



**STScI** | SPACE TELESCOPE  
SCIENCE INSTITUTE

EXPANDING THE FRONTIERS OF SPACE ASTRONOMY

## **Hundreds of Hubbles in the 2020s**

**Realizing the scientific potential of the Roman Space Telescope Archive**

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Karoline Gilbert

Nancy Grace Roman Space Telescope, Mission Scientist

**STScI Town Hall, 236<sup>th</sup> AAS meeting**

# MIRRORS



HUBBLE

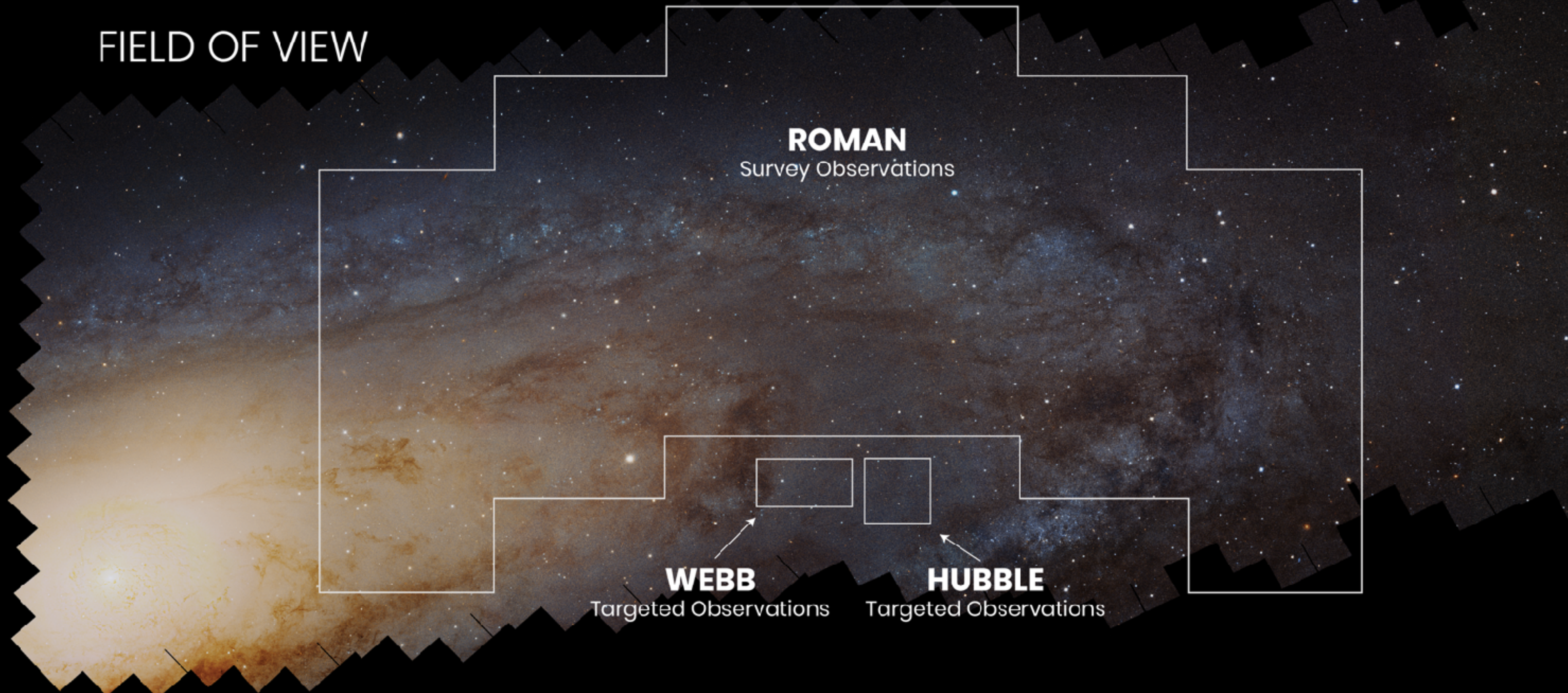


ROMAN



WEBB

# FIELD OF VIEW

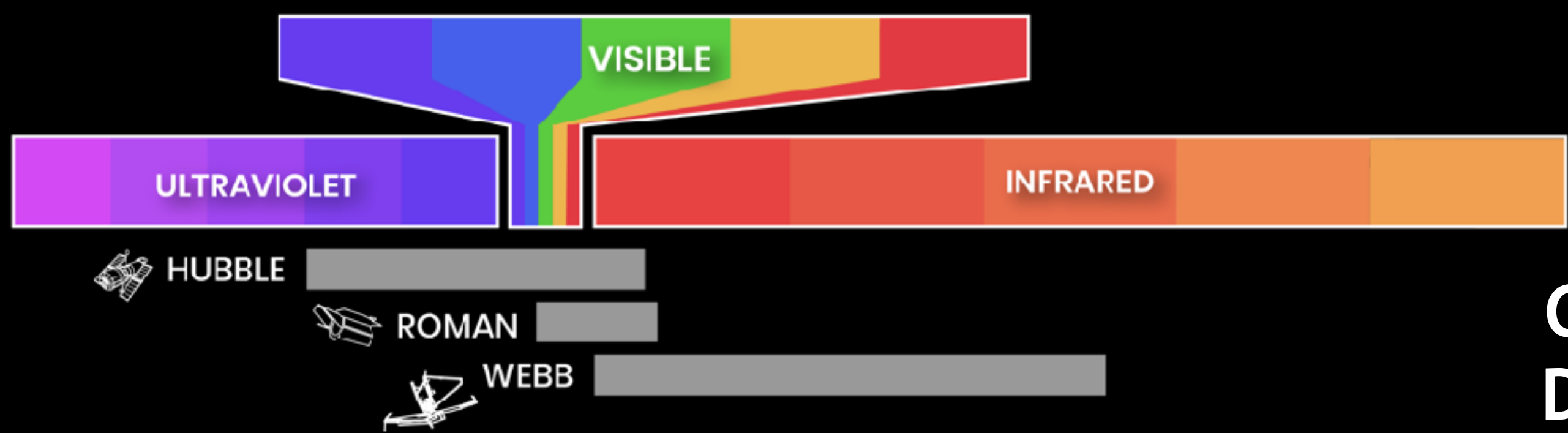


**ROMAN**  
Survey Observations

**WEBB**  
Targeted Observations

**HUBBLE**  
Targeted Observations

# WAVELENGTH



**Wide Field Instrument**  
*imaging from 0.5-2  $\mu$ m*  
*slitless spectroscopy from*  
*0.75-1.93  $\mu$ m*

**Coronagraphic Technology  
Demonstration Instrument**

# MIRRORS



HUBBLE

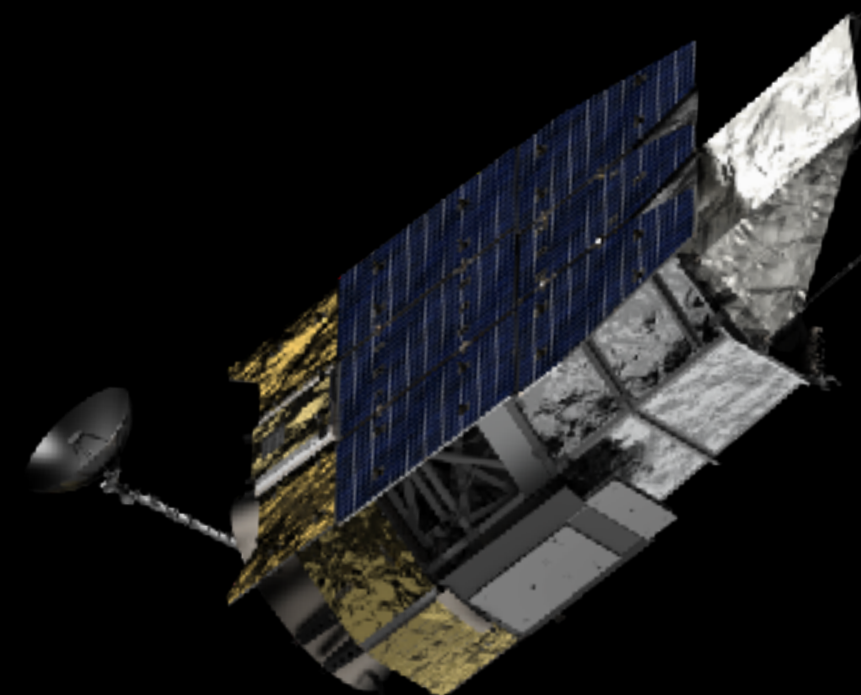
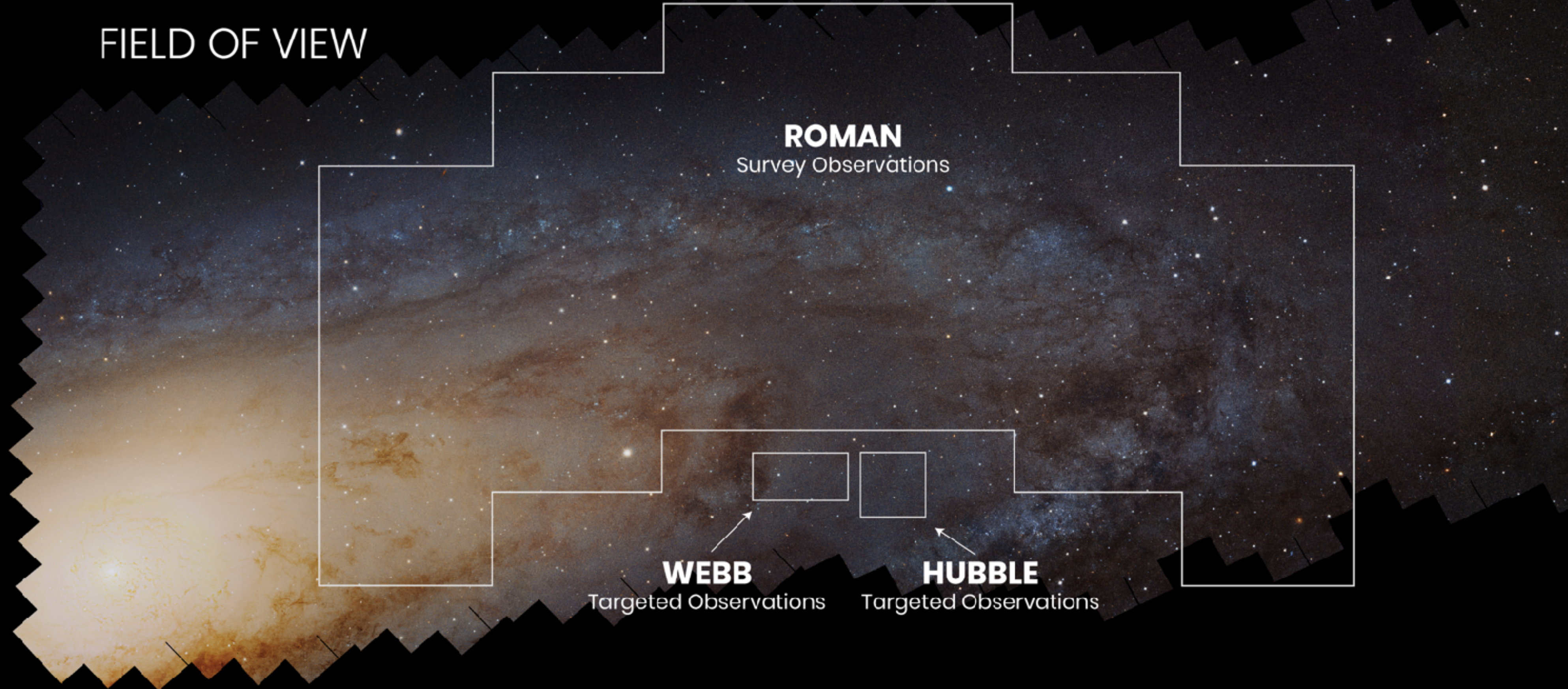


ROMAN

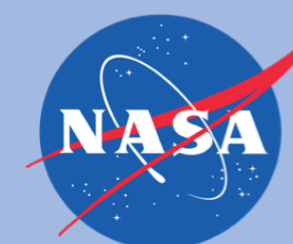


WEBB

# FIELD OF VIEW



The Partners  
Distributed Operations Model  
STScI is the Science  
Operations Center



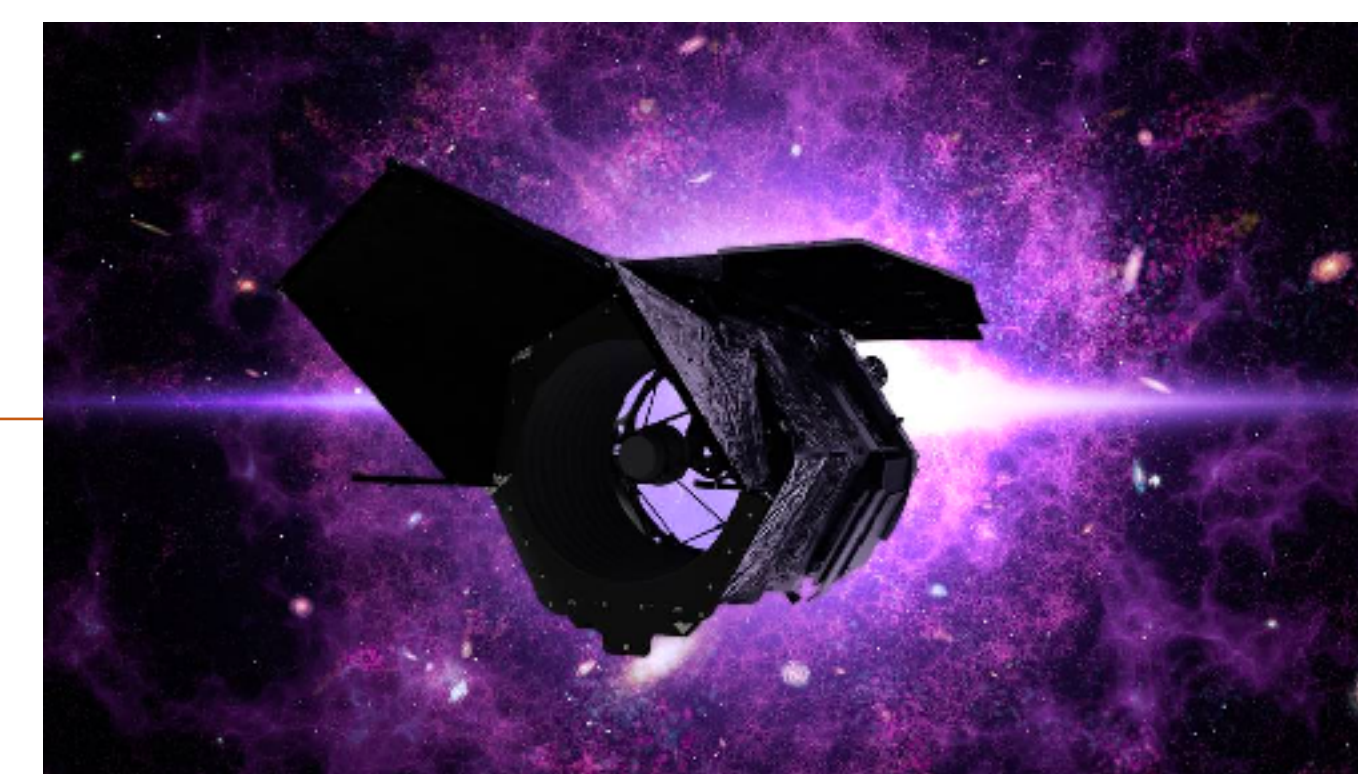
STScI | SPACE TELESCOPE  
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Plus Industry, International, and Academic Partners



# Roman Space Telescope Mission Status



Major mission milestone passed in February 2020: Out of “Formulation” and into “Implementation”

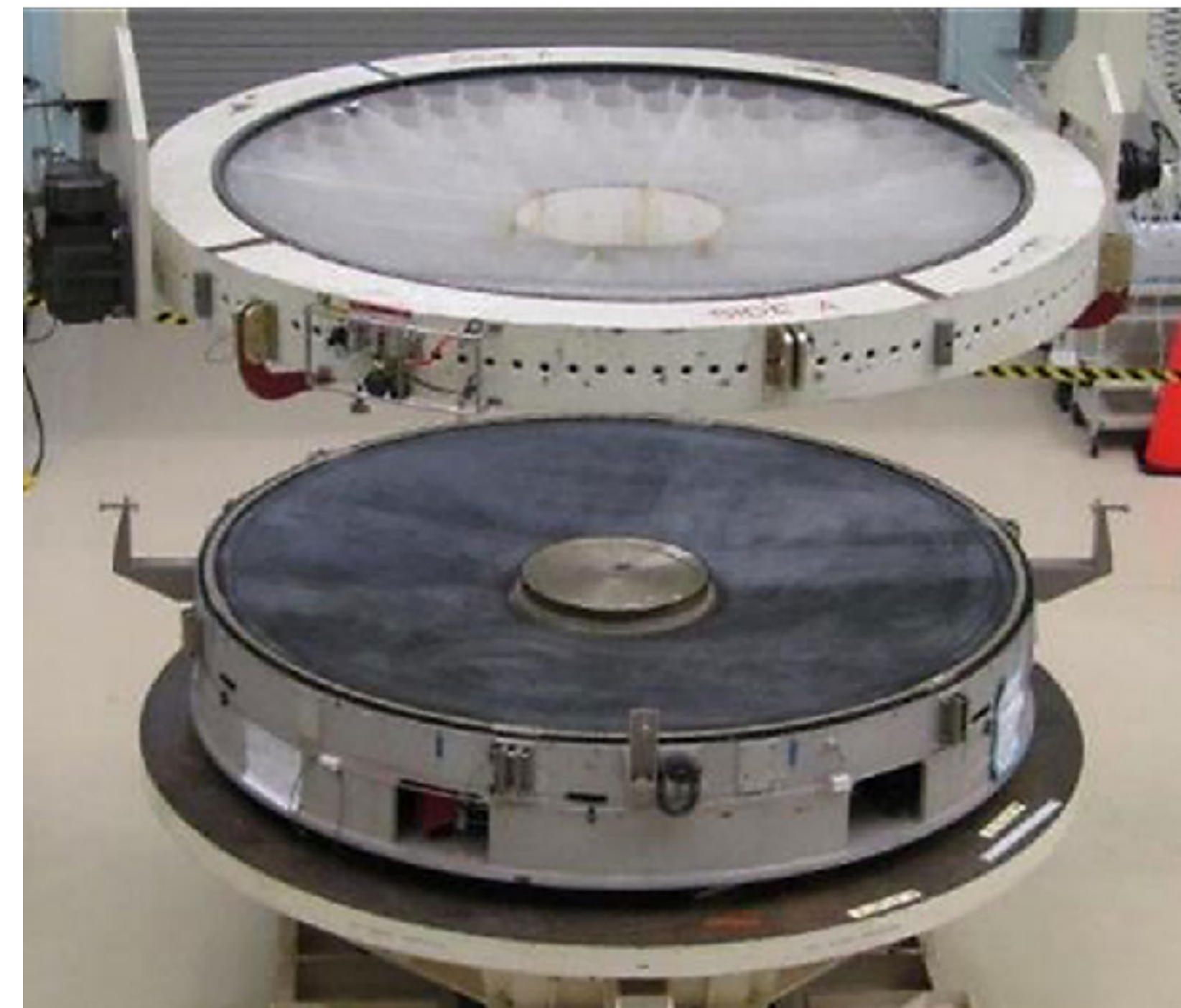
Hardware in development, flight detectors being built and delivered

All Observing Time remains available

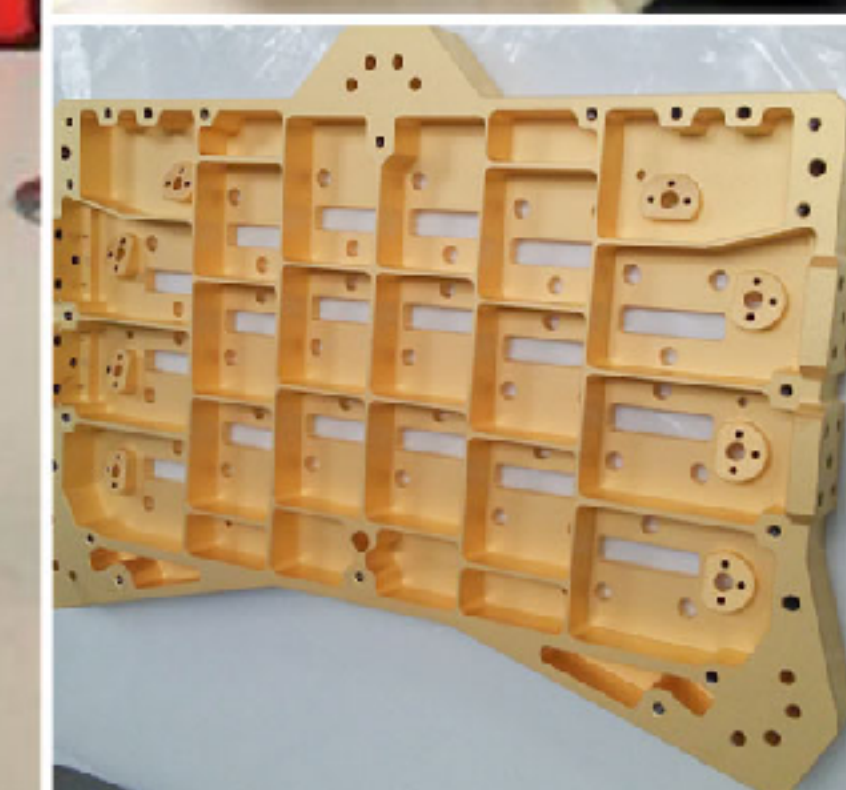
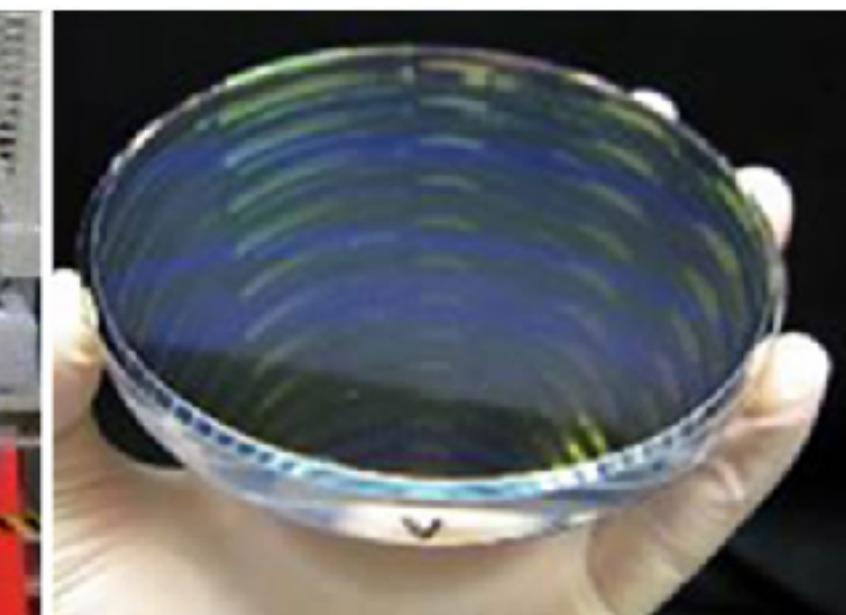
All data will be publicly available with no proprietary period

***Look for Proposal opportunities for a range of preparatory science programs beginning in 2021***

Primary Mirror



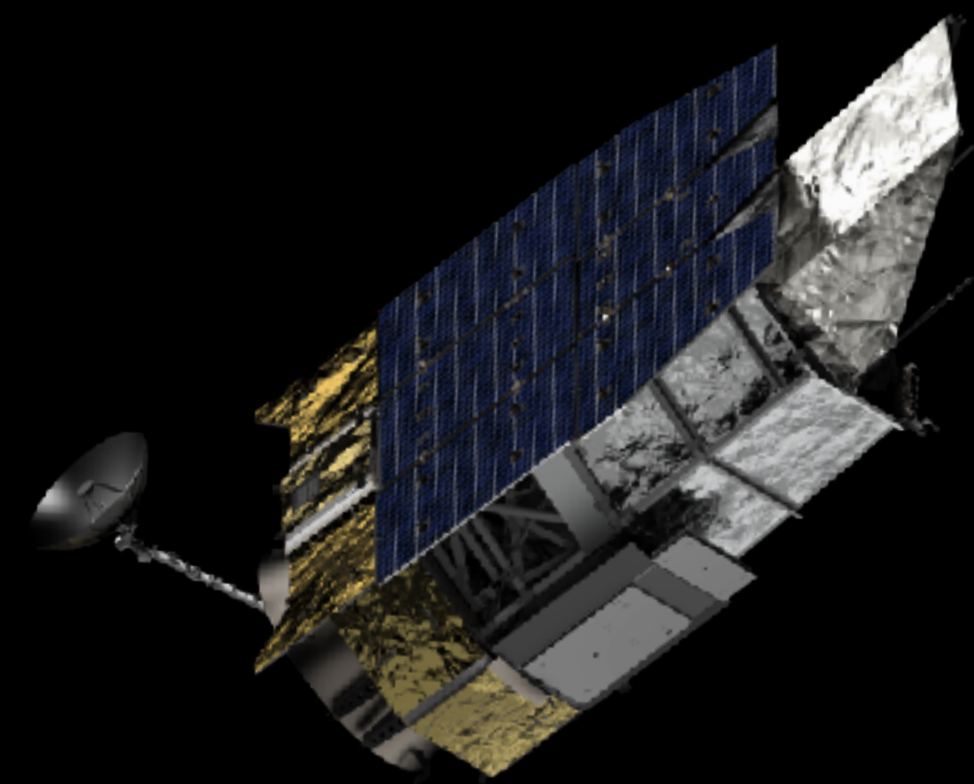
Engineering Test Unit WFI Filter



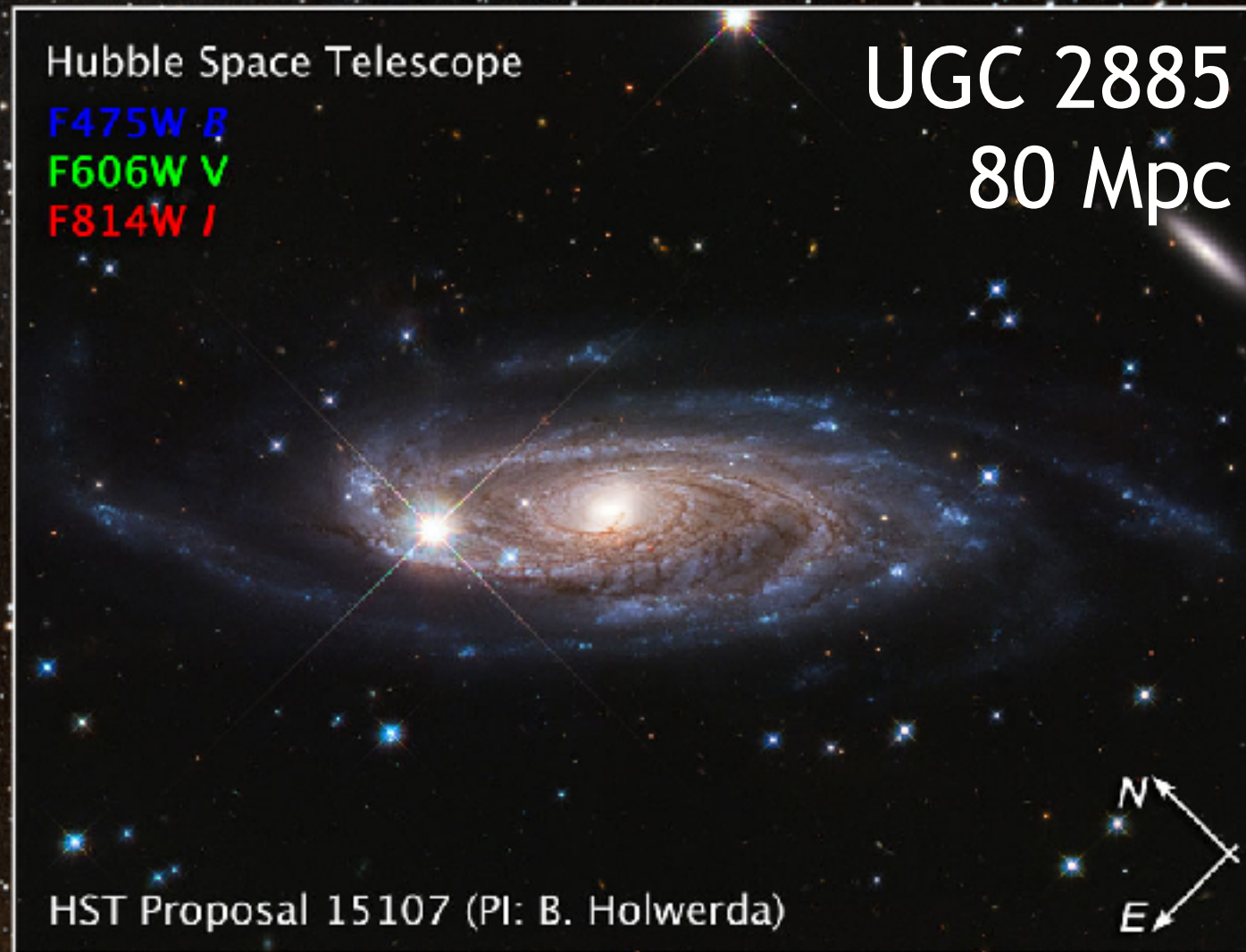
WFI Focal plane mosaic plate

Measure complete satellite and cluster populations with Hubble-like sensitivity and resolution

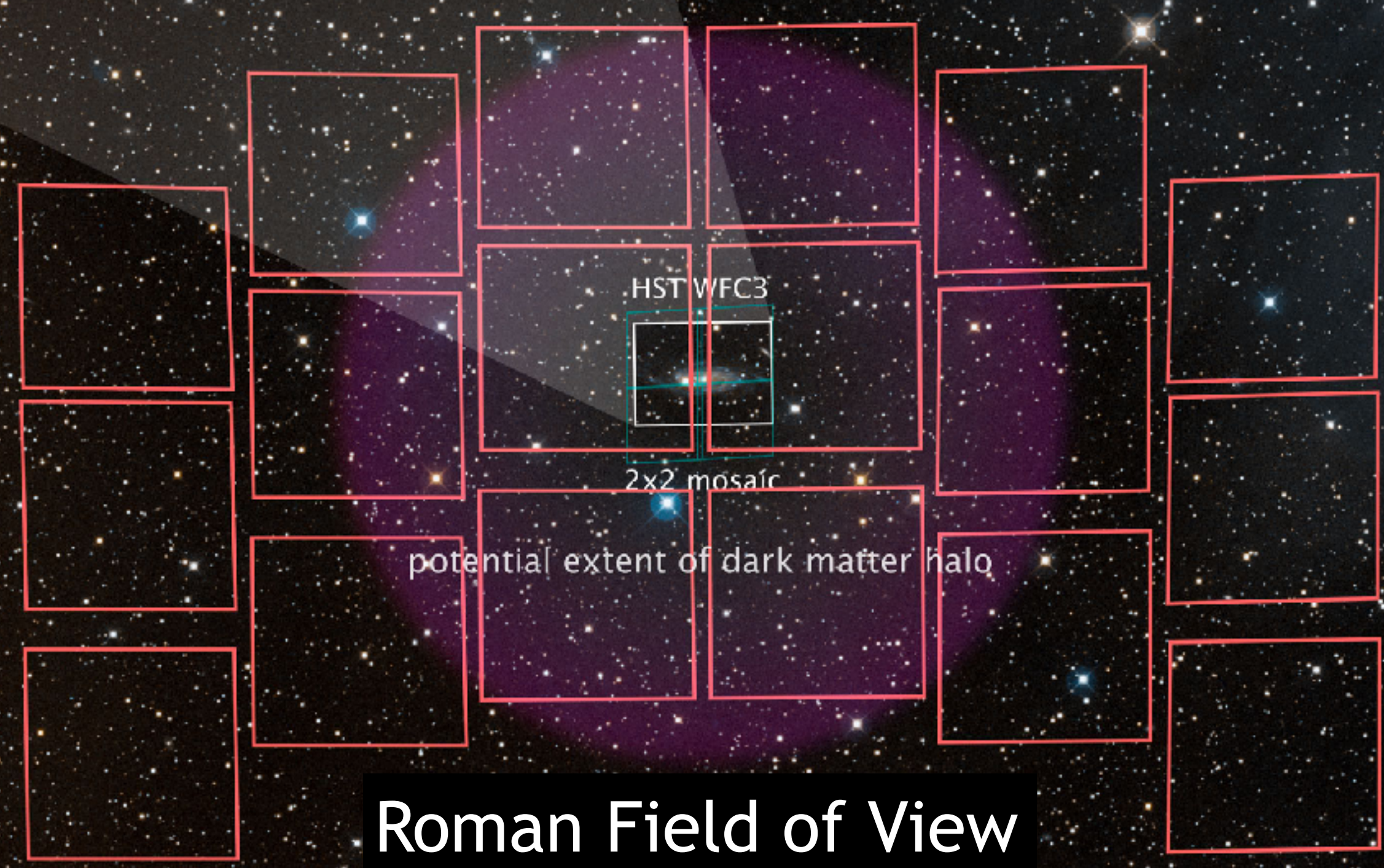
*in one pointing*



## 2x2 Hubble WFC3 Mosaic



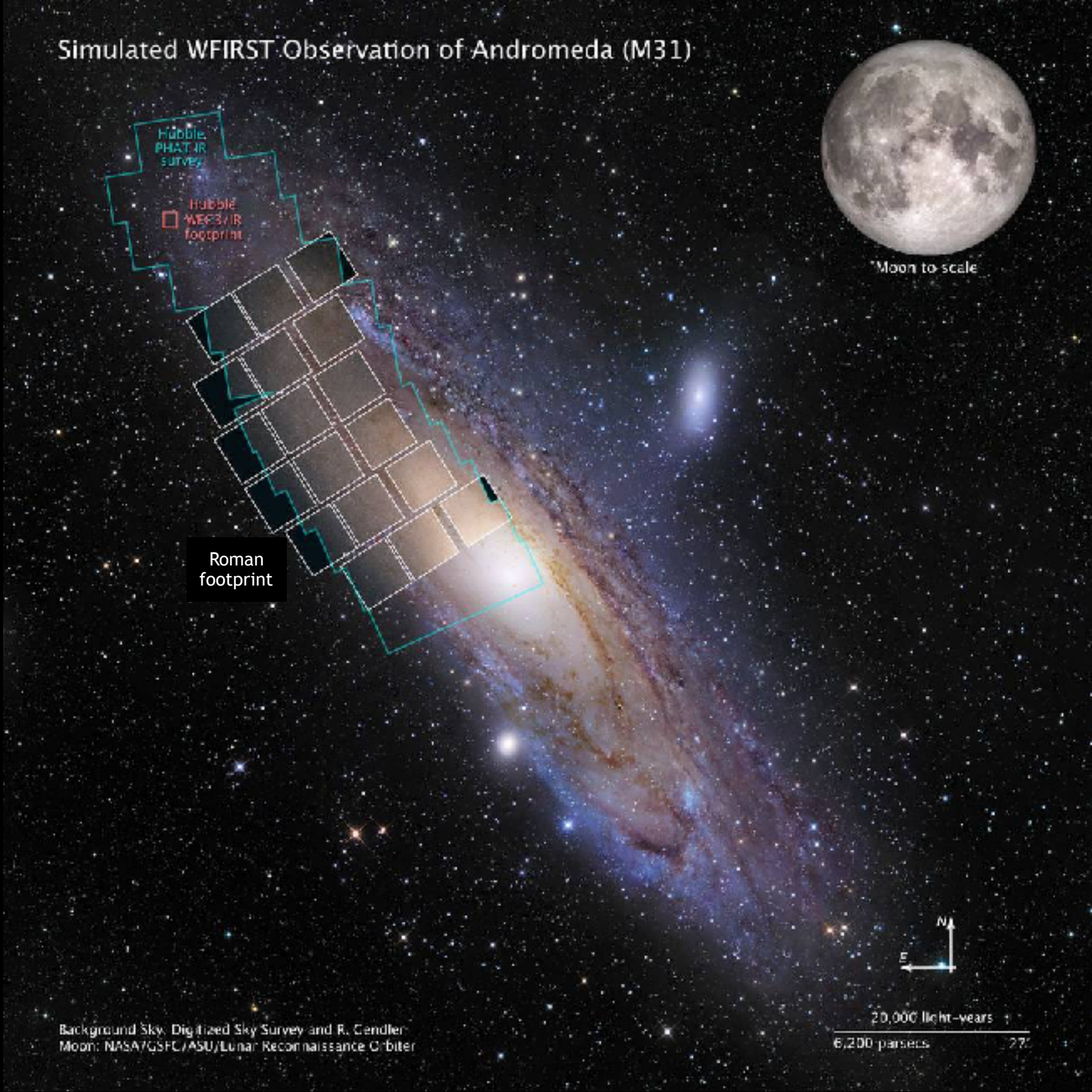
15'  
Background sky image: DSS



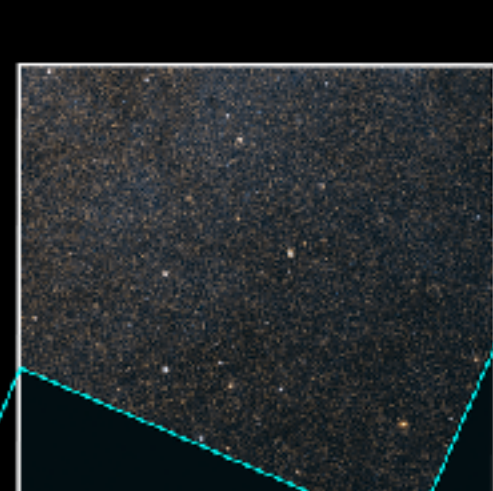
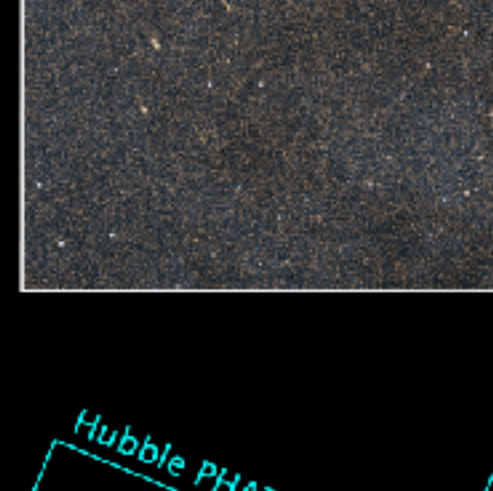
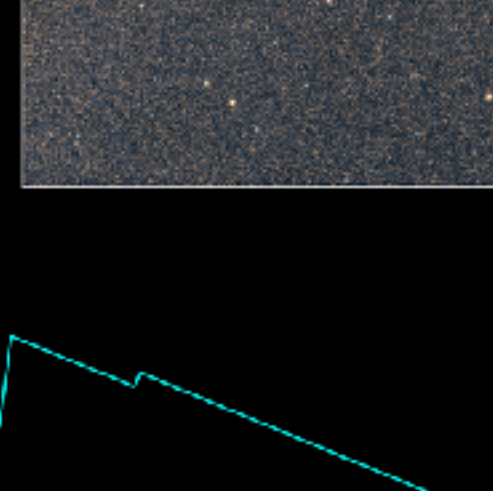
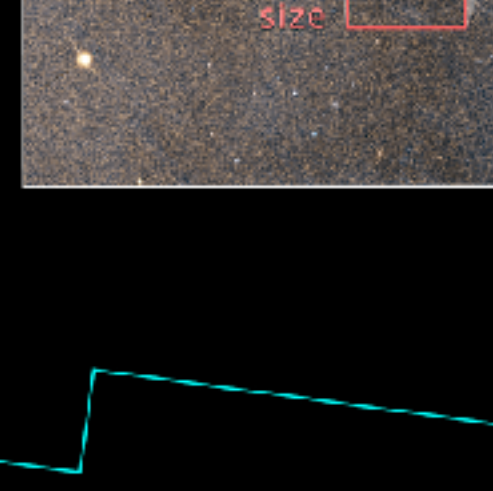
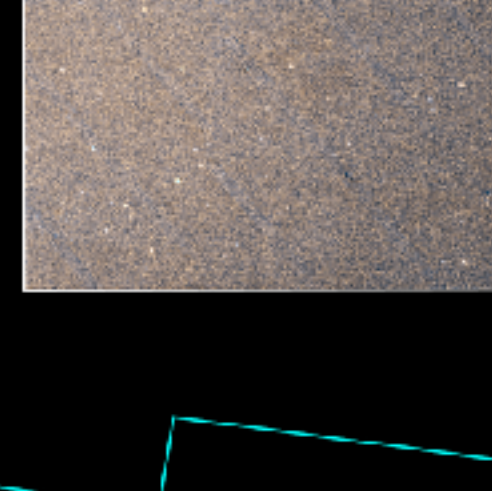
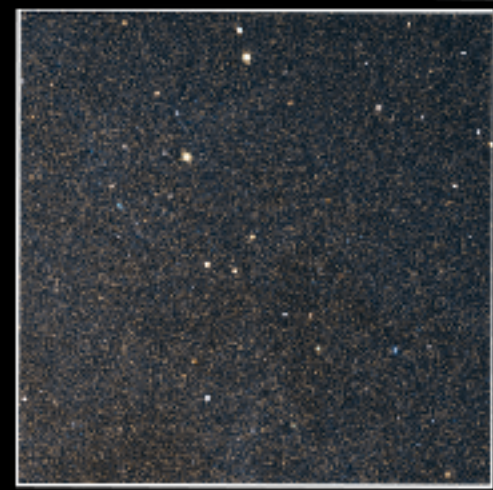
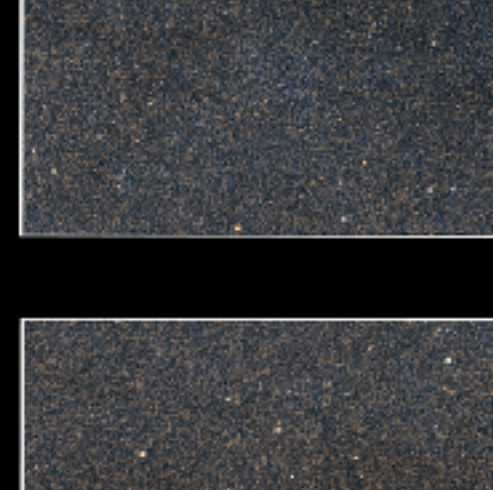
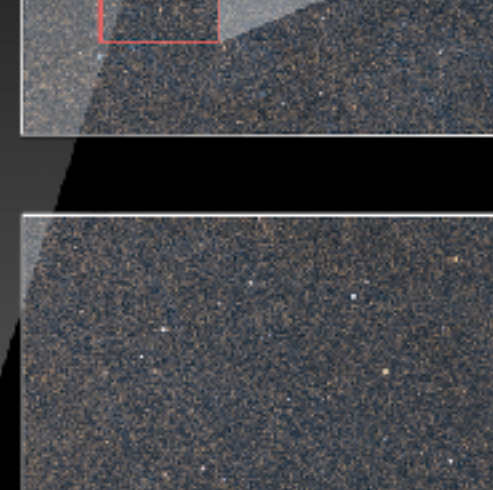
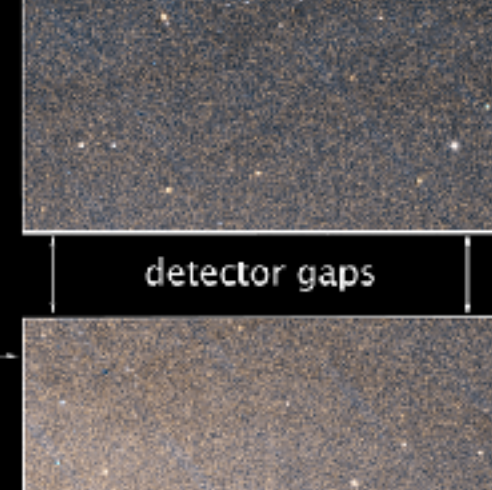
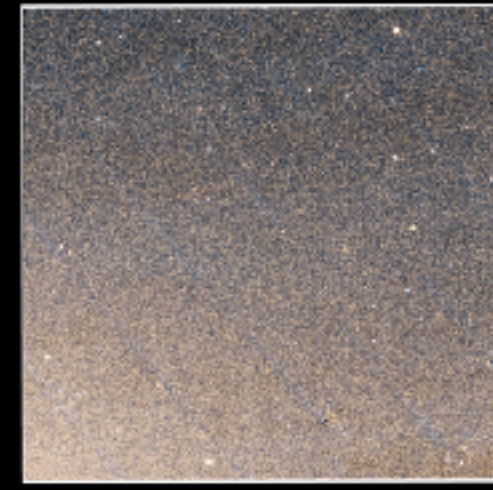
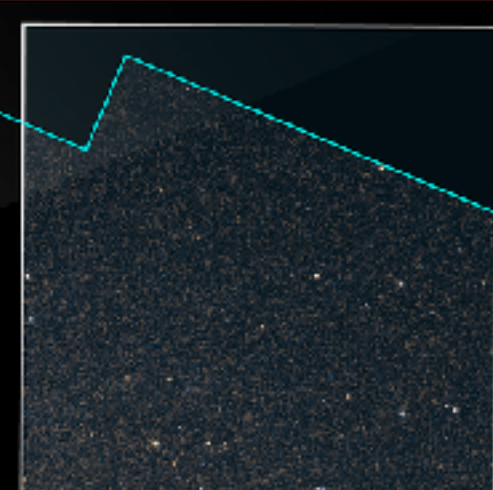
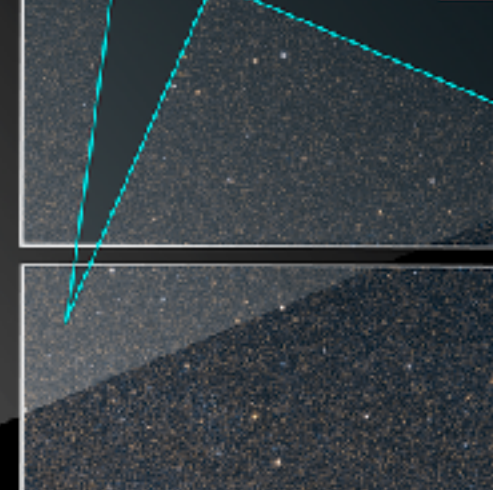
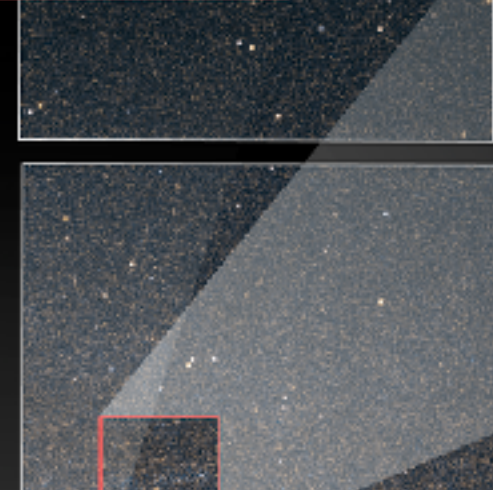
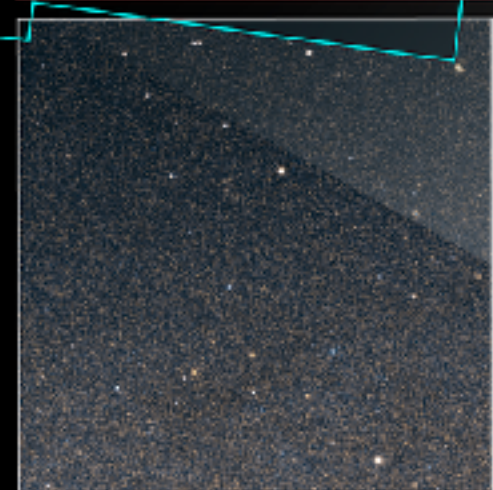
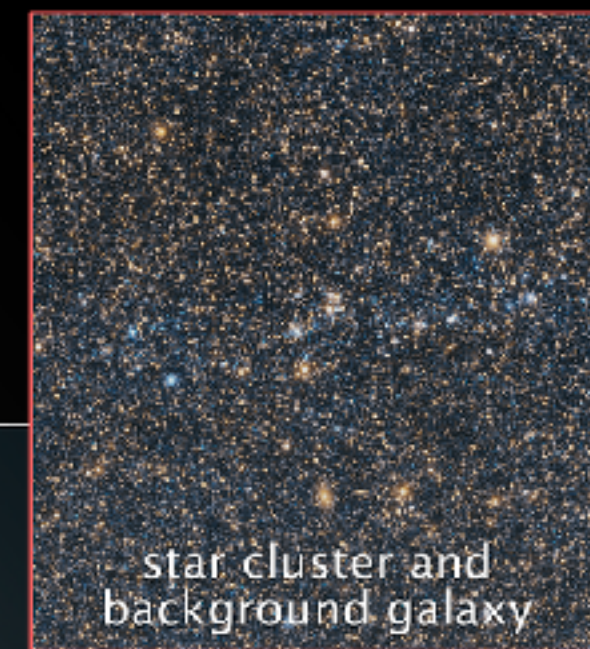
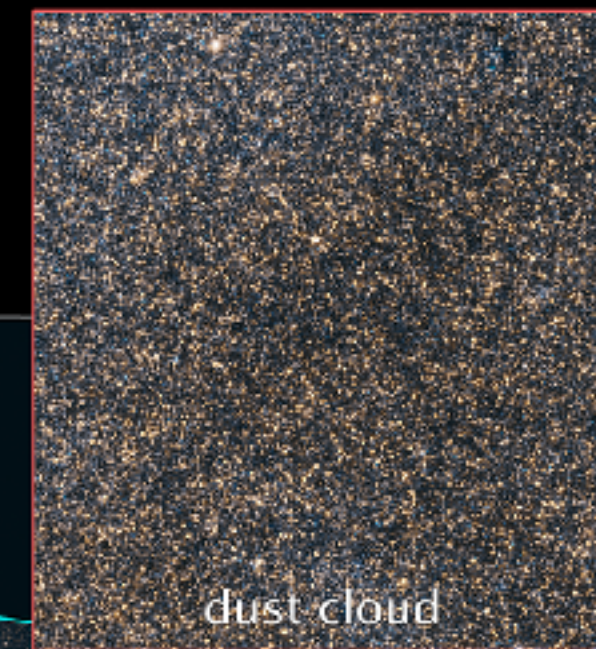
Roman Field of View



# Survey Nearby Galaxies ~1500 Times Faster



Background Sky: Digitized Sky Survey and R. Cendler  
Moon: NASA/GSFC/ASU/Lunar Reconnaissance Orbiter

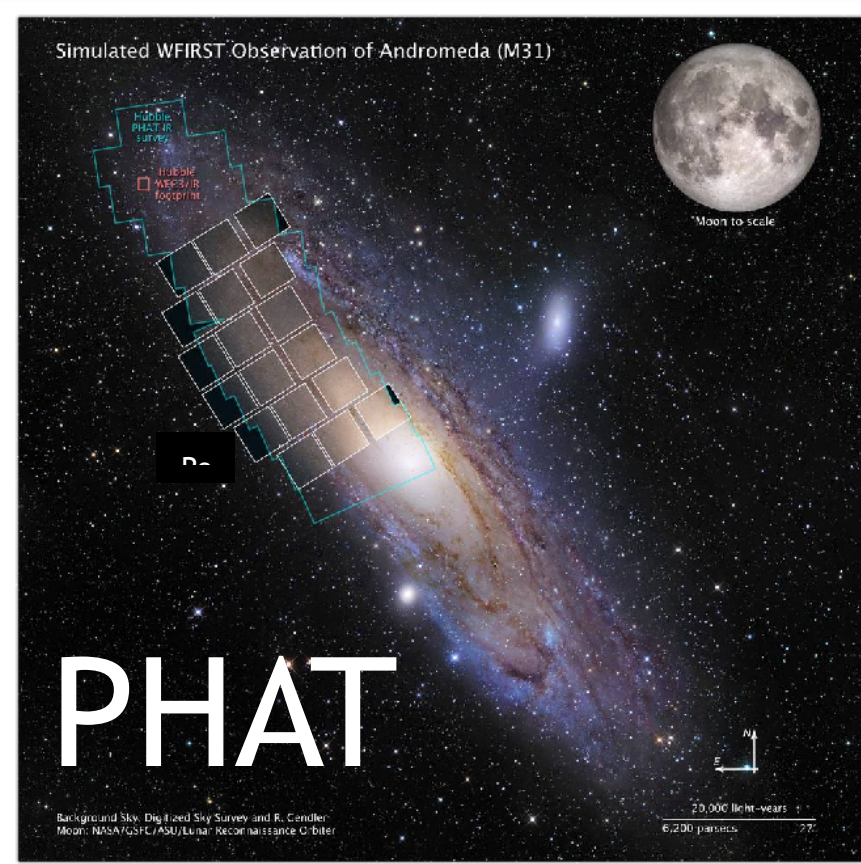


Simulated Roman  
WFI Image of  
Andromeda

Hubble  
WFC3/IR  
footprint  
size

Hubble PHAT IR survey

PI J. Dalcanton



Survey Nearby Galaxies  
~1500 Times Faster

PIs S. Faber,  
H. Ferguson

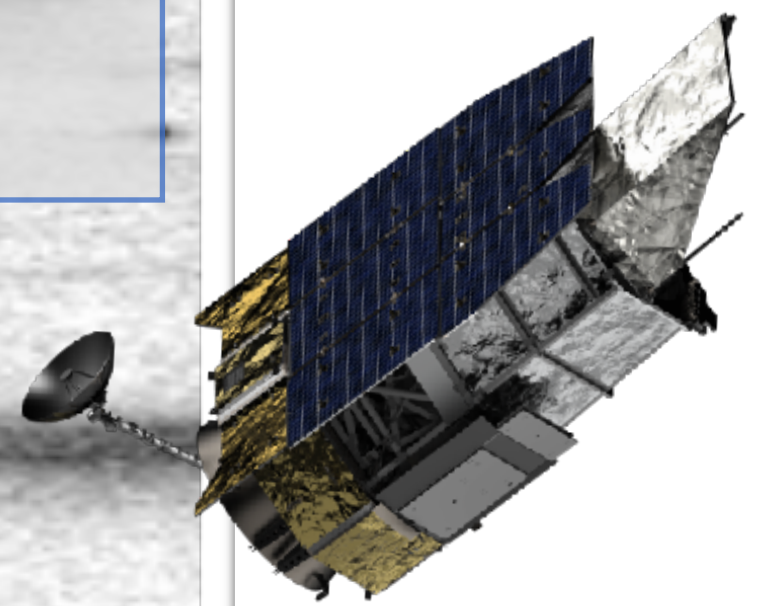


Image Galaxy Fields  
> 1000 Times Faster

PI P. van Dokkum

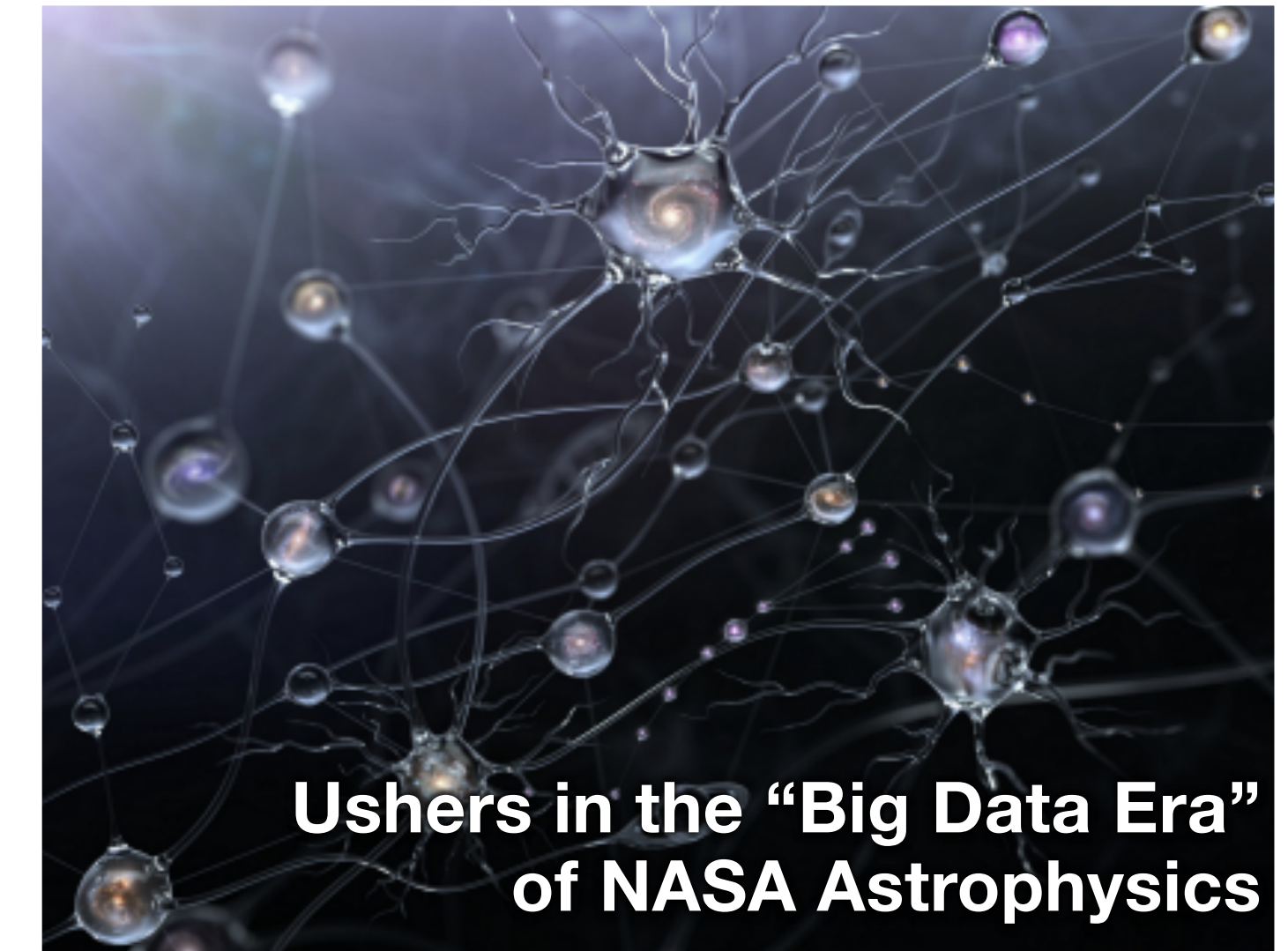
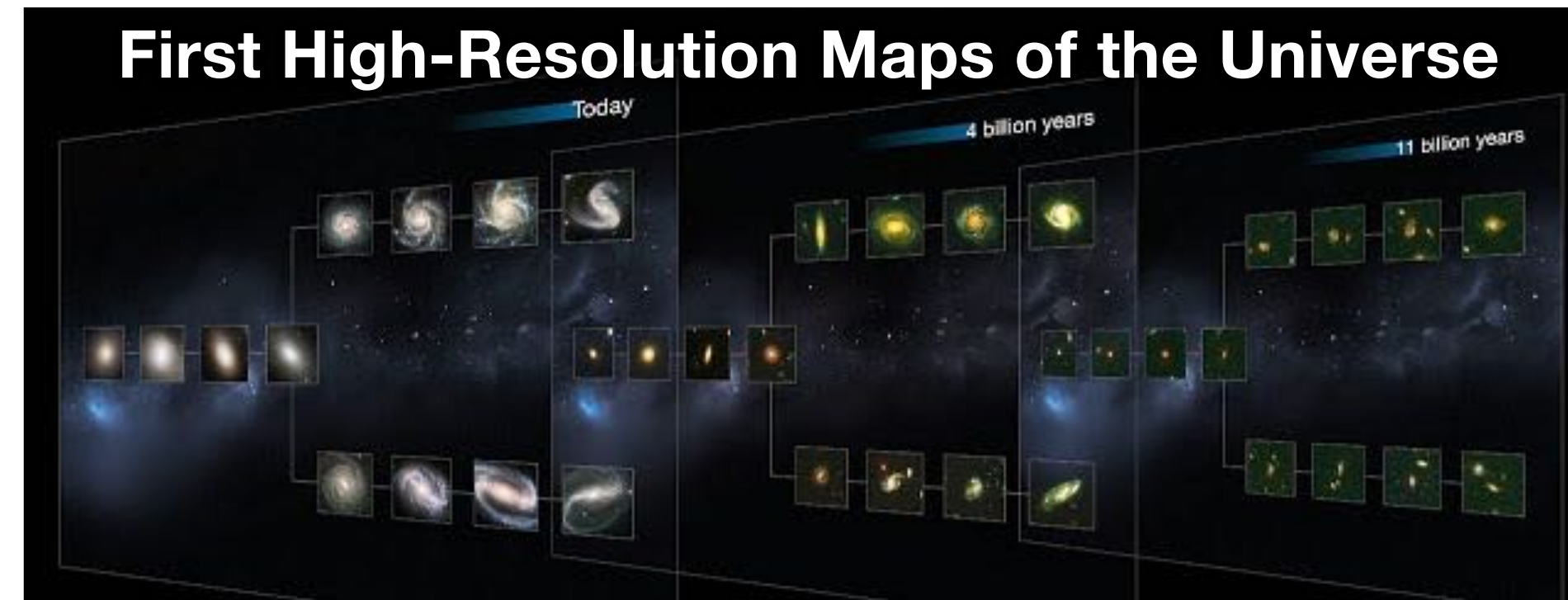
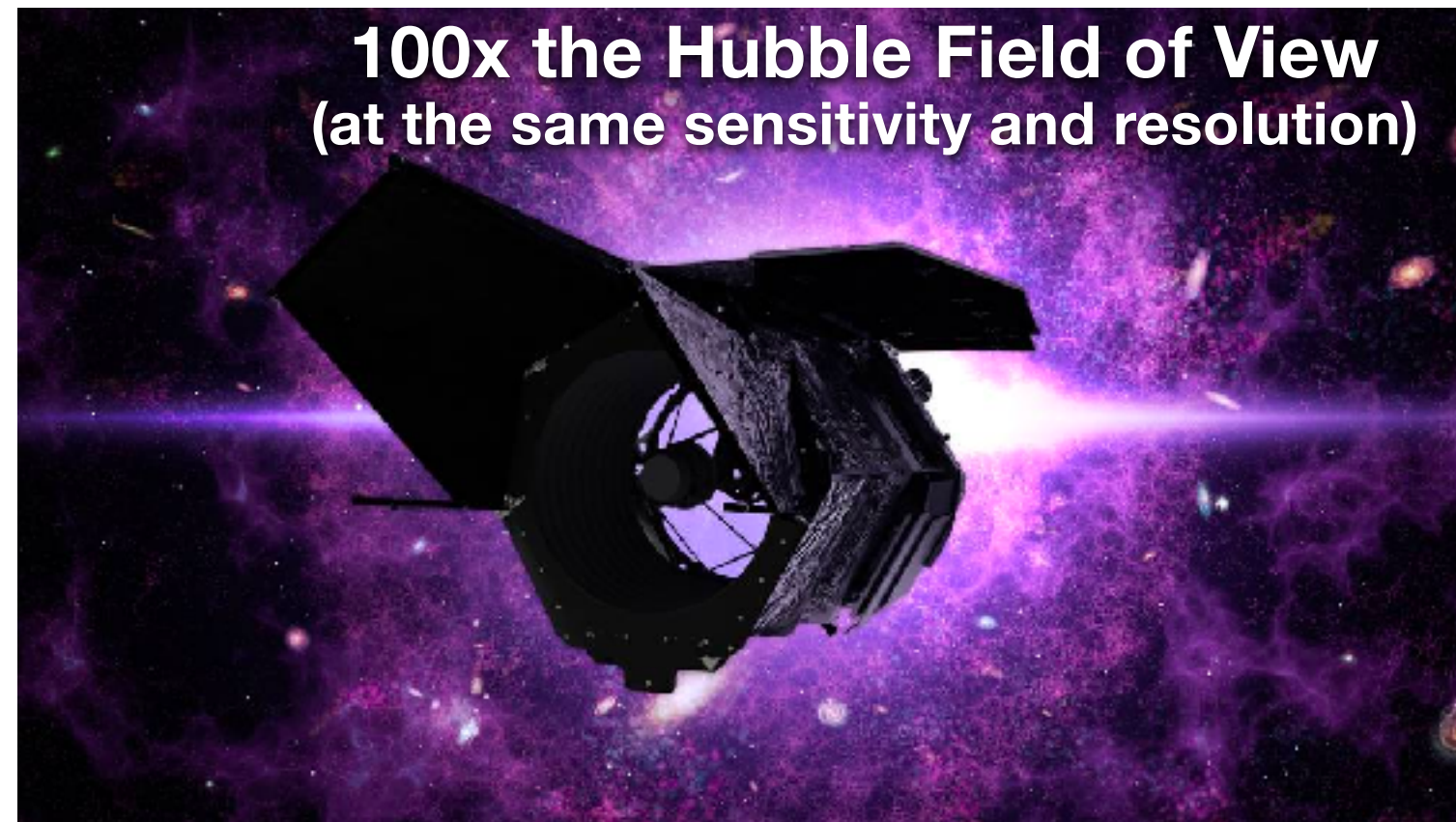


Perform Slitless Spectroscopy Galaxy  
Surveys > 700 Times Faster





# Enabling Guest Observer and Archival Science



Scale of Roman data will require a modern archive and data processing environment  
STScI will host the Roman archive, which will include **MAST-like capabilities and interfaces**

Bring the software to the data

An open source and modular science platform: Operations will include a cloud-based data management framework for high-level data processing

Common environment accessible to all users: STScI operations, survey teams, General Observers, and archival investigators



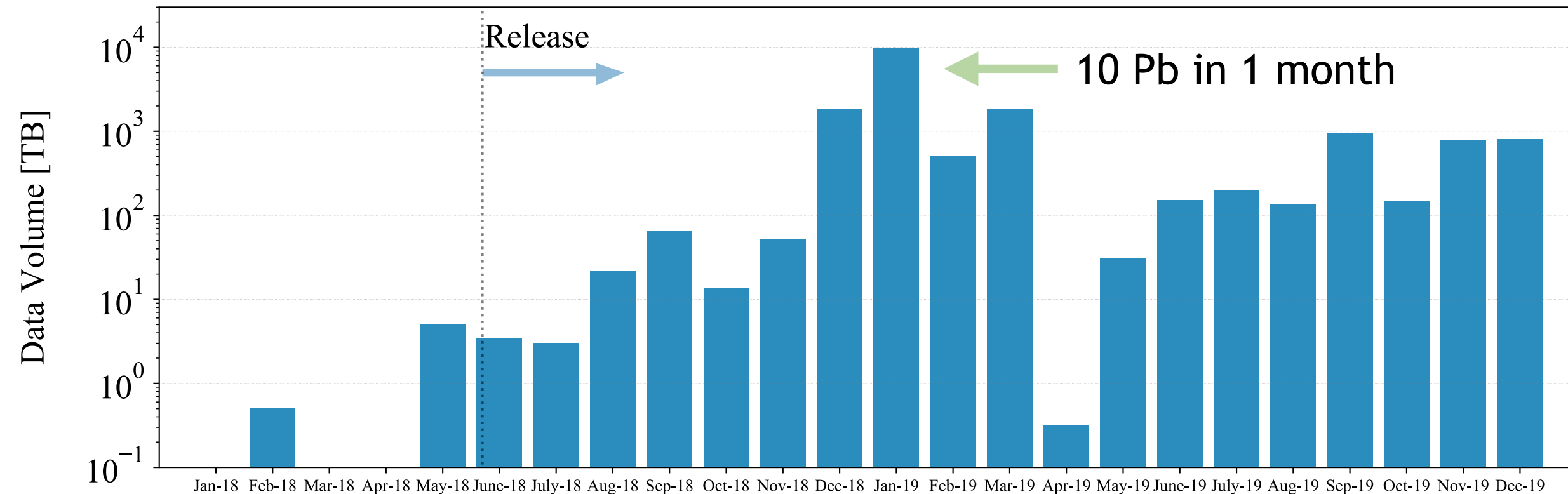


# Enabling Guest Observer and Archival Science

## Precursors to Roman Compute Environment



### Hubble Usage on Amazon Web Services



Hubble, Kepler, and TESS data are in the cloud  
STScI has staged all the *public* data from currently active Hubble instruments, Kepler, and TESS on Amazon Web Services

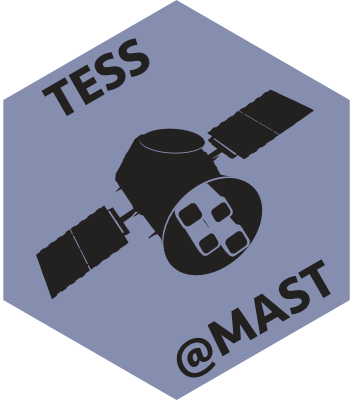
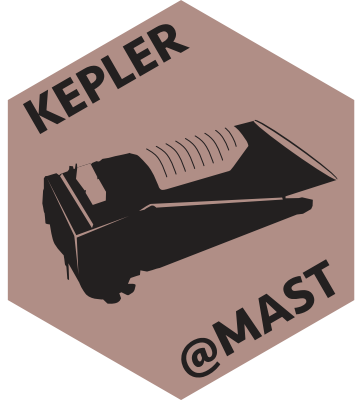
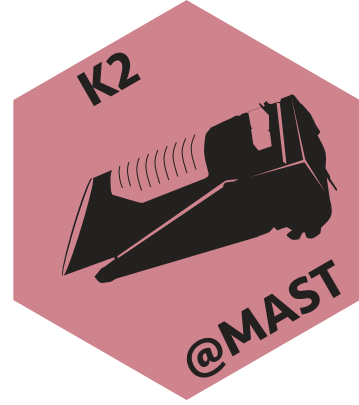
Users can now bring their software to the data  
Staging data on AWS allows for large scale archival analysis and application of AWS services to full Hubble dataset

Jupyter Lab environments and notebooks ease access and lower the learning curve

File Edit View Run Kernel Tabs Settings Help

Introduction.md TIC\_Panel\_Example.ipynb

# Welcome to the Time series Integrated Knowledge Engine

This [JupyterHub](#) instance running on AWS is intended to allow you to learn new data analysis tools, collaborate with your colleagues in a common workspace, customize data visualizations, and ultimately do research on TESS and Kepler data.

New to JupyterHub, take this [quick tour](#).

This platform is pre-loaded with python software packages and Jupyter notebook tutorials that teach how to do research with the TESS and Kepler Data (see the directory `notebooks/` on the left). We use git to pull new and updated notebooks into this instance, so if you decide to alter these notebooks for your own purposes (and we hope that you do), you should first make a copy for yourself.

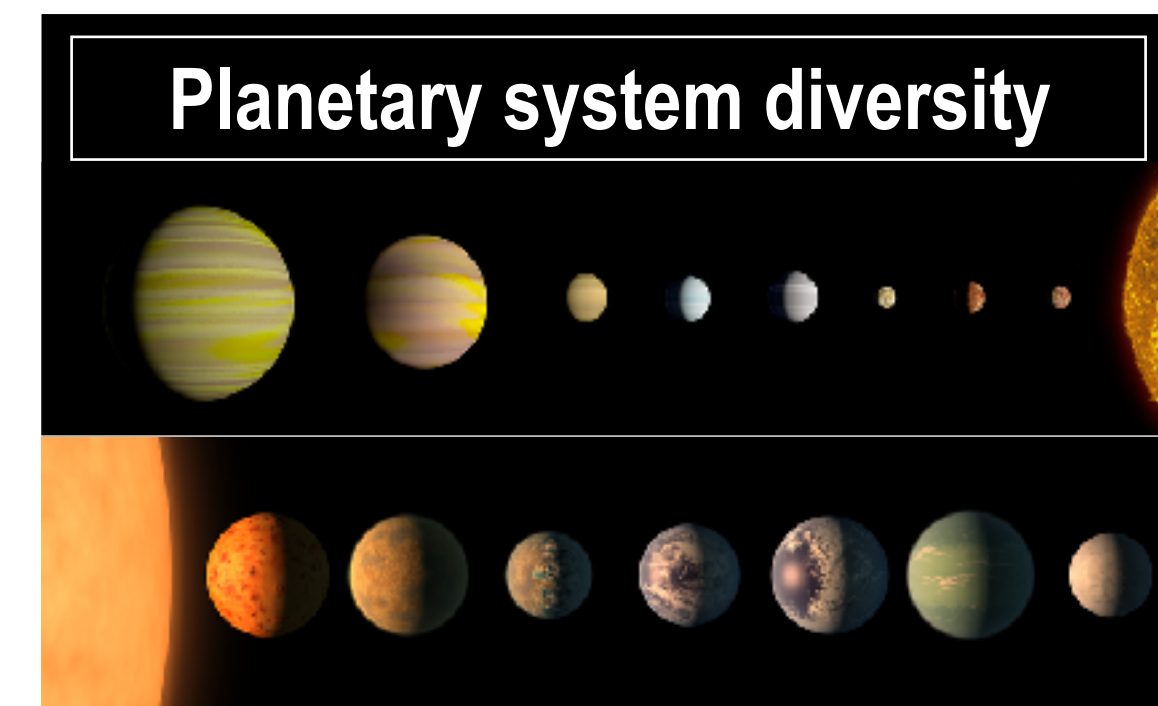
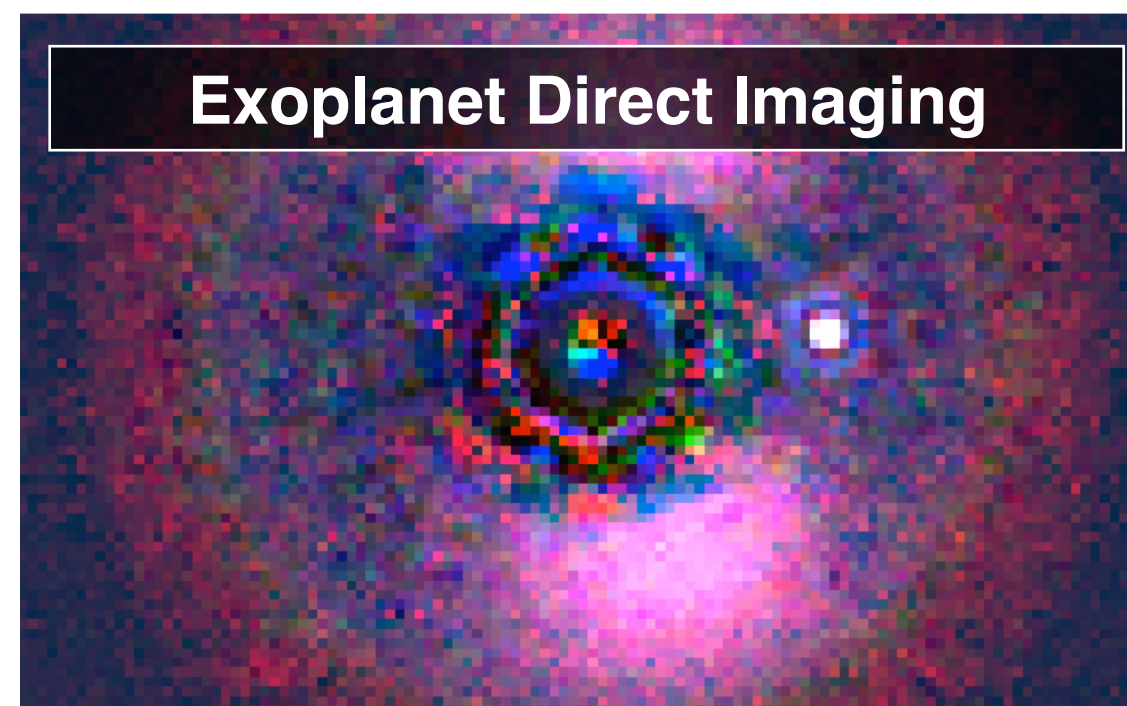
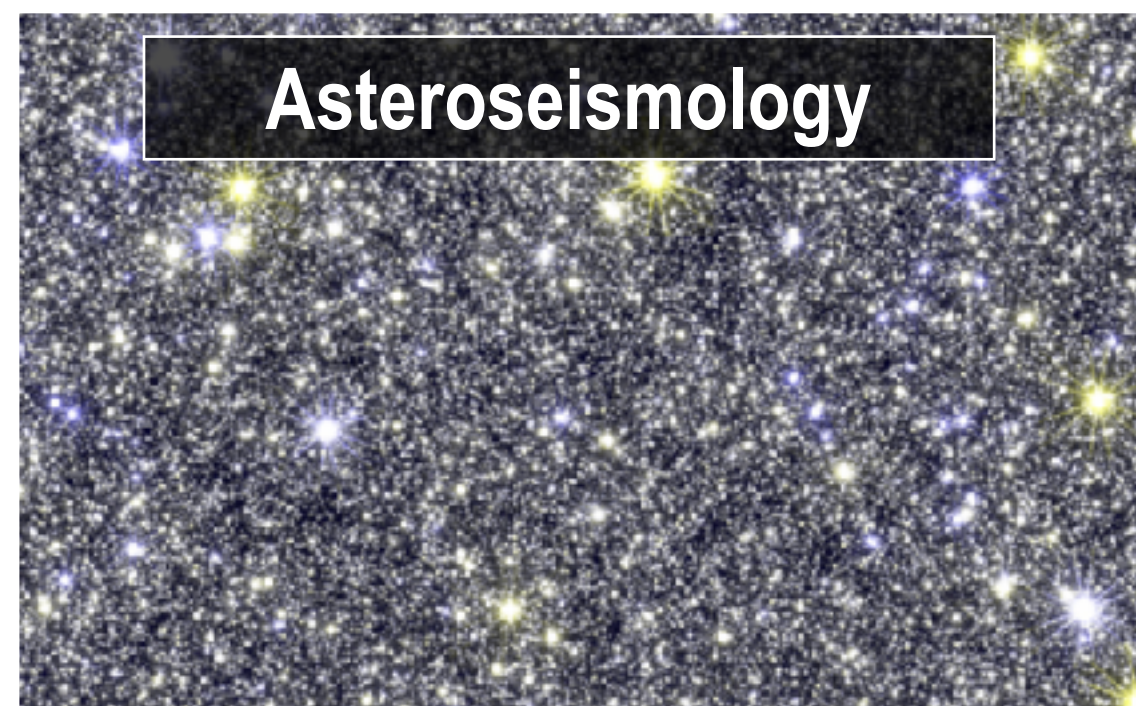
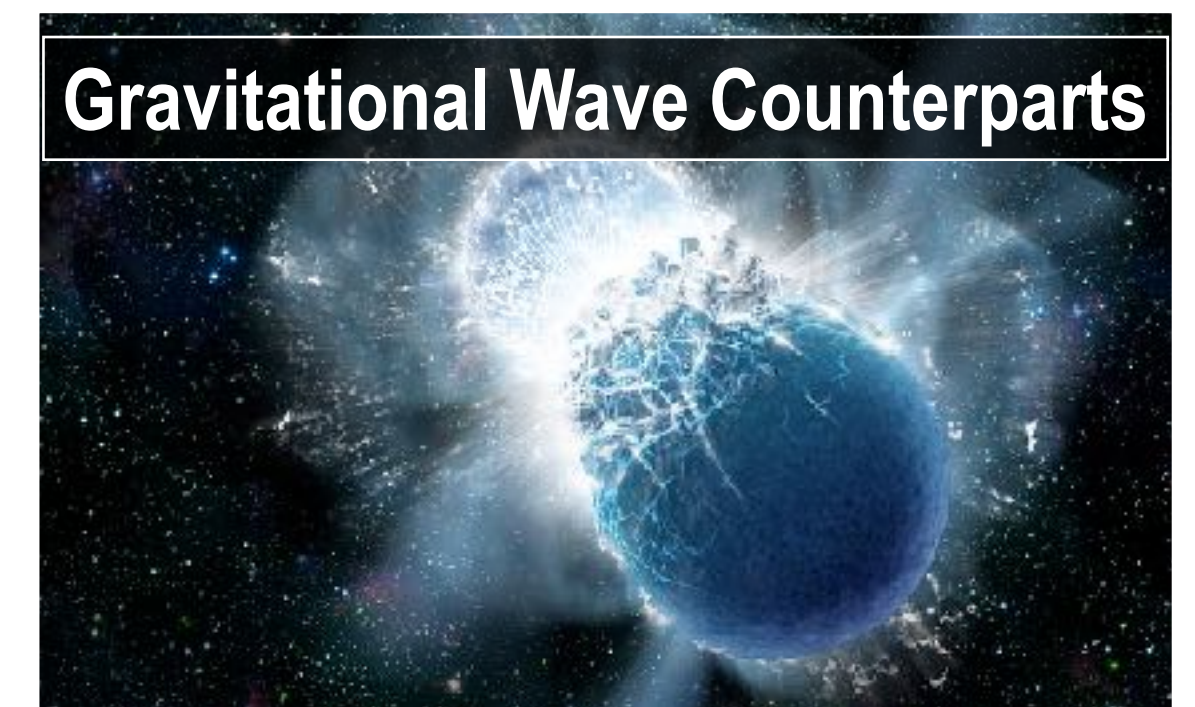
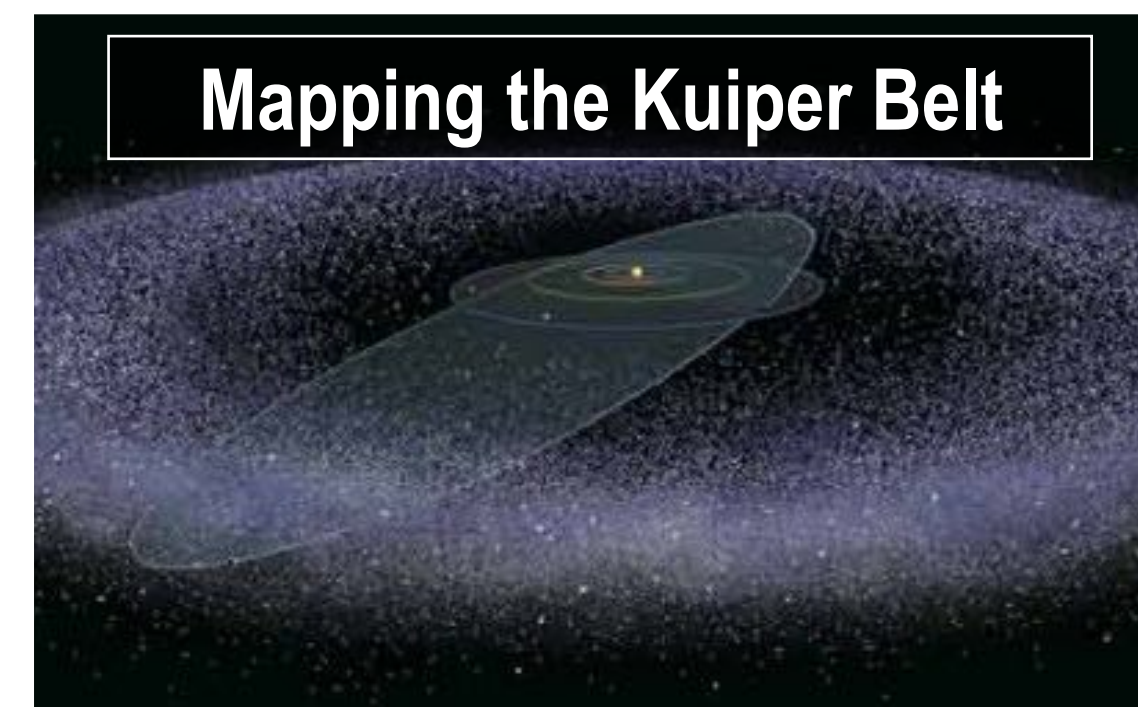
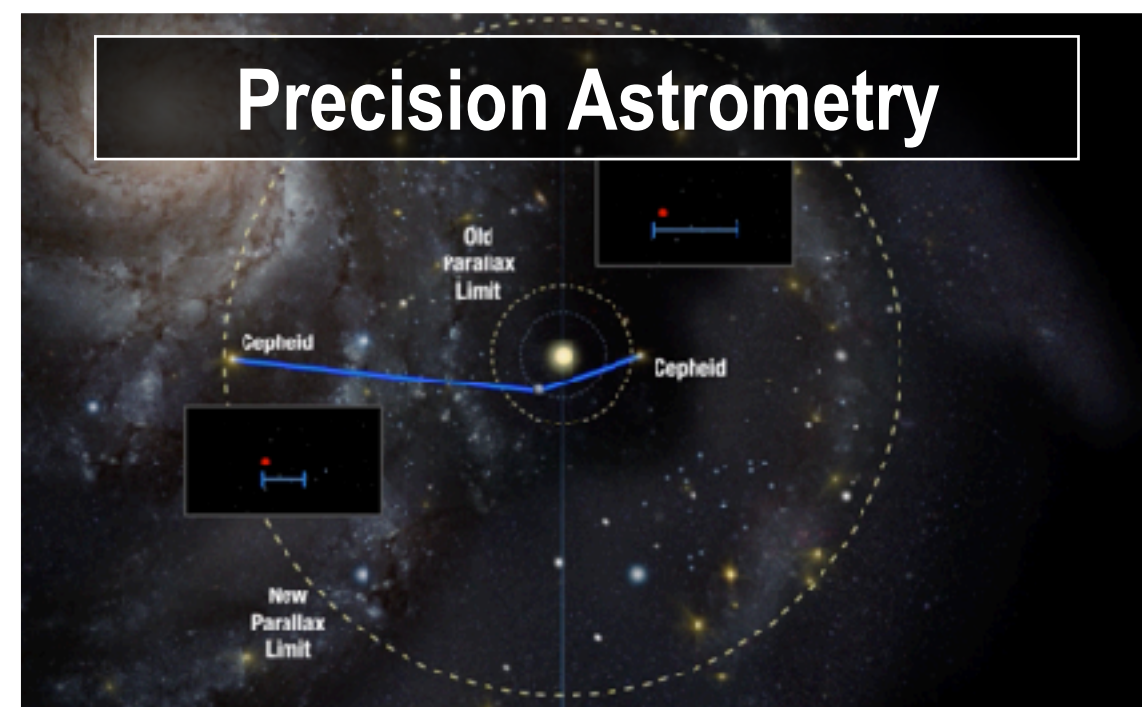
```

Terminal 1
(python37) mullally:code smullally$ ls
Dask_meanFTloop.ipynb
TIC_Panel_Example.ipynb
Untitled.ipynb
Untitled1.ipynb
Untitled2.ipynb
__pycache__
cloud_astroquery.ipynb
dask-worker-space/
kepler-manifest.txt.gz
lightkurve-cloud.ipynb
mastDownload/
/Users/smullally/Python_Code/pilotTessContent/code
old/
tess-s0016-3-4_249.766583_60.699660_5x5_astrocute.fits
tess-s0017-4-3_249.766583_60.699660_5x5_astrocute.fits
tess-s0018-4-3_249.766583_60.699660_5x5_astrocute.fits
tess-s0019-4-3_249.766583_60.699660_5x5_astrocute.fits
tess-s0020-4-3_249.766583_60.699660_5x5_astrocute.fits
tesscut_20200519134309.zip
tesscut_20200519140046.zip
test-cloud-lightkurve.py
tic_viz.py
  
```

# Precursor to Roman Compute Environment



# Great Observatory Science with the Roman Space Telescope





## Join the Roman Conversation

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Tell us how you will use the Nancy Grace Roman Space Telescope - participate in an open community survey by June 15

<https://www.surveymonkey.com/r/P72X3DR>

Look for proposal opportunities beginning in 2021 for a range of Roman preparatory science programs. The current terms of the Science Investigation Team will end in 2021.

Attend a virtual conference focused on the future of galaxy formation and evolution studies, October 5 - 9.

<https://www.stsci.edu/events>

Preregistration open, abstract submission deadline July 17

A conference poster with a dark background. On the right, there is a stylized illustration of the Nancy Grace Roman Space Telescope in space, with a bright yellow star and a galaxy visible through its field of view. The text on the left reads: "Galaxy Formation and Evolution in the Era of the NANCY GRACE ROMAN SPACE TELESCOPE". The dates "October 5-9, 2020" are written in orange below the main title. The STScI logo is in the bottom right corner.

Galaxy  
Formation  
and  
Evolution  
in the Era  
of the  
NANCY GRACE ROMAN SPACE TELESCOPE

October 5-9, 2020

STScI



# Additional Material

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### Roman Space Telescope Imaging Capabilities

Telescope Aperture (2.4 meter)		Field of View (45'x23'; 0.28 sq deg)			Pixel Scale (0.11 arcsec)		Wavelength Range (0.5-2.0 $\mu\text{m}$ )	
Filters	<b>F062</b>	<b>F087</b>	<b>F106</b>	<b>F129</b>	<b>F158</b>	<b>F184</b>	<b>W146</b>	
Wavelength ( $\mu\text{m}$ )	0.48-0.76	0.76-0.98	0.93-1.19	1.13-1.45	1.38-1.77	1.68-2.00	0.93-2.00	
Sensitivity (5 $\sigma$ AB mag in 1 hr)	28.5	28.2	28.1	28.0	28.0	27.5	28.3	

### Roman Space Telescope Spectroscopic Capabilities

	Field of View (sq deg)	Wavelength ( $\mu\text{m}$ )	Resolution	Sensitivity (AB mag) (10 $\sigma$ per pixel in 1hr)
Grism	0.28 sq deg	1.00-1.93	461	20.5 at 1.5 $\mu\text{m}$
Prism	0.28 sq deg	0.75-1.80	80-180	23.5 at 1.5 $\mu\text{m}$

### Roman Space Telescope Coronagraphic Capabilities

	Wavelength ( $\mu\text{m}$ )	Inner Working Angle (arcsec)	Outer Working Angle (arcsec)	Detection Limit*	Spectral Resolution
Imaging	0.5-0.8	0.15 (exoplanets) 0.48 (disks)	0.66 (exoplanets) 1.46 (disks)	10 <sup>-9</sup> contrast (after post-processing)	47-75
Spectroscopy	0.675-0.785				

[https://roman.gsfc.nasa.gov/science/WFIRST\\_Reference\\_Information.html](https://roman.gsfc.nasa.gov/science/WFIRST_Reference_Information.html)