

Planning for the Next UV-Opt-IR Space Telescope

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History

HST and Beyond

*Exploration and the Search for Origins:
A Vision for
Ultraviolet-Optical-Infrared
Space Astronomy*

1995

Commissioned by AURA

1. Extend HST lifetime
2. Build JWST
- ~~3. Develop space interferometry~~



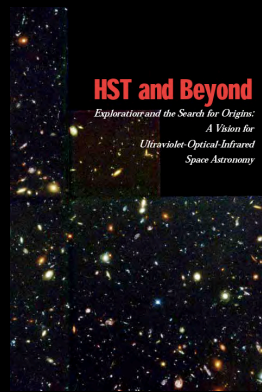
23+ year lead
time between
report & launch

Why This Exercise?

1995

2000

2018



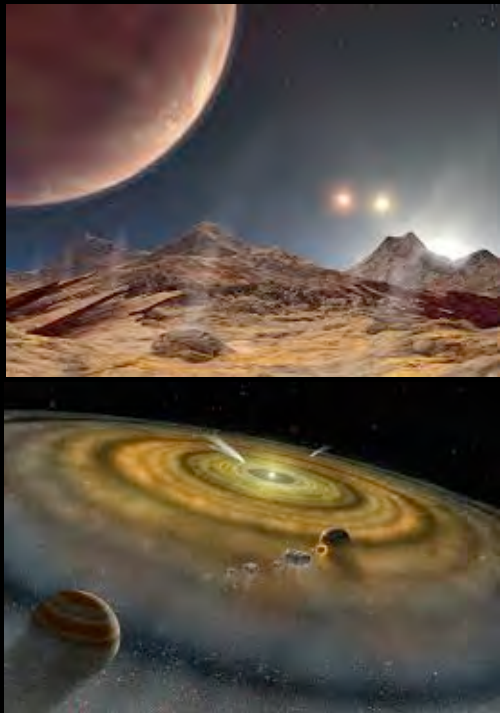
2014

2020

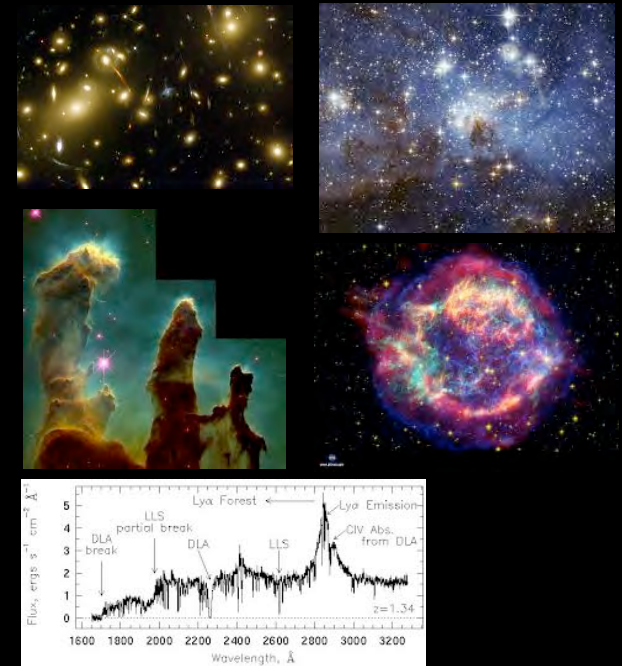
2035

Why This Exercise?

EXOPAG



COPAG



In the UVOIR,
the goals and
requirements
are very similar

One mission + Broad science = Large Community

Committee

- Chaired by Julianne Dalcanton & Sara Seager
- Broad mix of technologists and scientists
- AURA, NASA, & ESA observers

Not exclusive. Drawing
expertise broadly from
community.

Committee

Suzanne Aigraine

Steve Battel

Niel Brandt

Charlie Conroy

Julianne Dalcanton

Lee Feinberg

Suvi Gezari

Olivier Guyon

Walt Harris

Chris Hirata

John Mather

Marc Postman

Dave Redding

David Schiminovich

Sara Seager

Phil Stahl

Jason Tumlinson

technologists
scientists

Observers:

Heidi Hammel (AURA)

Paul Hertz & Mike Garcia (NASA)

Arvind Parmar (ESA)

Process

- Draw heavily from rich body of existing work (ATLAST, TPF-C, THEIA, EUVO)
- Outreach to community (one-on-one now, broader soon)
- Phone cons. Oh golly, the phone cons.
- Face-to-Face Meeting: Dec 2013, Spring 2014
- Report: Summer 2014

Key Goals

- Compelling science theme that resonates universally (Congress, Public, etc)
- Compelling capabilities that engage the astrophysics community
- Feasible, fundable technology path

Emerging science themes

Detecting & characterizing habitable
exoplanets.

Exoplanets Drivers

- Large aperture
 - Issues: How large? Requires mature DRM. Launch vehicle?
- Superb mirror (10's of picometer stability)
 - Issues: stable over what timescale & mode?
- Coronagraphic capability
 - Issues: Internal (hard requirements) vs external (inefficient, limited lifetime)

Emerging science themes

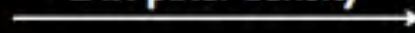
- Exoplanets
- “The Universe in High-Definition”

HDST: High-Definition Space Telescope



SDTV
720x480

24x pixel density



UltraHD
3820x2160



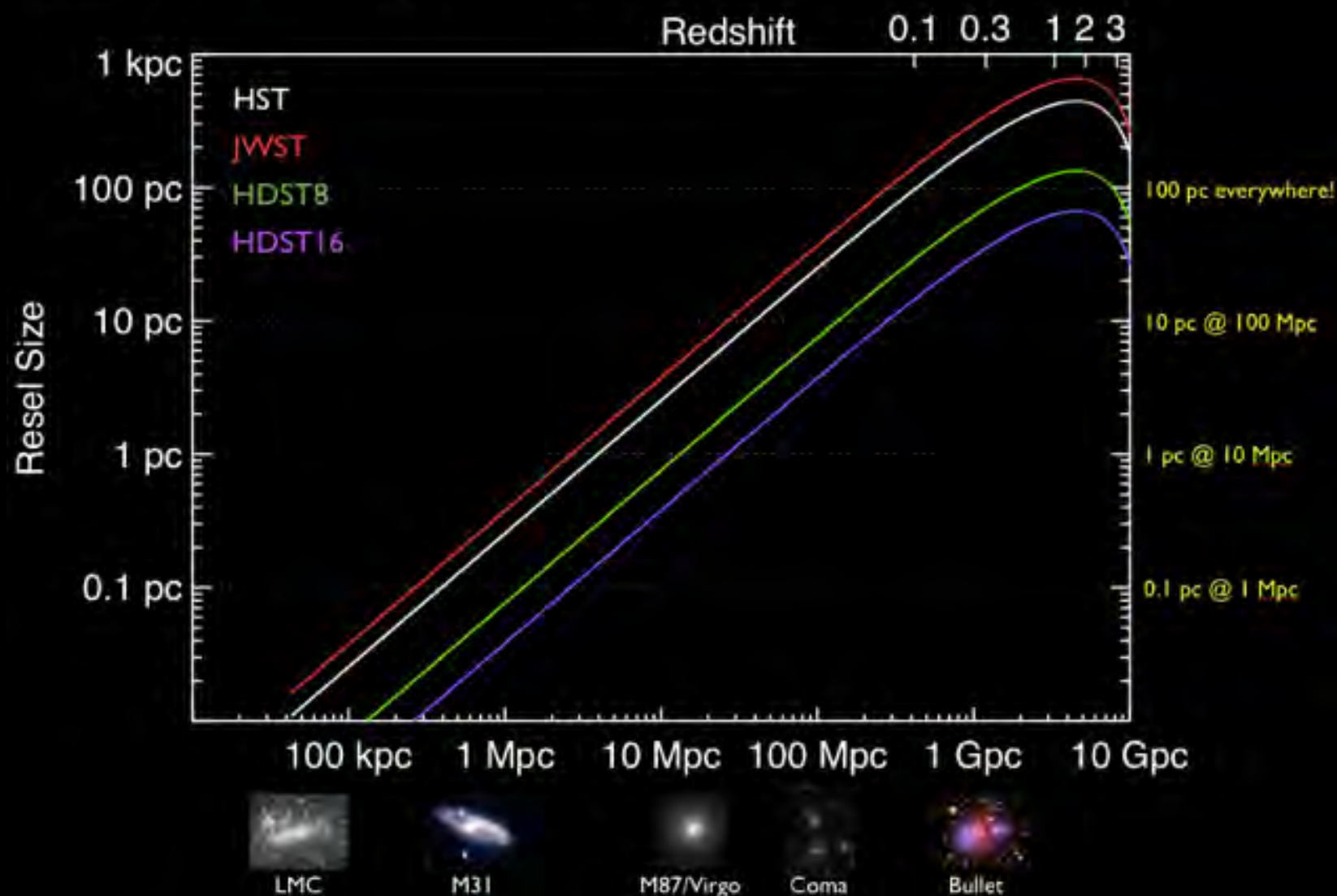
HST
2.4 m

24x image sharpness

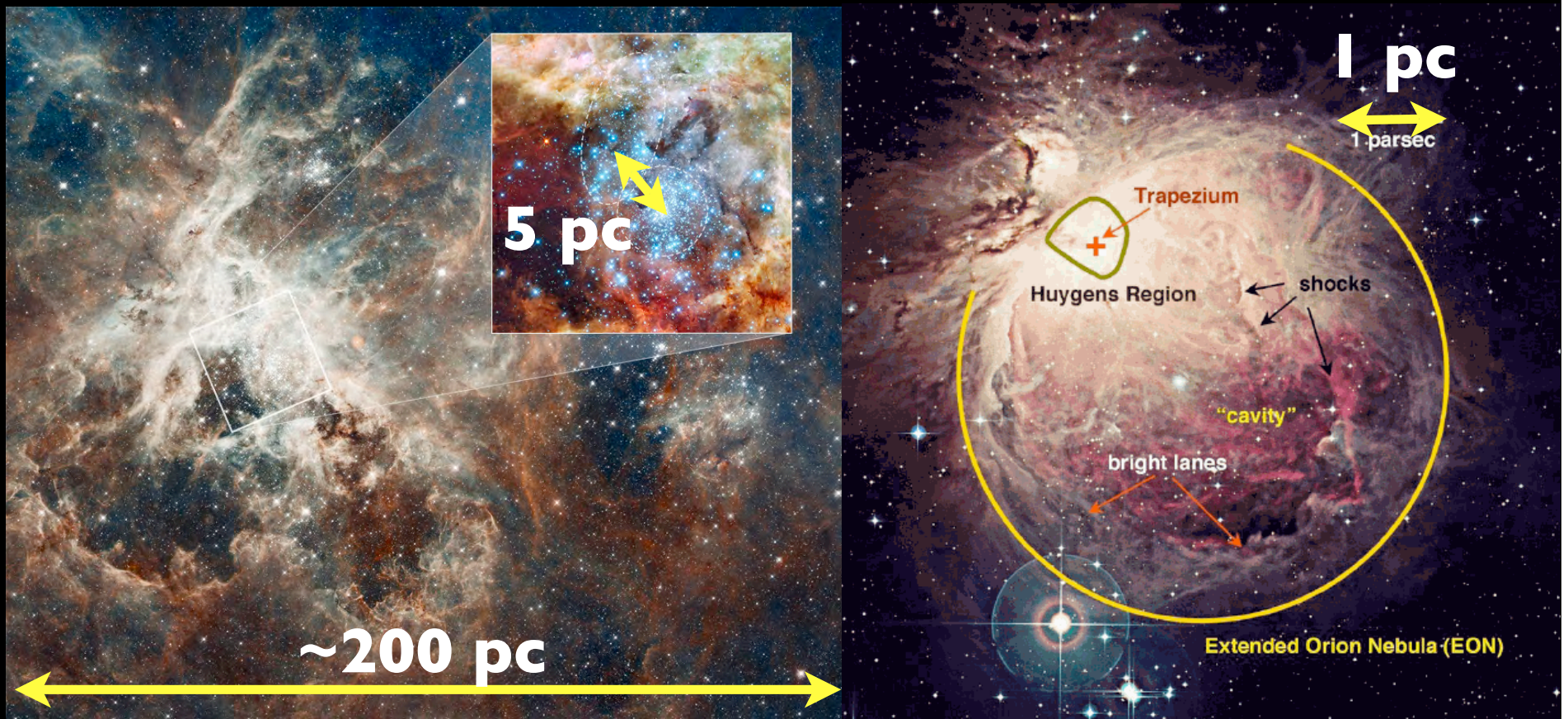


HDST
12 m

HDST: Breaking Resolution Barriers



Size scales



HDST: Resolving 100 pc star forming regions everywhere in the universe! 1 pc resolved out to 10 - 25 Mpc.

HDST: Breaking Resolution Barriers



Orion



Bulge



LMC



M31



M87/Virgo



Coma



Bullet

General Astrophysics Drivers

- Large aperture: Throughput + Resolution
- UV (102 nm) through NIR (2.5 μm , non-cryo)
 - Issues: Coatings, Compatibility w/ Coronagraphy
- Large FOV + Spectroscopic Multiplexing
 - Issues: Tradeoff between cost of more complex instruments vs efficiency gains

Additional Considerations

- Serviceable as means of risk reduction, possible lifetime extension
- If an internal coronagraph is used, explore providing capabilities to allow starshade at later time.

Technological issues

- Mirror technology
- Reducing vibration
- UV Coatings
- Coronagraphy
- Low read noise detectors
- Launch vehicle (<9.2m w/ existing)

Moving forward

- Improve science requirements, particularly those in support of coronagraphy (help from EXOPAG?).
- Identify aperture thresholds, based on DRMs.
- Create technology development plan for investment in advance of 2020.
- Present viable joint exoplanet-astrophysics space mission to 2020 decadal review.

Help from EXOPAG SAGs?

- Refine coronagraphy requirements on telescope stability (timescales, modes, etc)
- Improve understanding of interaction between coatings & coronagraphy
- Develop efficient strategies for minimizing time needed for exoplanet characterization (i.e., preselection of targets, reducing number of repeat visits to confirm planet, etc).
- Prioritization of wavelength ranges for band-limited coronagraphy.

Help from COPAG?

- May request help with technology assessment.

Input welcome!

- Please talk to any committee member, at any time.

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