

HUBBLE SPACE TELESCOPE



Cosmic Expansion | Dark Energy | Dark Matter | Galaxies | Black Holes | Nebulae | Exoplanets | Stars | Solar System

The Hubble Space Telescope: 25 Years of Cosmic Discovery



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The Hubble Space Telescope mission is a

NASA-ESA Partnership:

Launch date: 24 April 1990

Launch vehicle: Space Shuttle Discovery (STS-31)

Mass: 24,500 lbs (11,113 kg)

Maximum diameter: 14 ft (4.2 m)

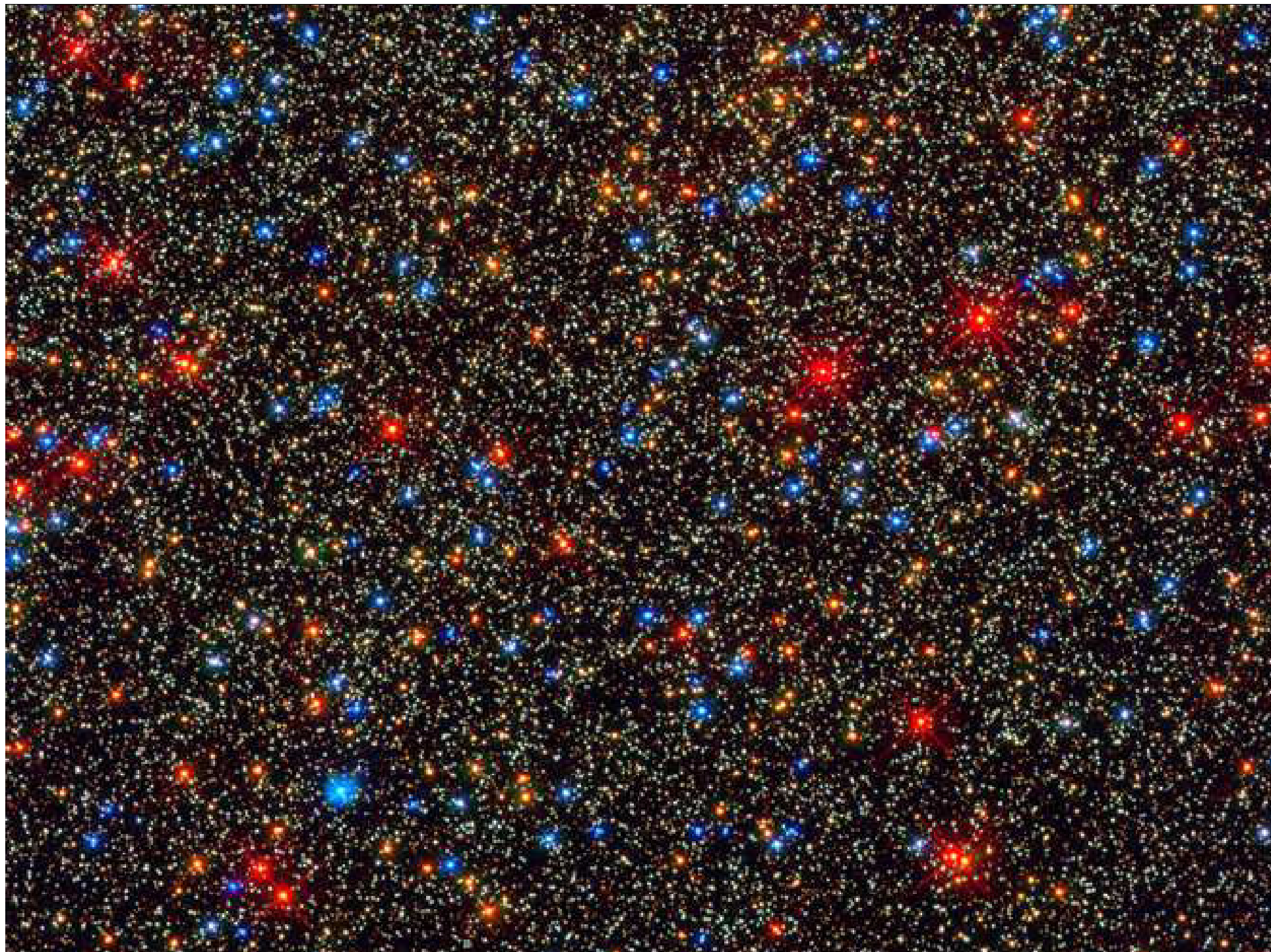
Length: 43 ft (13 m)

Orbit Height: 339 miles (545 km)

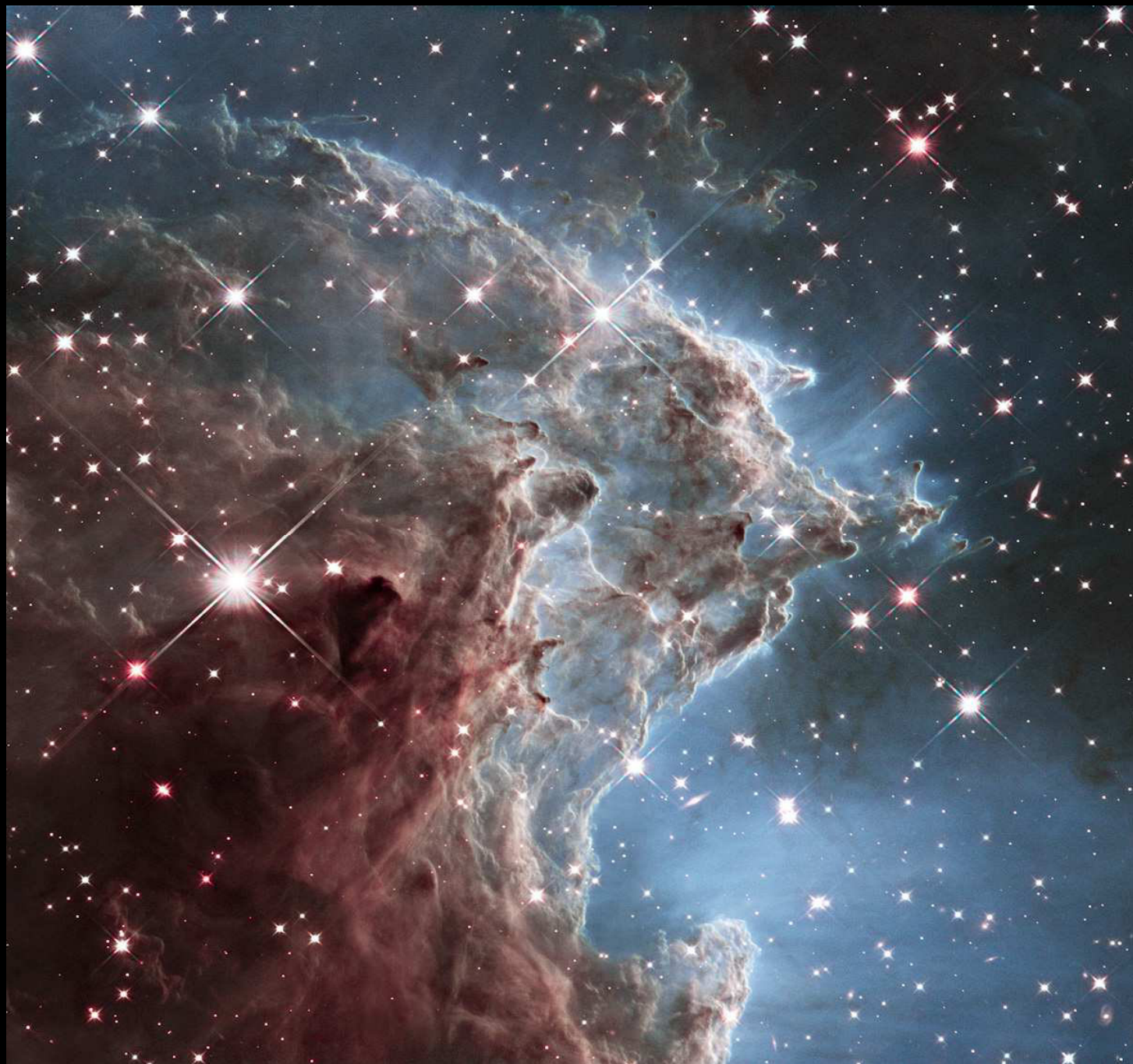
Orbit period: 96-97 minutes

Orbit velocity: 16,800 mph (27,037 kph)





Hubble Space Telescope images display *beauty*
in the universe



Horsehead Nebula in Infrared



Hubble
Heritage

NASA, ESA, and the Hubble Heritage Team (STScI/AURA)
HST WFC3/IR • STScI-PRC13-12a

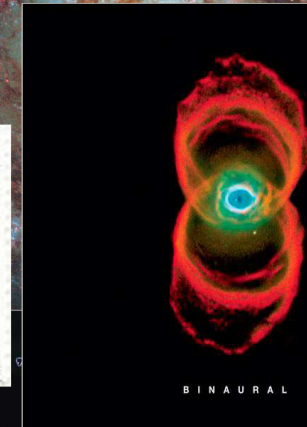
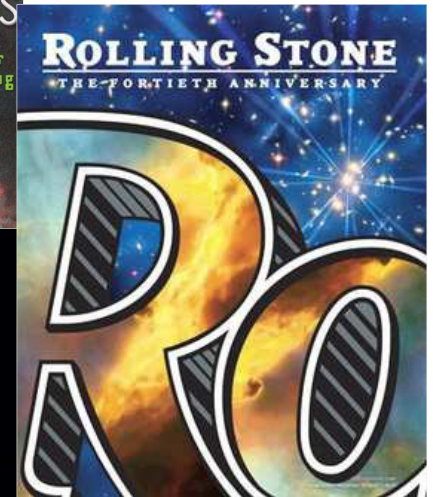
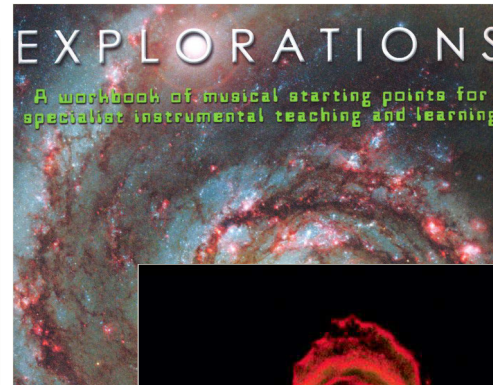
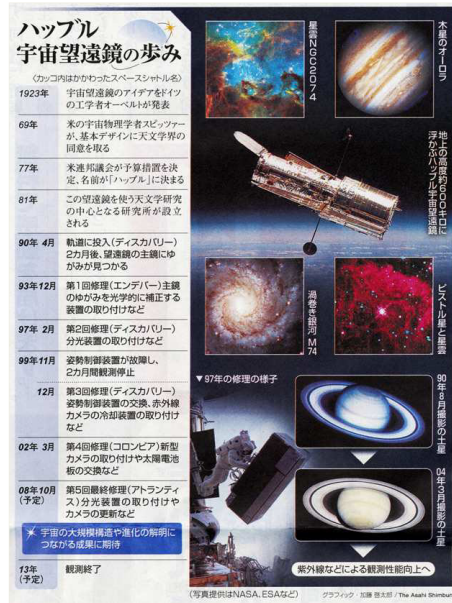
Spiral Galaxy NGC 1309



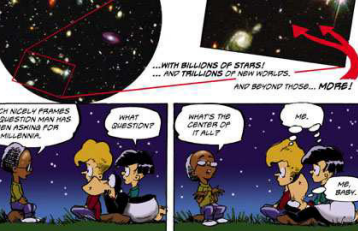
Hubble
Heritage

NASA, ESA, The Hubble Heritage Team (STScI/AURA), and A. Riess (STScI)
Hubble Space Telescope ACS • STScI-PRC06-07

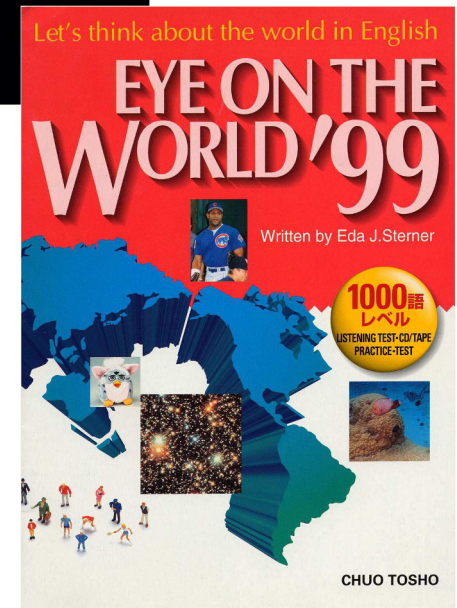
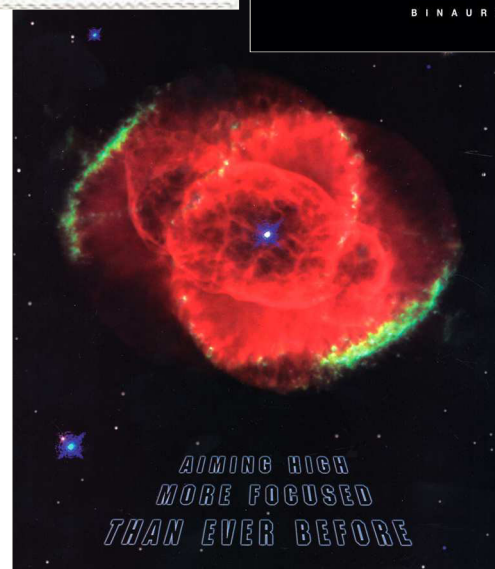
Hubble Space Telescope Images are loved around the world



KULTURMAGAZIN
MUSEION 2000
GLAUBE, WISSEN, KUNST IN GESCHICHTE UND GEGENWART
5/1999



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Shuttle Missions for Hubble Launch, Repair, and Refurbishment

Launch

STS-31
Discovery



April
1990

Servicing Mission 1

STS-61
Endeavour



Wide Field
Planetary Camera 2
Corrective Optics
Space Telescope
Axial Replacement
Gyros
Solar Arrays



December
1993

Servicing Mission 2

STS-82
Discovery



Space Telescope
Imaging
Spectrograph
Near Infrared
Camera and
Multi-Object
Spectrometer
Fine Guidance
Sensor

February
1997

Servicing Mission 3A

STS-103
Discovery



Advanced
Computer
Gyros
Fine Guidance
Sensor



December
1999

Servicing Mission 3B

STS-109
Columbia



Advanced Camera
for Surveys
Near Infrared
Camera and
Multi-Object
Spectrometer
Cooling System
Power Control Unit
Solar Arrays

March
2002

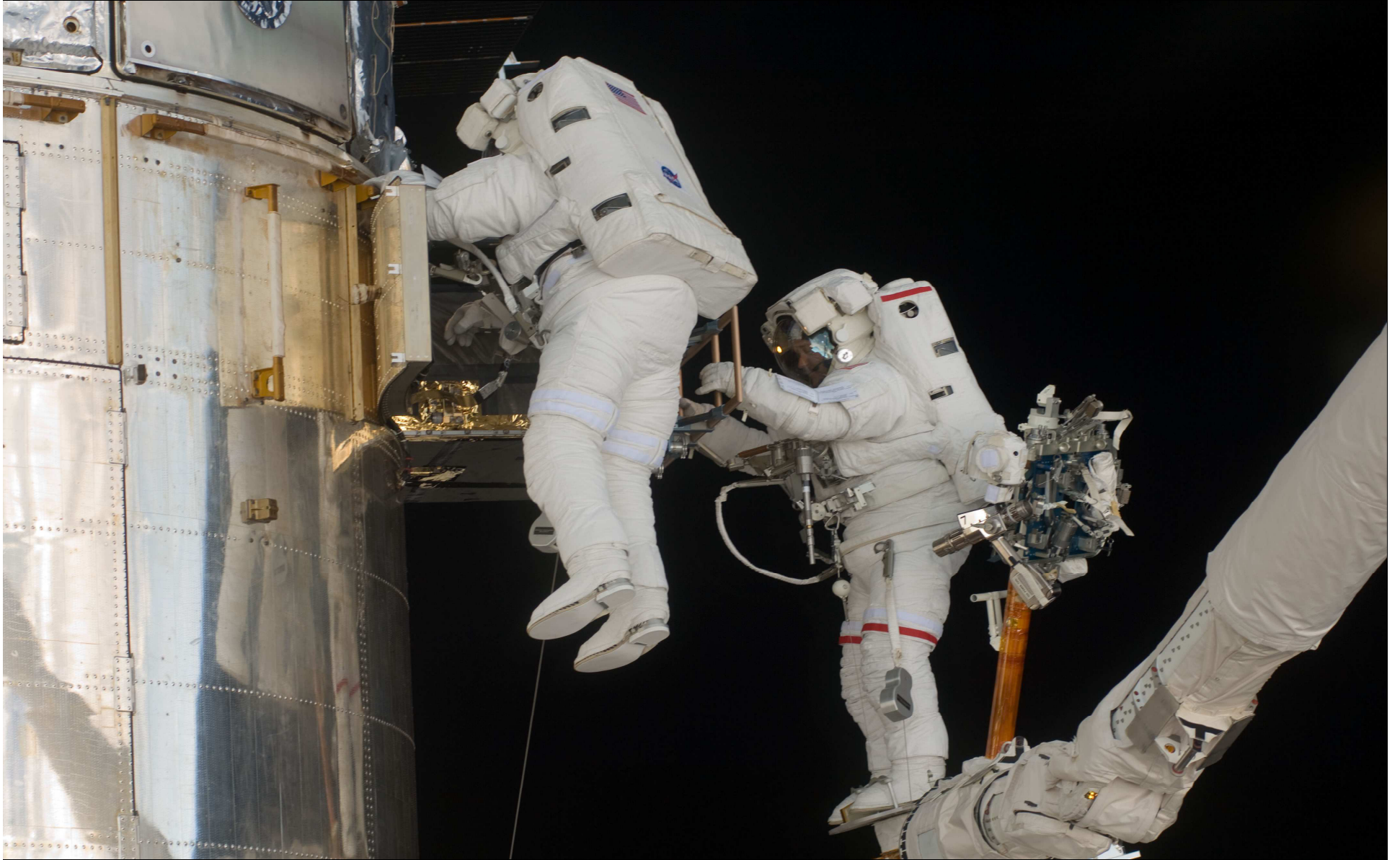
Servicing Mission 4

STS-125
Atlantis



Wide Field Camera 3
Cosmic Origins
Spectrograph
Space Telescope
Imaging
Spectrograph Repair
Advanced Camera
for Surveys Repair
Science Instrument
and Data
Handling Unit
Gyros
New Outer Blanket
Layer
Soft Capture
Mechanism
Batteries
Fine Guidance
Sensor

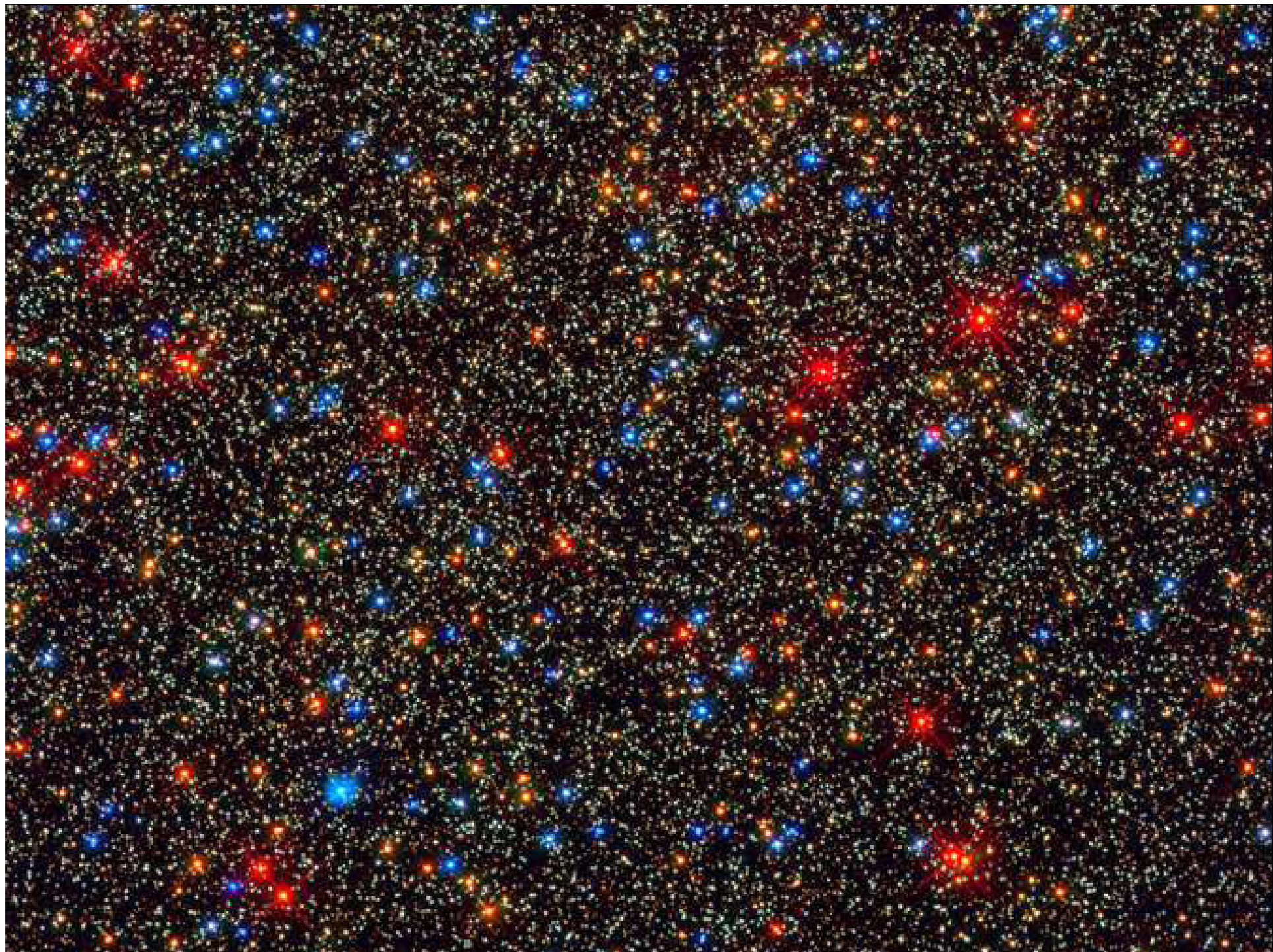
May
2009





The Hubble Space Telescope shows the power of scientists, astronauts, engineers, managers, governments and the public working together for peaceful scientific exploration of space.

Scientists from around the world use Hubble, and Hubble images are freely available to the public.



The Hubble telescope reveals *vibrant activity* in
the Universe

Jupiter's Red Spot is Shrinking...

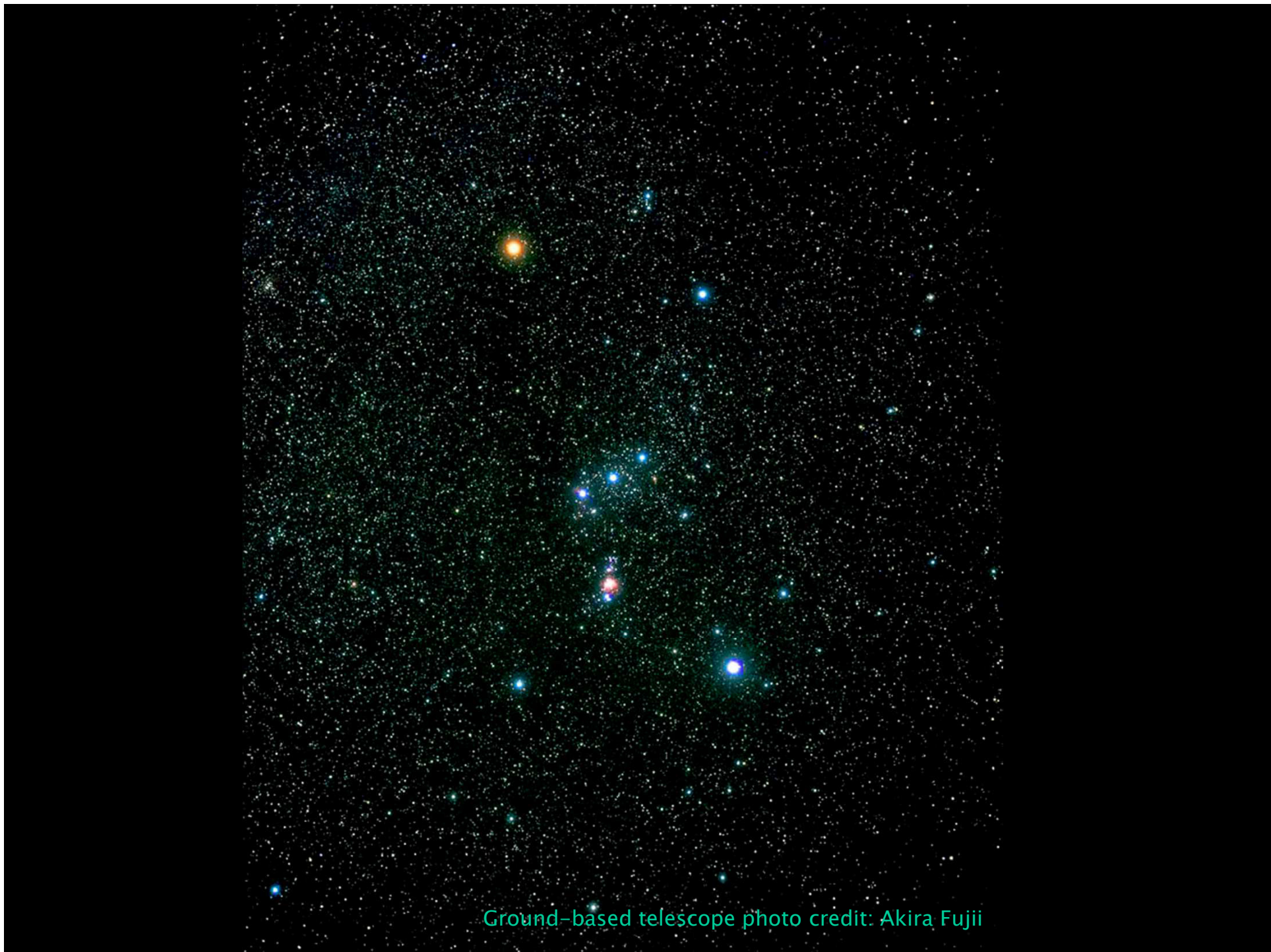
Jupiter and the Great Red Spot ■ *HST* ■ WFC3/UVIS ■ WFPC2



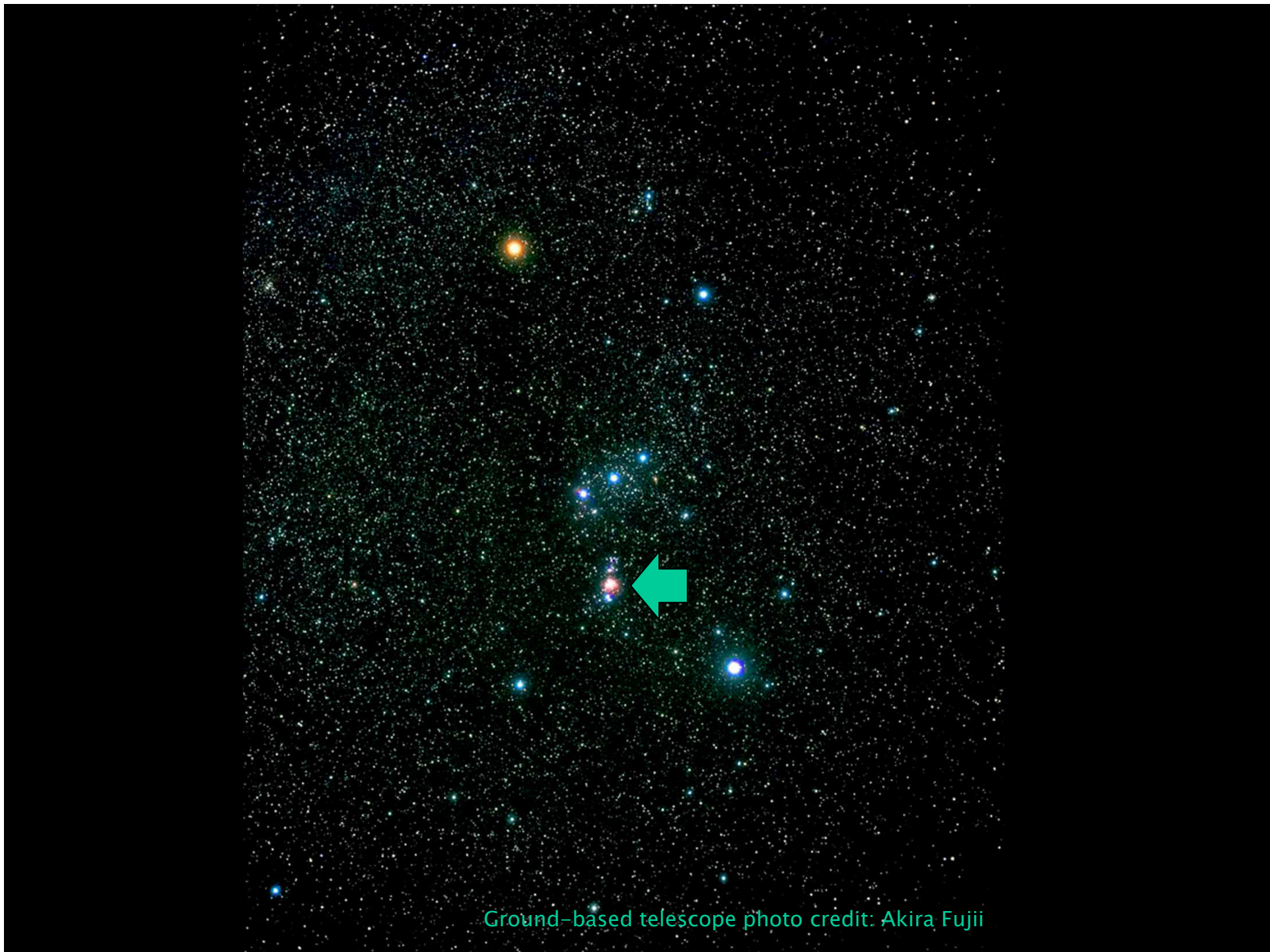
NASA and ESA



STScI-PRC14-24a



Ground-based telescope photo credit: Akira Fujii



Ground-based telescope photo credit: Akira Fujii

Orion Nebula • M42

HST • ACS/WFC



NASA, ESA, M. Robberto (STScI), and the HST Orion Nebula Team

STScI-PRC06-01a







1995 ■ WFPC2

M16 ■ Eagle Nebula
Hubble Space Telescope

NASA and ESA ■ STScI-PRC15-01a



2014 ■ WFC3/UVIS

M16 ■ Eagle Nebula



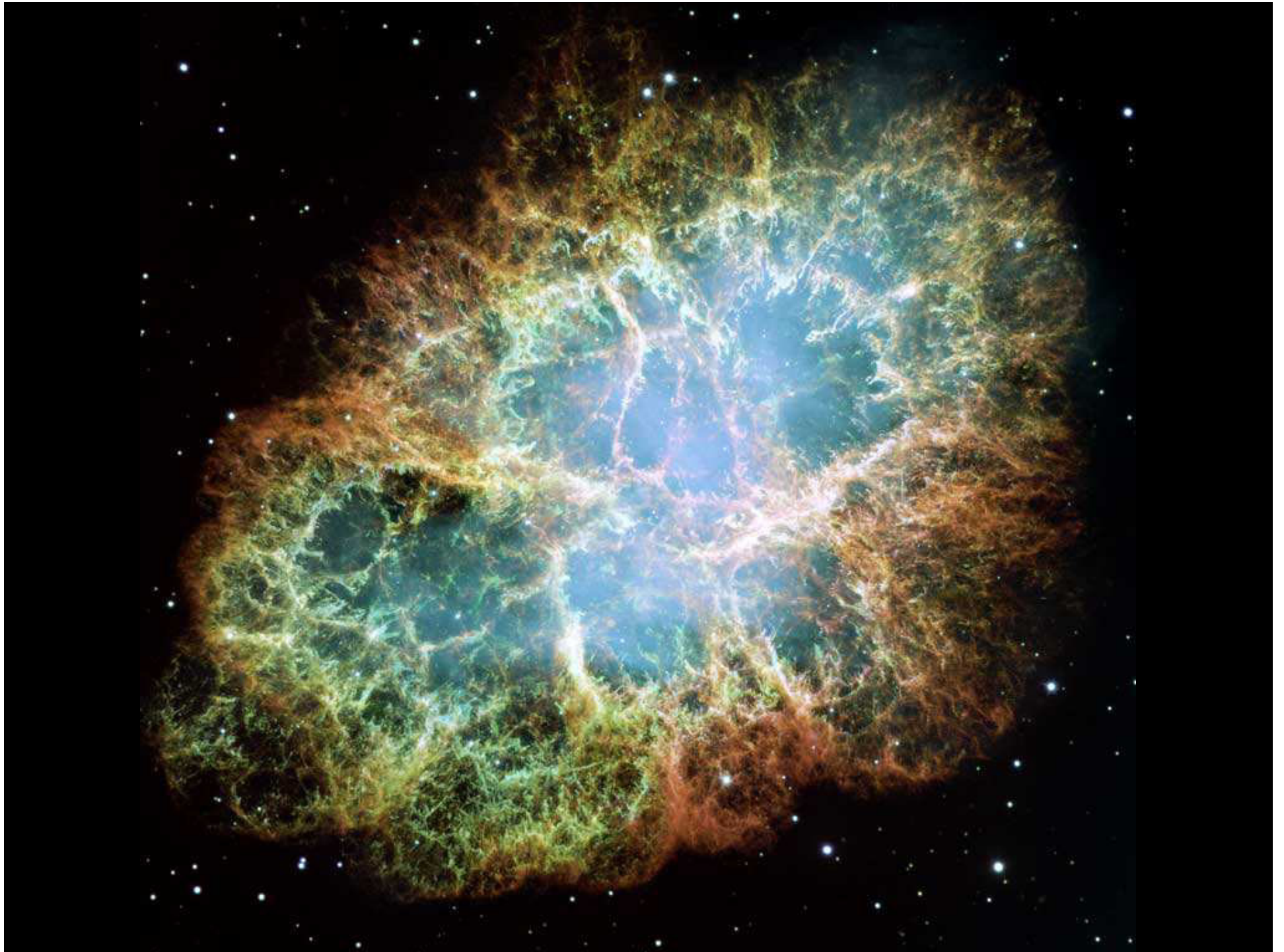
NASA and ESA

Hubble Space Telescope ■ WFC3/UVIS/IR



STScI-PRC15-01c





Galaxies NGC 2207 and IC 2163



Hubble
Heritage

NCC 4038-4039 • Antennae Galaxies



Hubble
Heritage

The Universe is ENORMOUS, in both Space and Time, and in numbers of stars and galaxies!

Spiral Galaxy NGC 1309

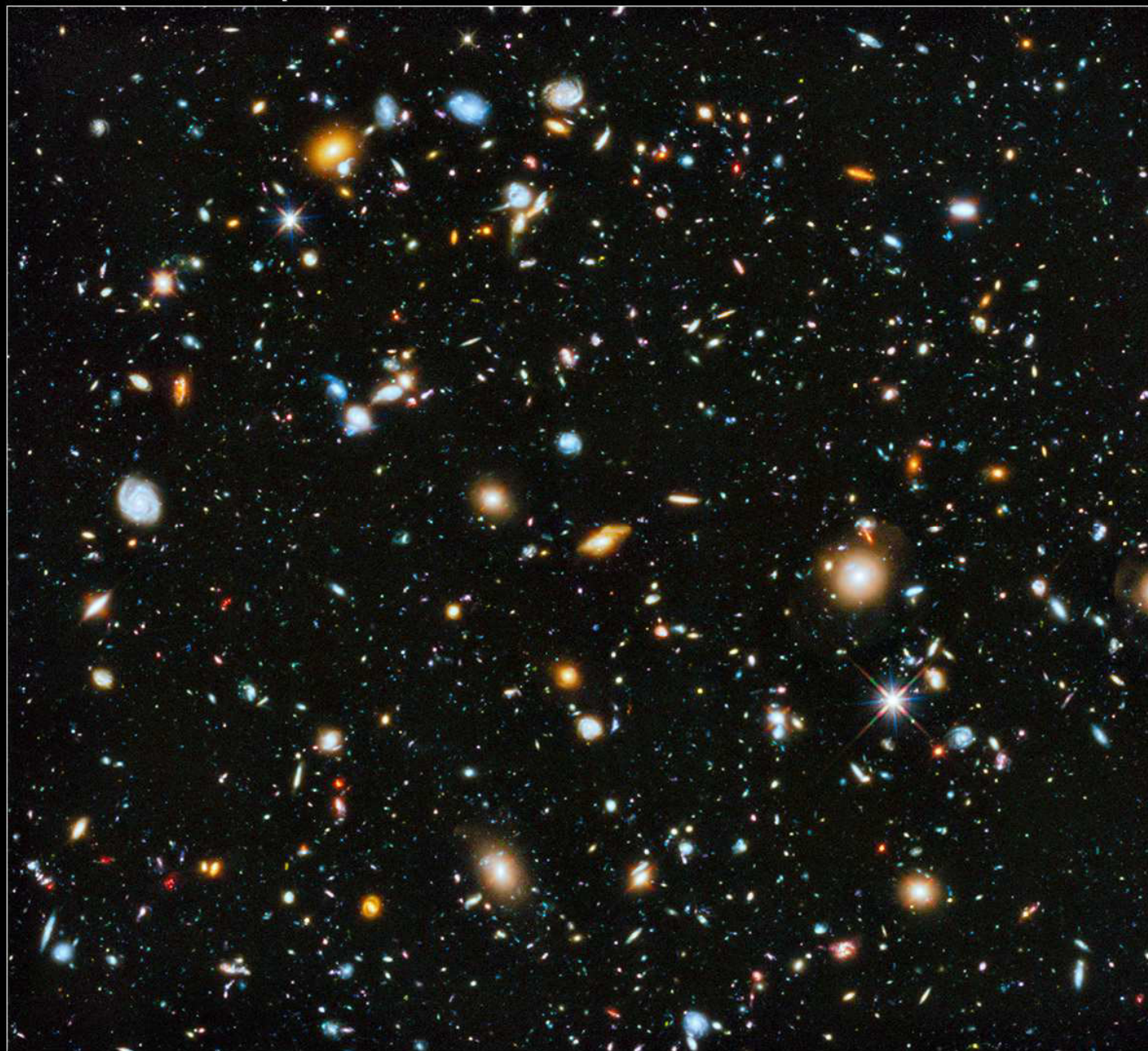


Hubble
Heritage

NASA, ESA, The Hubble Heritage Team (STScI/AURA), and A. Riess (STScI)
Hubble Space Telescope ACS • STScI-PRC06-07

Hubble Ultra Deep Field 2014

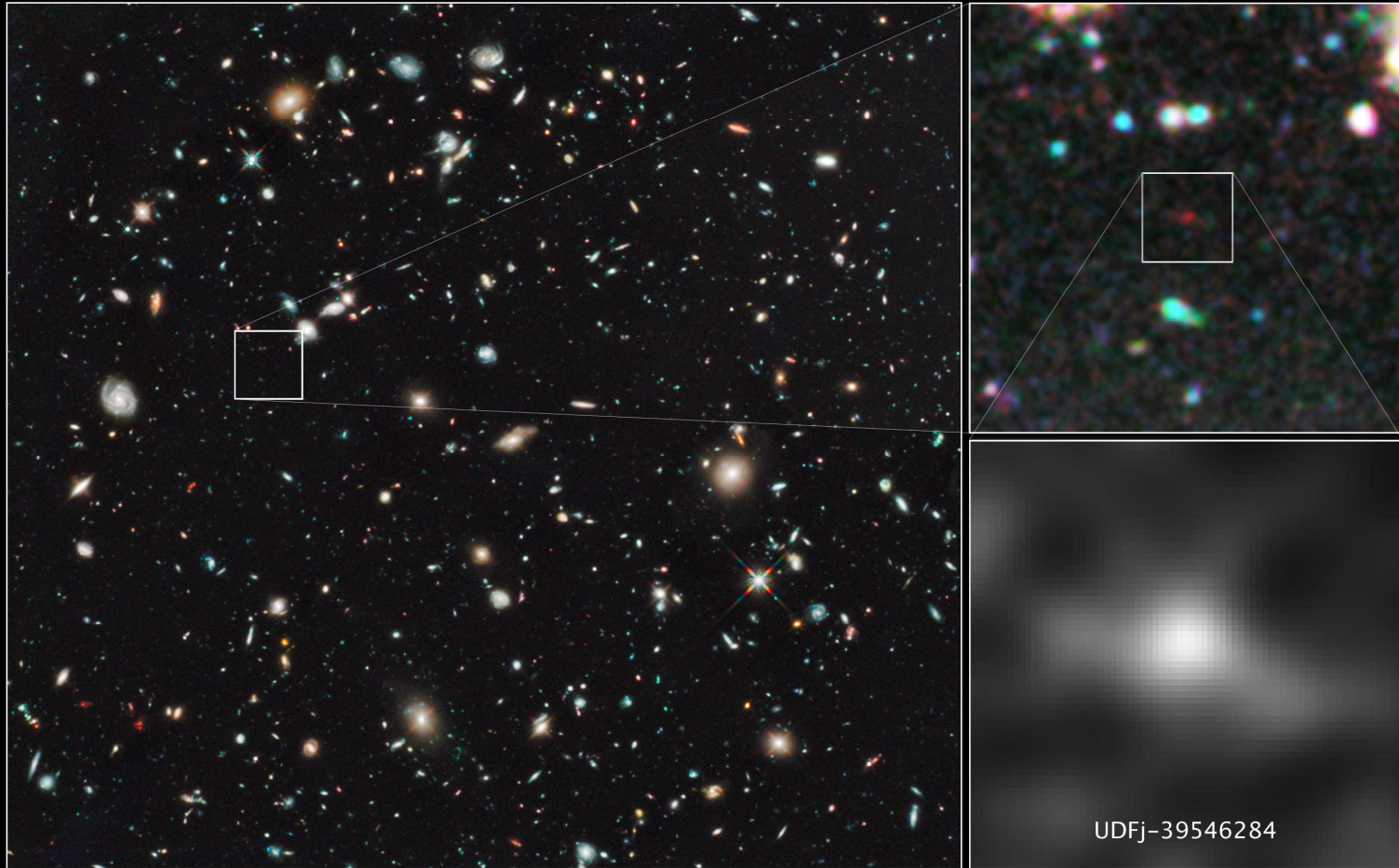
HST • ACS • WFC3



NASA and ESA

STScI-PRC14-27a

Hubble Sees Very Distant Galaxies



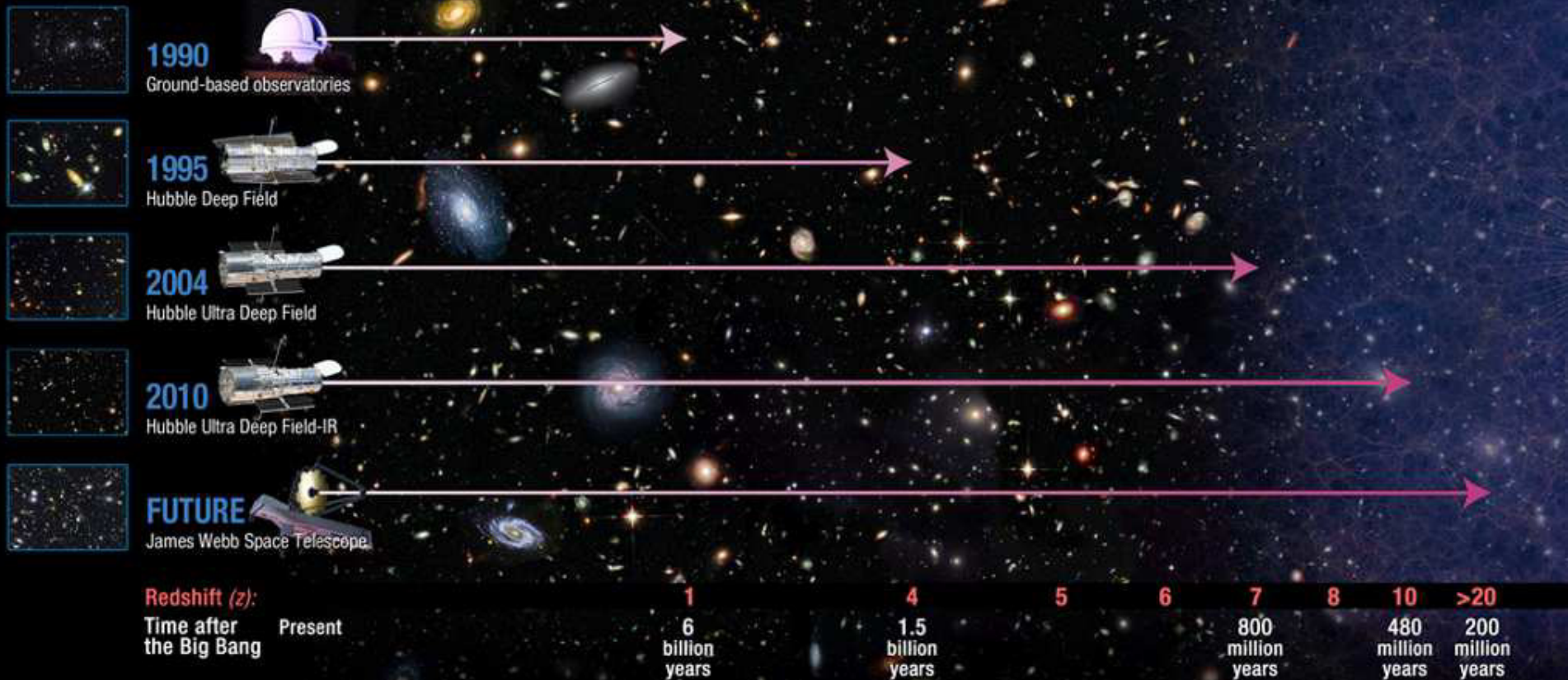
Hubble Ultra Deep Field 2009-2010
Hubble Space Telescope • WFC3/IR

NASA, ESA, G. Illingworth (University of California, Santa Cruz),
R. Bouwens (University of California, Santa Cruz, and Leiden University), and the HUDF09 Team

STScI-PRC11-05

Looking Deep Into Space and Time

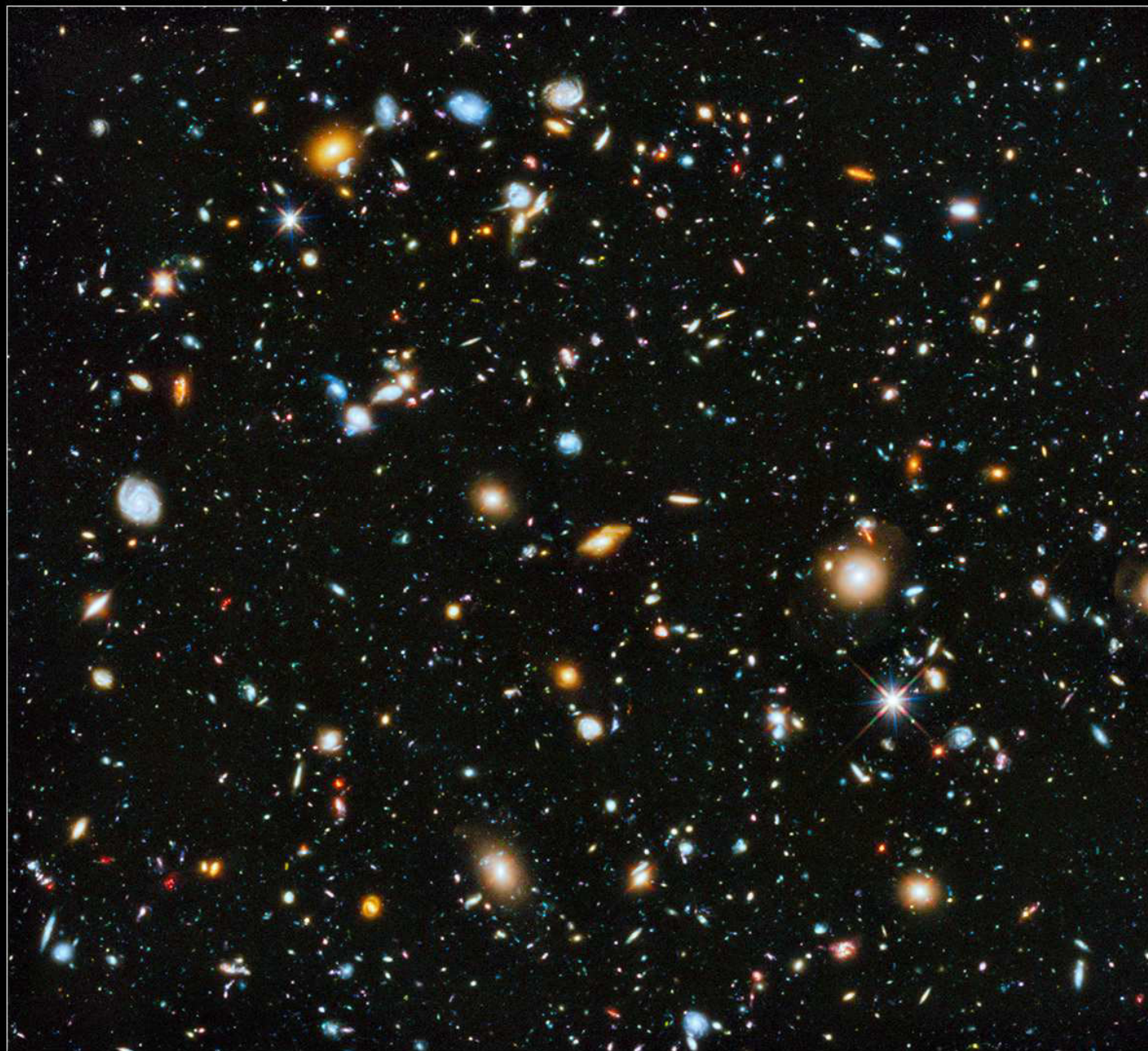
Hubble Probes the Early Universe



The Hubble Telescope has revealed
New Discoveries, New Mysteries, and
New Surprises about the Universe

Hubble Ultra Deep Field 2014

HST • ACS • WFC3



NASA and ESA

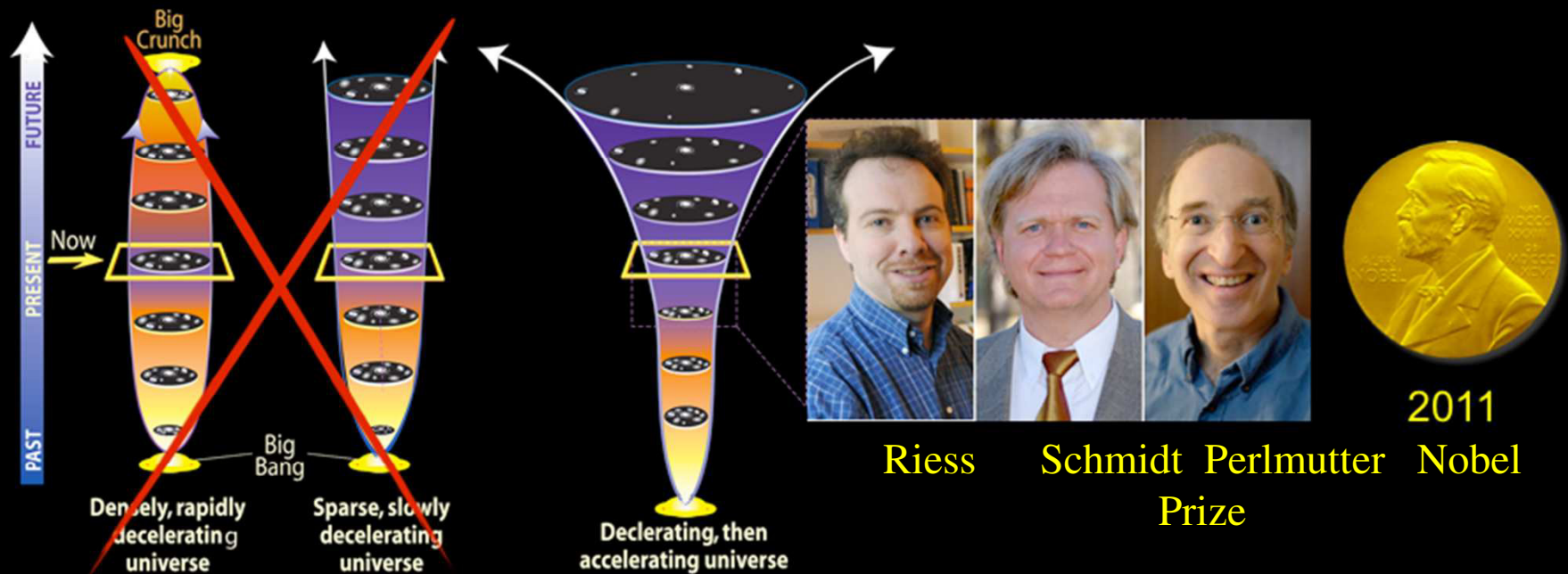
STScI-PRC14-27a

The Expansion of the Universe is Accelerating

!!

HST has played a key role in detecting the *acceleration* of the expanding universe and in the study of “Dark Energy”

An accelerating Universe!



the Universe is being pushed apart, and we don't know by what..

Hubble Is Investigating Big Questions About the Universe

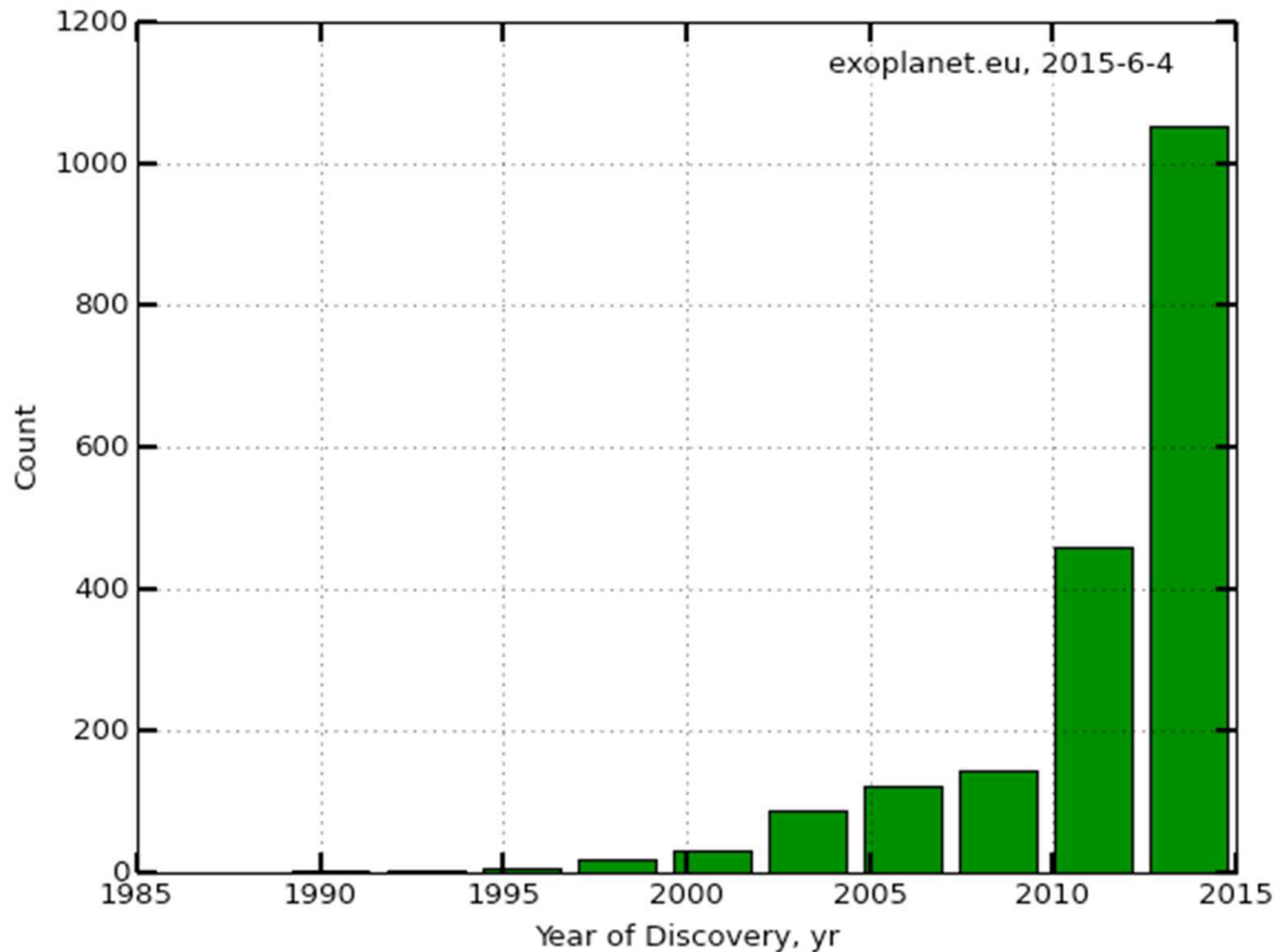
What is Dark Energy?

What is Dark Matter?

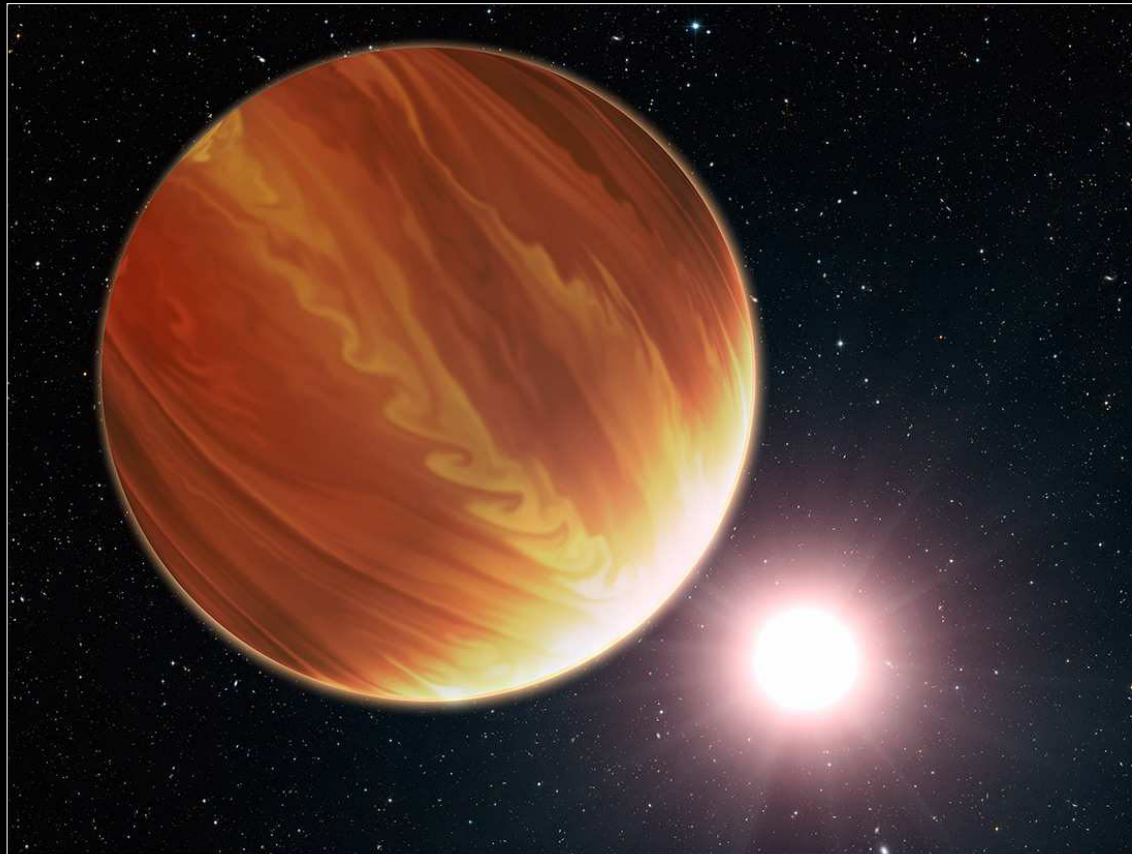
Are there other planets like Earth?



Exoplanet Discovery Rate



Hubble is analyzing exoplanet atmospheres



Artist's View of the Hot Extrasolar Planet Osiris (HD 209458b)

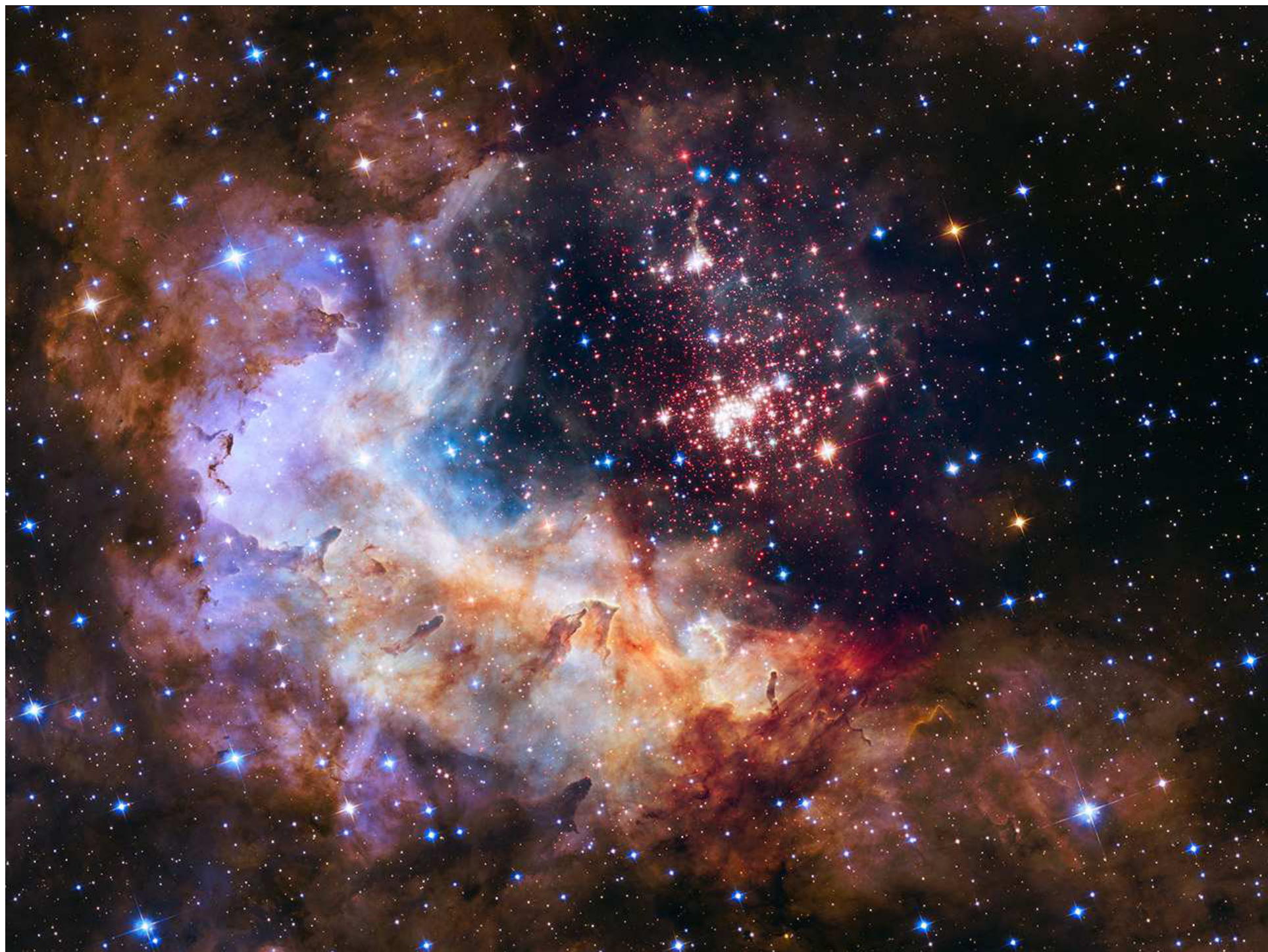
NASA, ESA, and G. Bacon (STScI) ■ STScI-PRC14-36a

Science and discovery can lift the
human spirit

And Hubble plays a big part!







Great Web sites for Hubble Space Telescope Images and Information!

www.nasa.gov/hubble

www.spacetelescope.org

Hubblesite.org

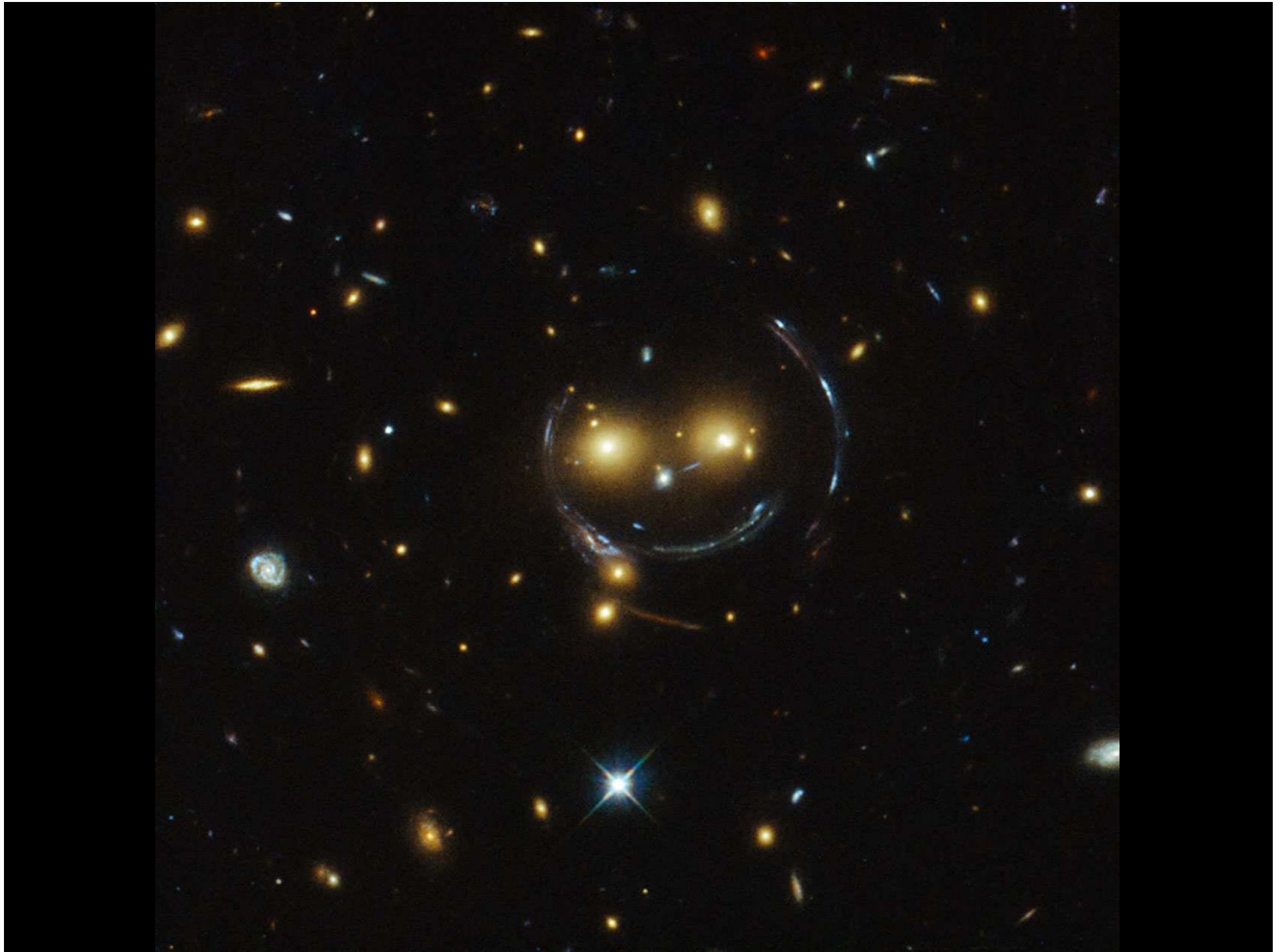
(Click on “Gallery”)

Also, find 25th anniversary information and events
at

Hubble25th.org

The Hubble Space Telescope mission continues with strong scientific capability, hopefully for some years beyond 2020, and its scientific discoveries are also helping preparations for future missions like the James Webb Space Telescope (JWST, 2018)







HAPPY 25TH BIRTHDAY, HUBBLE !!

HUBBLE SPACE TELESCOPE



Galaxies | Dark Matter | Dark Energy | Cosmic Expansion |

Solar System

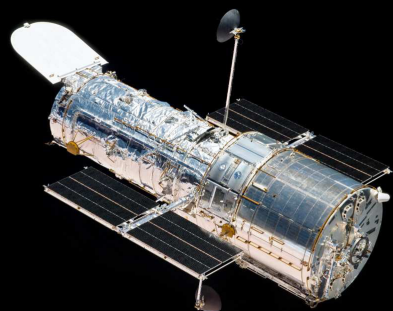
Stars

Exoplanets

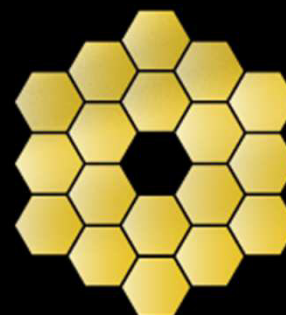
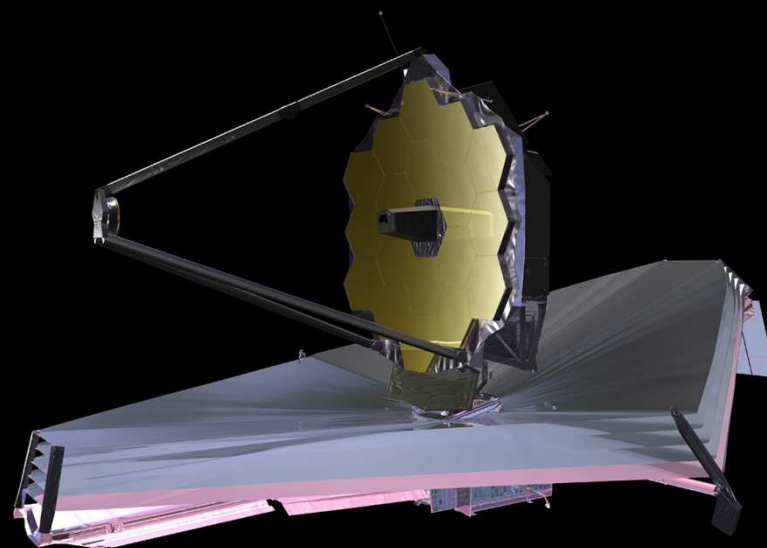
Nebulae

Black Holes

Additional information



HST
2.4 m



JWST
6.5 m

1 μm

10 μm

100 μm

Hubble

JWST

Infrared



jwst

The James Webb Space Telescope (JWST)

Launch segment



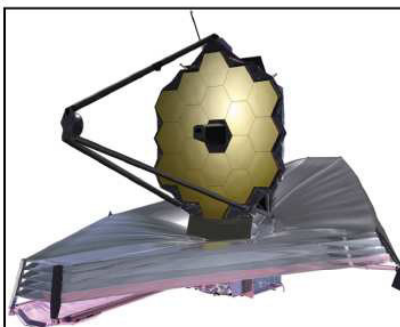
Payload
adapter

Launcher
(Ariane 5)

Launch site
services



Observatory segment



Spacecraft
(bus,
sunshield...)

Telescope

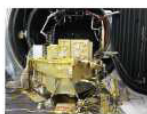
Payload module (ISIM) and instruments

NIRCam



NIRSpec

FGS /
NIRISS



MIRI

Ground segment



Science and operation
center (STScI)

15 ESA staff members

Common systems
(deep space network)

 Provided by NASA

 Provided by ESA and Europe

 Provided by CSA