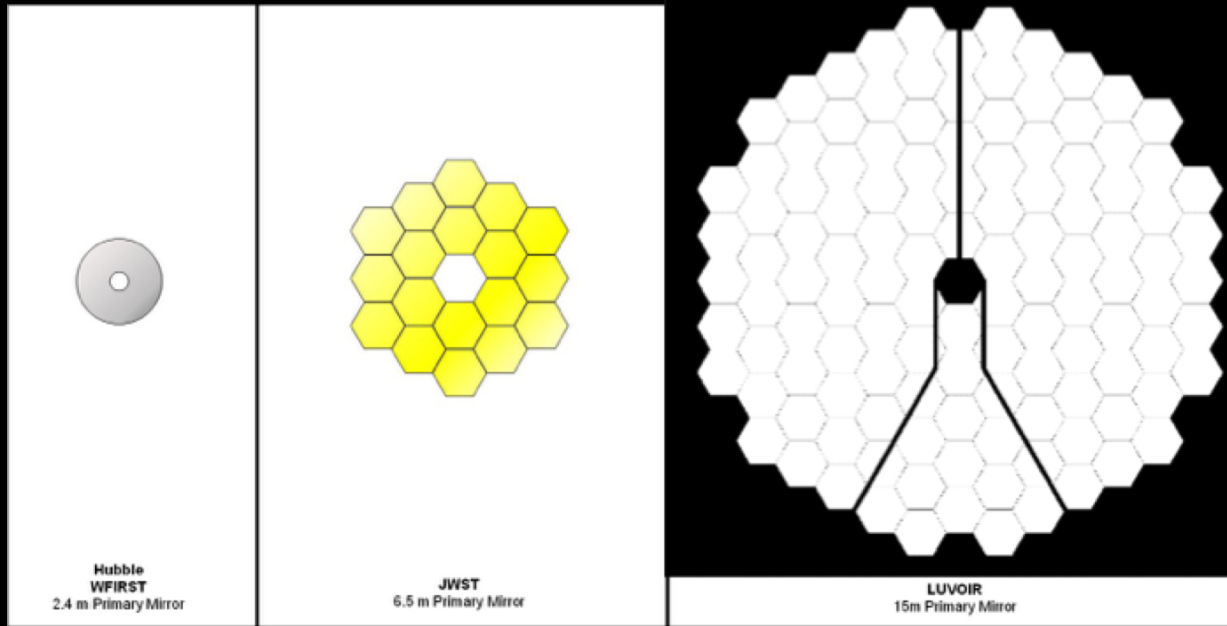
Credit: T. B. Grisswold (NASA GSFC)

The exoplanet zoo

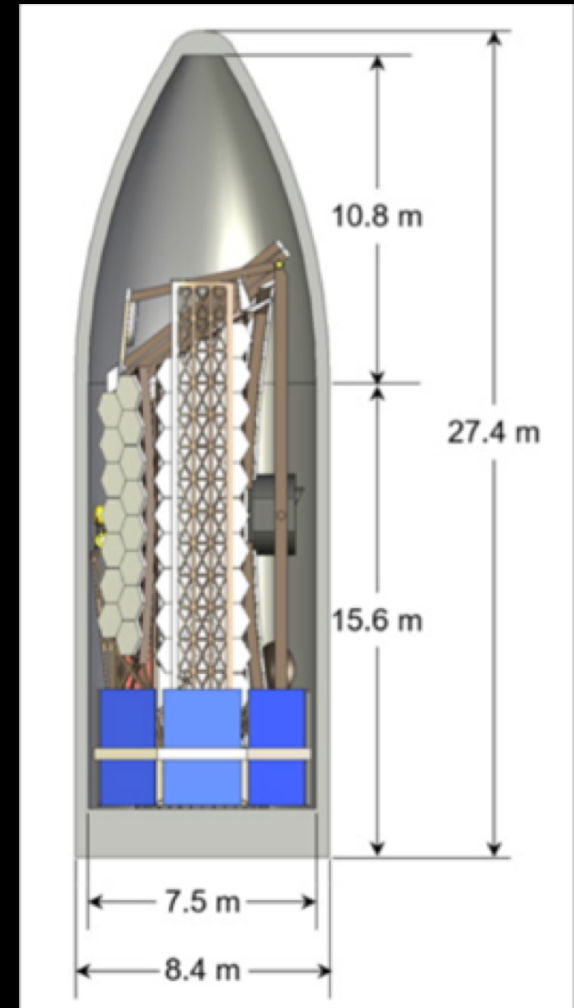


Credit: LUVOIR Tools

Segmented and deployable



LUVOIR-A



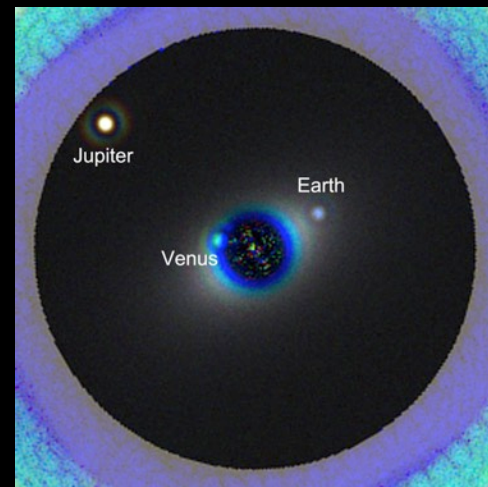
LUVOIR-A +
SLS Block 2 Fairing

The LUVOIR instruments



Observational challenge

Faint planets next to bright stars



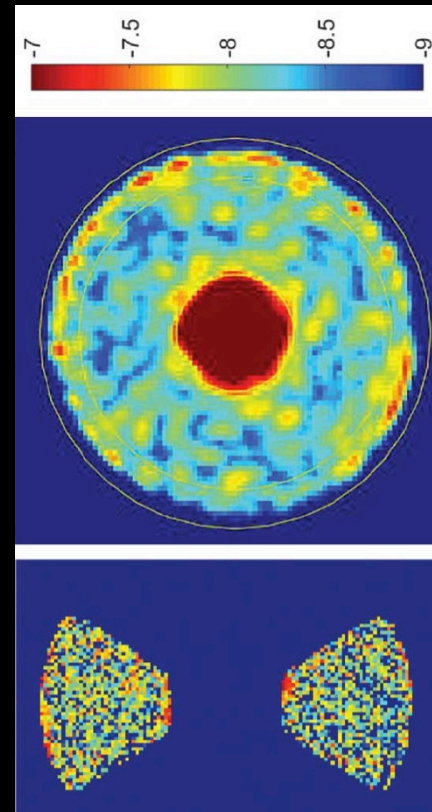
Extreme Coronagraph for Living Planetary Systems (ECLIPS)

Contrast $< 10^{-10}$

Low resolution imaging spectroscopy

Bandpass: $0.2 \mu\text{m}$ to $2.0 \mu\text{m}$

Tech development via WFIRST coronagraph



WFIRST
HLC

WFIRST
SPC

The LUVOIR instruments



Observational challenge

Very cold to very hot gases

LUVOIR UV Multi-Object Spectrograph (LUMOS)

$R = 500 - 63,000$

Bandpass: 100 nm to 400 nm

FOV: 3' x 1.6' (FUV), 1.3' x 1.6' (NUV)

FUV imaging channel

Heritage from STIS, COS, & NIRSPEC



Europa geysers



HST STIS UV instrument

The LUV OIR instruments

Observational challenge

Imaging the ultra faint and very small at high resolution

High-Definition Imager (HDI)

2 x 3 arcmin field-of-view

Bandpass: 0.2 μm to 2.5 μm

Nyquist sampled

Micro-arcsec astrometry capability
(measure planet masses, etc.)

Heritage from HST WFC3 & WFIRST



HST Wide Field Camera 3

POLLUX: a European contribution to the LUVOIR mission study

- ▶ UV spectro-polarimeter with high resolution point-source capability ($R \sim 120,000$).
- ▶ Circular + linear polarizations and unpolarized light
- ▶ Defined & designed by consortium of 10 European institutions, with leadership/support from CNES
- ▶ Builds off Arago mission concept. Instrument study could serve as basis for a future ESA contribution to LUVOIR

LUVOIR online simulation tools

<http://asd.gsfc.nasa.gov/luvoir/tools/>



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Tools

This page links to performance simulation and visualization tools for the LUVOIR mission, a future ultraviolet / optical / near-infrared observatory concept.

These widgets are experimental. If they are not working, email [Jason Tumlinson](#) (STScI). For the Planetary Spectrum Generator, email [Geronimo Villanueva](#) (GSFC).

Coronagraphic Spectra of Exoplanets

Simulate optical/near-IR reflection spectra of various exoplanets with realistic noise.

Multiplanet Yield Tool

Tool for visualizing yields of observed exoplanets (of various types) as function of basic mission parameters.

Planetary Spectrum Generator

Advanced tool for simulating spectra of Solar System bodies (with LUVOIR and other telescopes).

HDI Photometric ETC

Basic exposure time calculator for optical photometry in multi-band images.

LUMOS Spectroscopic ETC

Simple exposure time calculator for UV spectroscopy.

UV MOS Visualizer

See the impact of UV multi-object spectroscopy on the study of stellar clusters and their feedback.

High-Resolution Imaging

Examples of astronomical objects viewed with different sized telescopes.



Curator: J.D. Myers
NASA Official: Phil Newman

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Page Last Updated: Fri, Dec 01, 2017

How we're doing the study

Science and Technology Definition Team

- 25 voting members from community
- 10 non-voting reps. of international space agencies

Six Community Working Groups

- Exoplanets, Cosmic Origins, Solar System, Simulations, Communications, Technology

Four Instrument Teams

Study office and engineering team at GSFC

Summary

LUV O I R has multiple primary science goals

- ① Habitable exoplanets & biosignatures
- ② Broad range of general astrophysics and Solar System observations

Challenge is to blend goals into single powerful mission

LUV O I R will provide a statistical study of Goal 1,
factors of ~ 100 increased science grasp over
Hubble for Goal 2

Wide range of capabilities to enable decades of future
investigations and unexpected discoveries