STScI | SPACE TELESCOPE SCIENCE INSTITUTE

EXPANDING THE FRONTIERS OF SPACE ASTRONOMY

Supporting the James Webb Space Telescope with an Agile Culture

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Nashville Tennessee

Introduction

Susan Reed

Started at Space Telescope June 0f 2015 managed IT Support Services for 5 years and in 2020 became the IT Deputy Division Head / Director of IT Operations.

IT Deputy Division Head leads IT Operations consisting of Information Security and Network Services, Infrastructure and Cloud Services, IT Support Services, IT Asset Management, IT Service Management and Core Mission Services.

Agenda – What we will talk about today…

- Space Telescope Science Institute – STScI – who we are and what we do
- Why we are here (in this room – not on Earth)
- Discuss the importance of an Agile Culture
- Hear some stories of where we do it right…and where we are still learning

“Intelligence is the ability to adapt to change.” Stephen Hawking

“There is a way to do it better — find it!” Thomas A. Edison

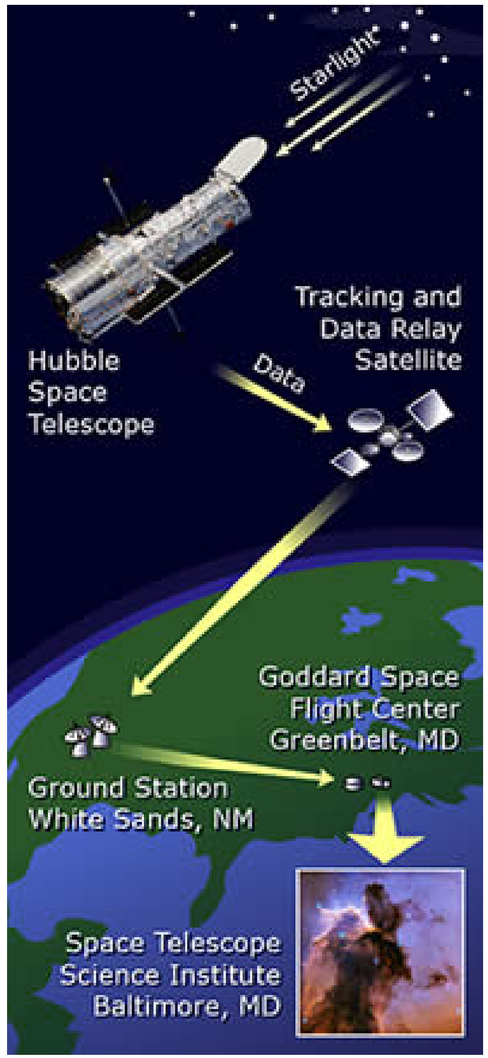
“Learn from yesterday, live for today, hope for tomorrow. The important thing is not to stop questioning.” Albert Einstein

Space Telescope

Who we are

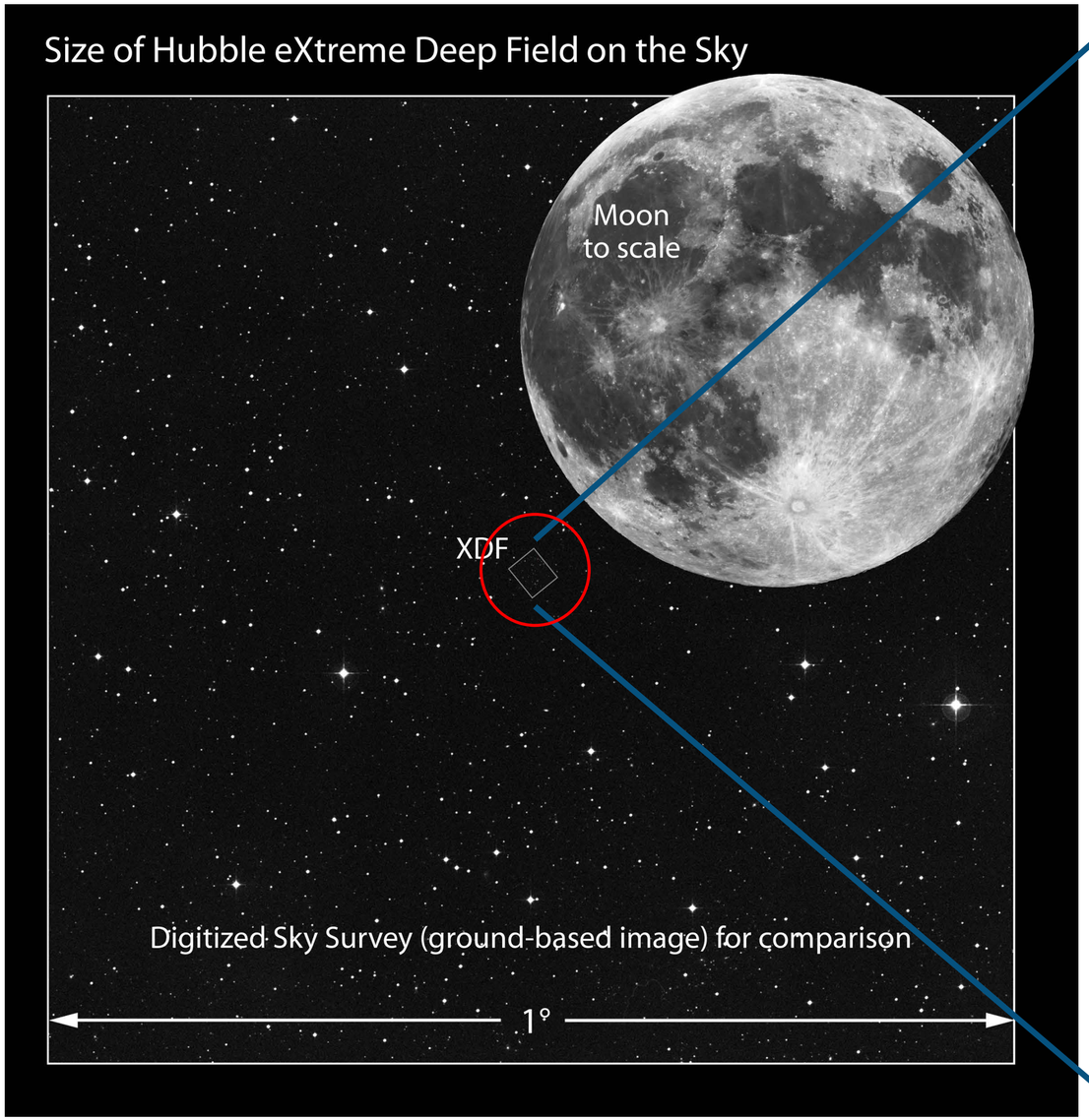
STScI was established in 1981 as a community-based science center that is **operated for NASA by the Association of Universities for Research in Astronomy (AURA)**. STScI's offices are located on the Johns Hopkins University Homewood Campus and in the Rotunda building in Baltimore, Maryland.

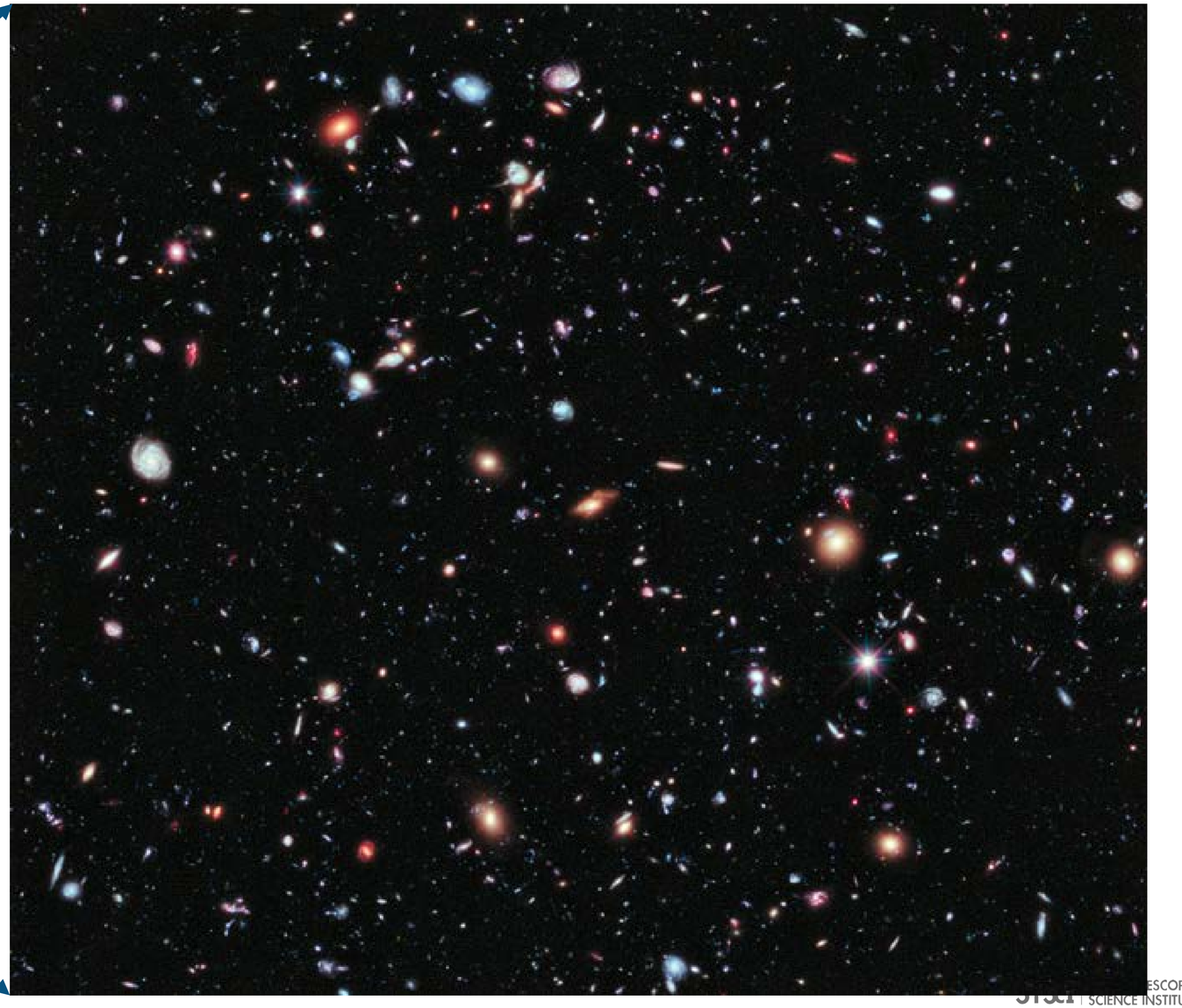
What we do…. Hubble Space Telescope Science Operations

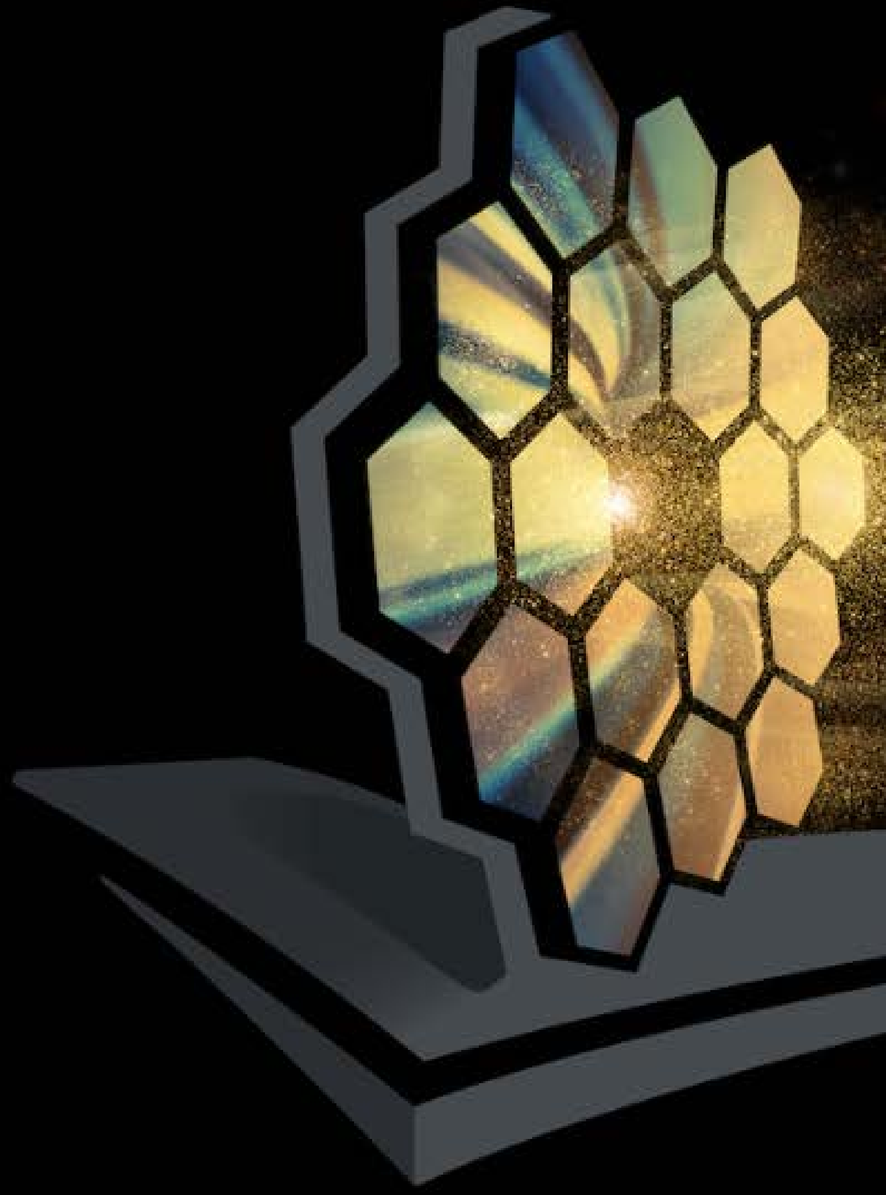


- The solar-powered Hubble telescope launched on April 24, 1990 on board the space shuttle Discovery and was deployed one day later.
- Hubble orbits about 340 miles above Earth. Its average speed is 17,000 mph, and it takes 97 minutes to complete one orbit.
- Hubble transmits about 120 gigabytes of science data every week. That would be roughly 3,600 feet of books on a shelf.
- The telescope's primary mirror is 94.5 inches wide and weighs 1,825 pounds. Its secondary mirror is 12 inches wide and weighs 27.4 pounds.
- Astronauts have serviced Hubble five times, on missions that launched in December 1993, February 1997, December 1999, February 2002 and May 2009.

When Hubble stared at ‘nothing’ for 23 days







Science and Technology

WEBB

SPACE TELESCOPE

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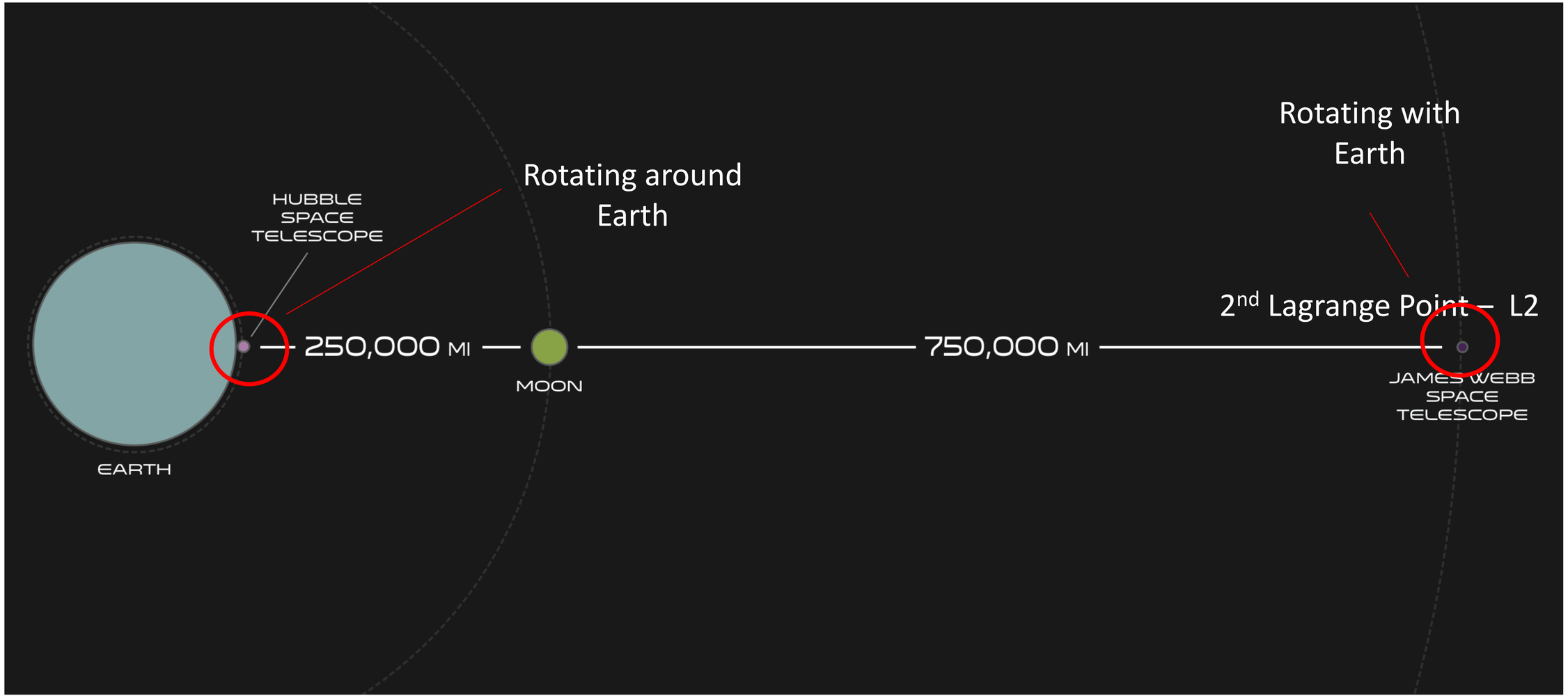
What we do… James Webb Space Telescope Flight and Science Operations

JWST Observatory

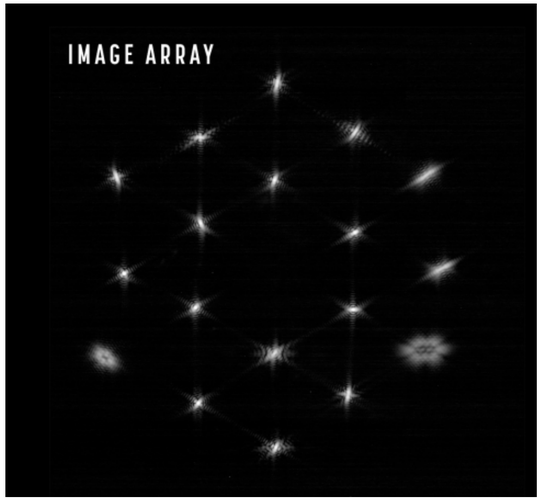
Webb is NASA's largest and most powerful space science telescope ever constructed. Webb's enormous size and frigid operating temperature presented extraordinary engineering challenges. After launching from French Guiana on Christmas morning 2021, the observatory traveled to an orbit about one million miles away from Earth and went through six months of commissioning in space—unfolding its mirrors, sunshield, and other smaller systems; cooling down; aligning; and calibrating. Astronomers worldwide are now able to conduct scientific observations to broaden our understanding of the universe.

Where is the James Webb Space Telescope

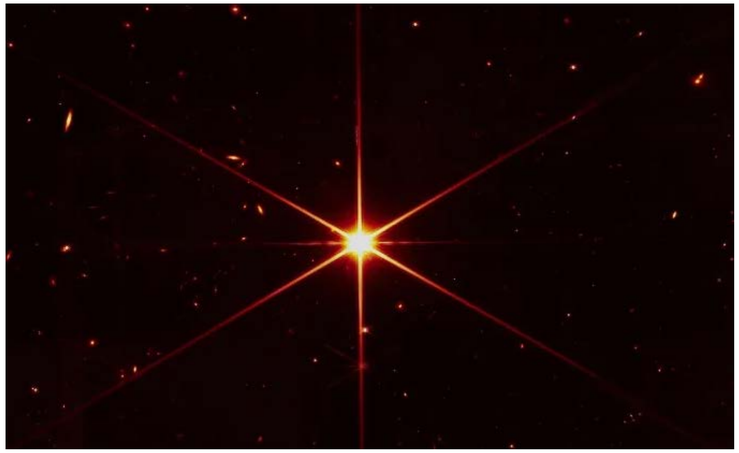


James Webb Space Telescope Commissioning

The first published image taken by the James Webb Space Telescope shows part of a mosaic created over 25 hours beginning on Feb. 2, 2022, early in the process of aligning the 18 segments of the James Webb Space Telescope's mirror. (Image credit: NASA)

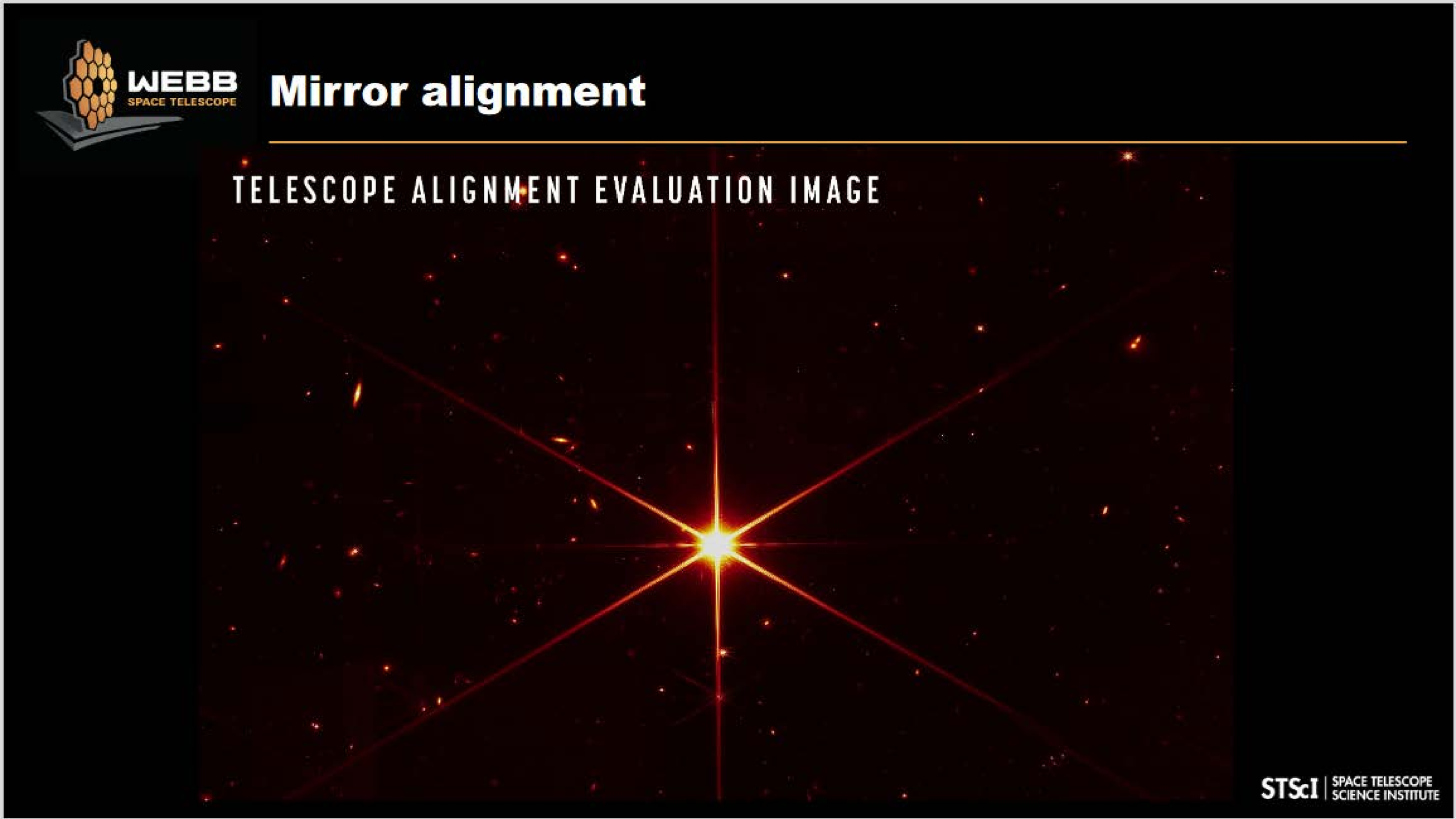


Webb finished the first major stage in its long process of aligning the observatory's 18-segmented primary mirror. Eventually, those 18 images will perfectly align into a single sharp focus. Released on Feb. 18, 2022. (Image credit: NASA/STScI/J. DePasquale)



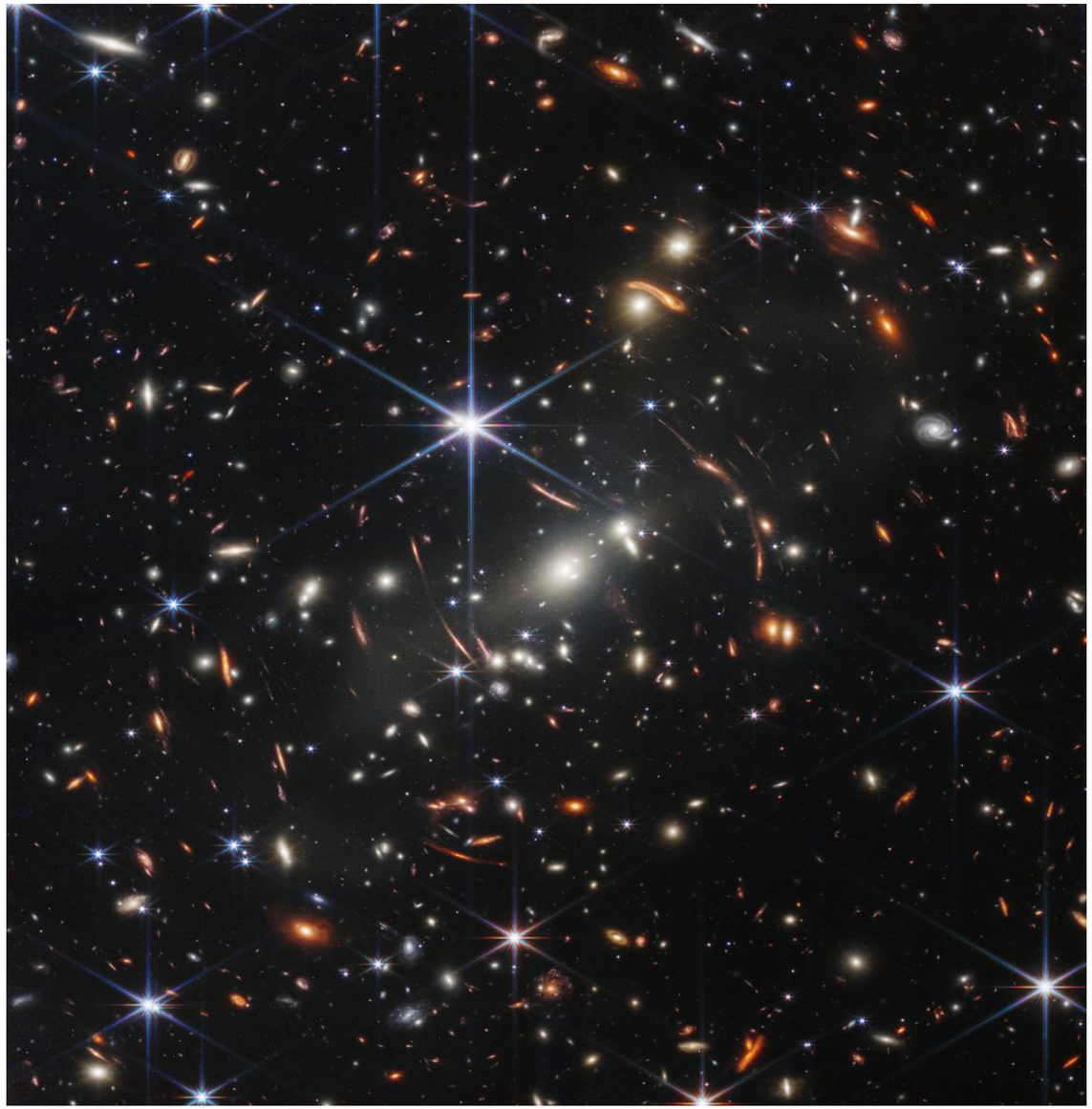
After weeks of alignment, NASA finished focusing the James Webb Space Telescope's primary mirror on March 11, 2022, achieving a precision that exceeded the original goal and resulted in the image bove: an image of star 2MASS J17554042+6551277, released on 16 March 2022.

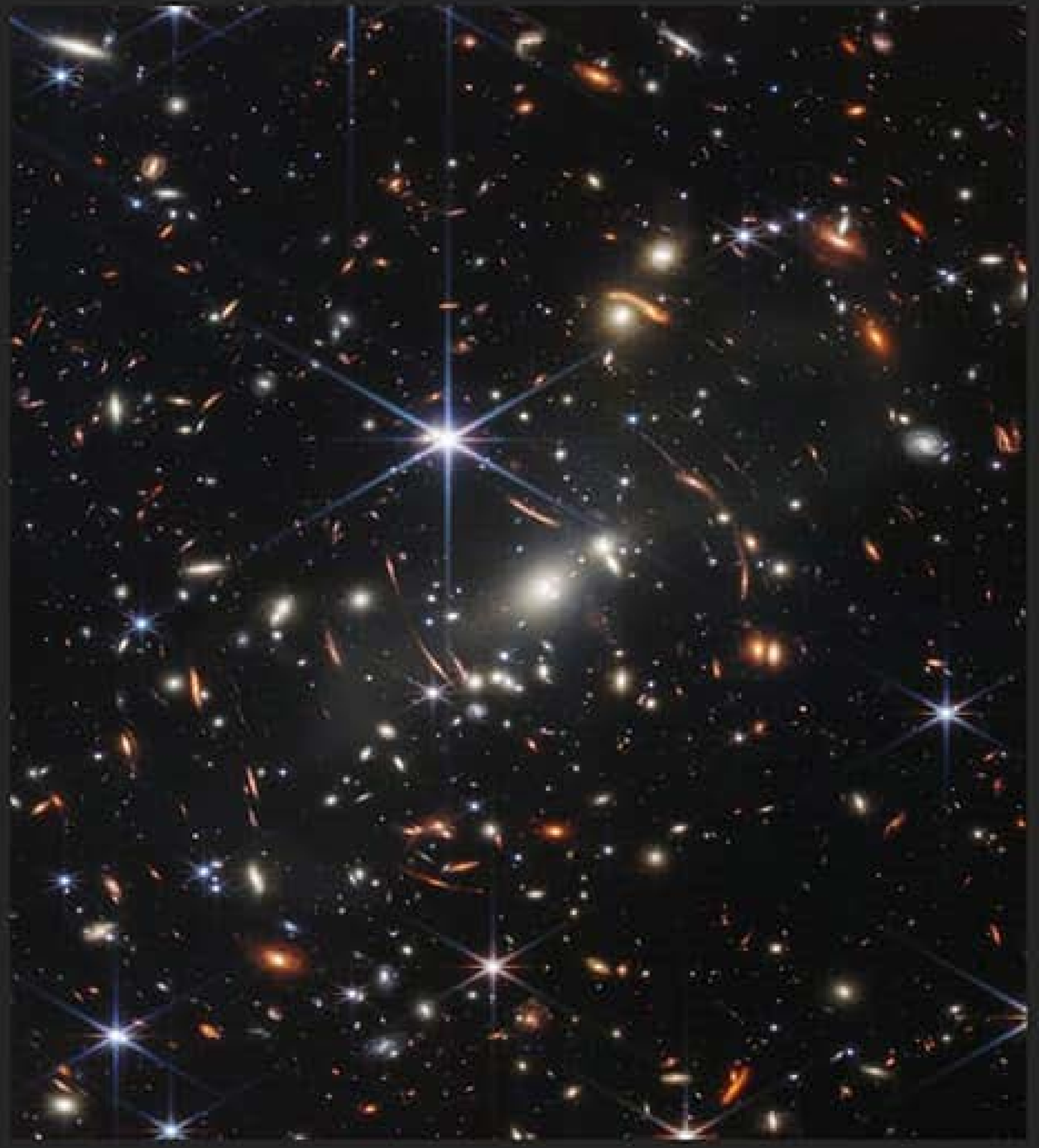
Mirror alignment

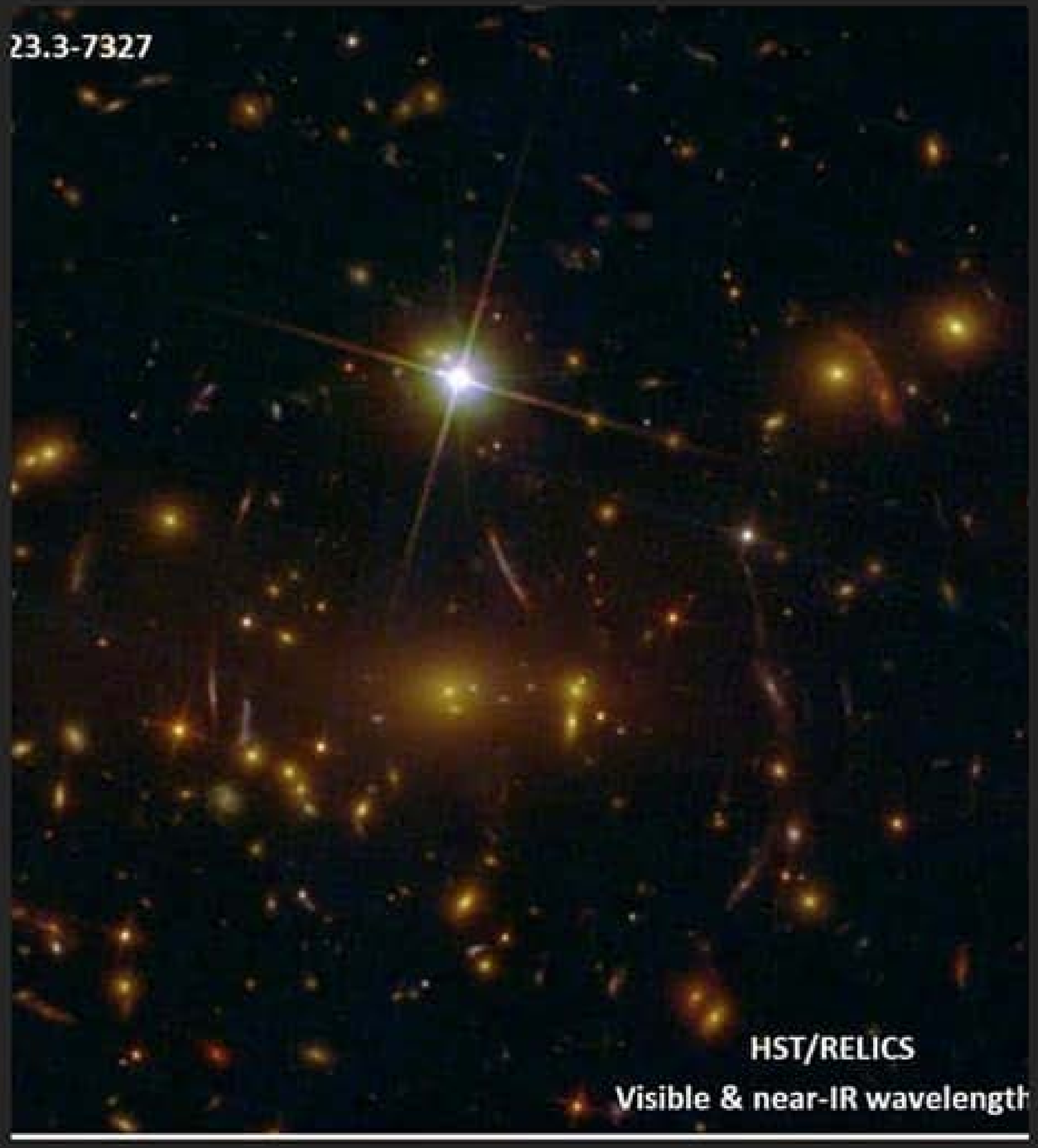


James Webb Space Telescope Science Operations – First Picture

The image shows the galaxy cluster SMACS 0723 as it appeared 4.6 billion years ago. The combined mass of this galaxy cluster acts as a gravitational lens, magnifying much more distant galaxies behind it. Webb's NIRCam has brought those distant galaxies into sharp focus – they have tiny, faint structures that have never been seen before, including star clusters and diffuse features. Researchers will soon begin to learn more about the galaxies' masses, ages, histories, and compositions, as Webb seeks the earliest galaxies in the universe.



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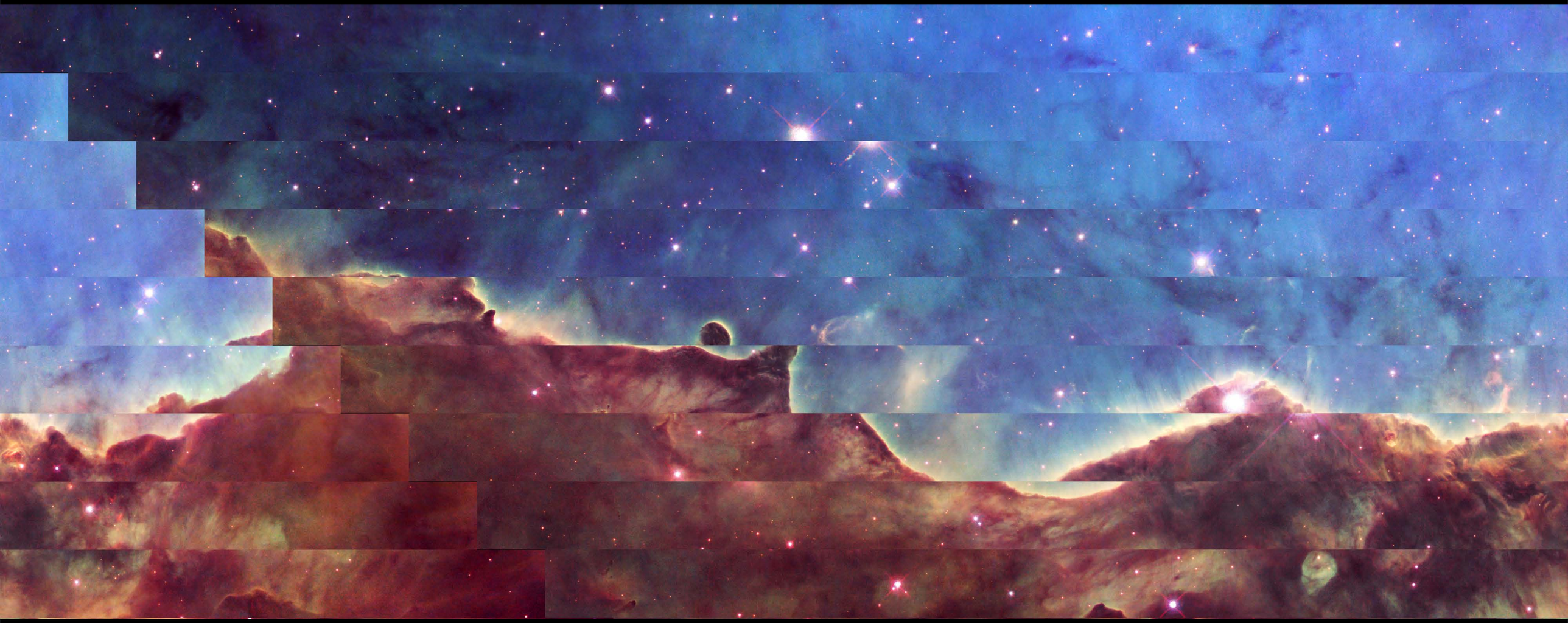
Visible & near-IR wavelength

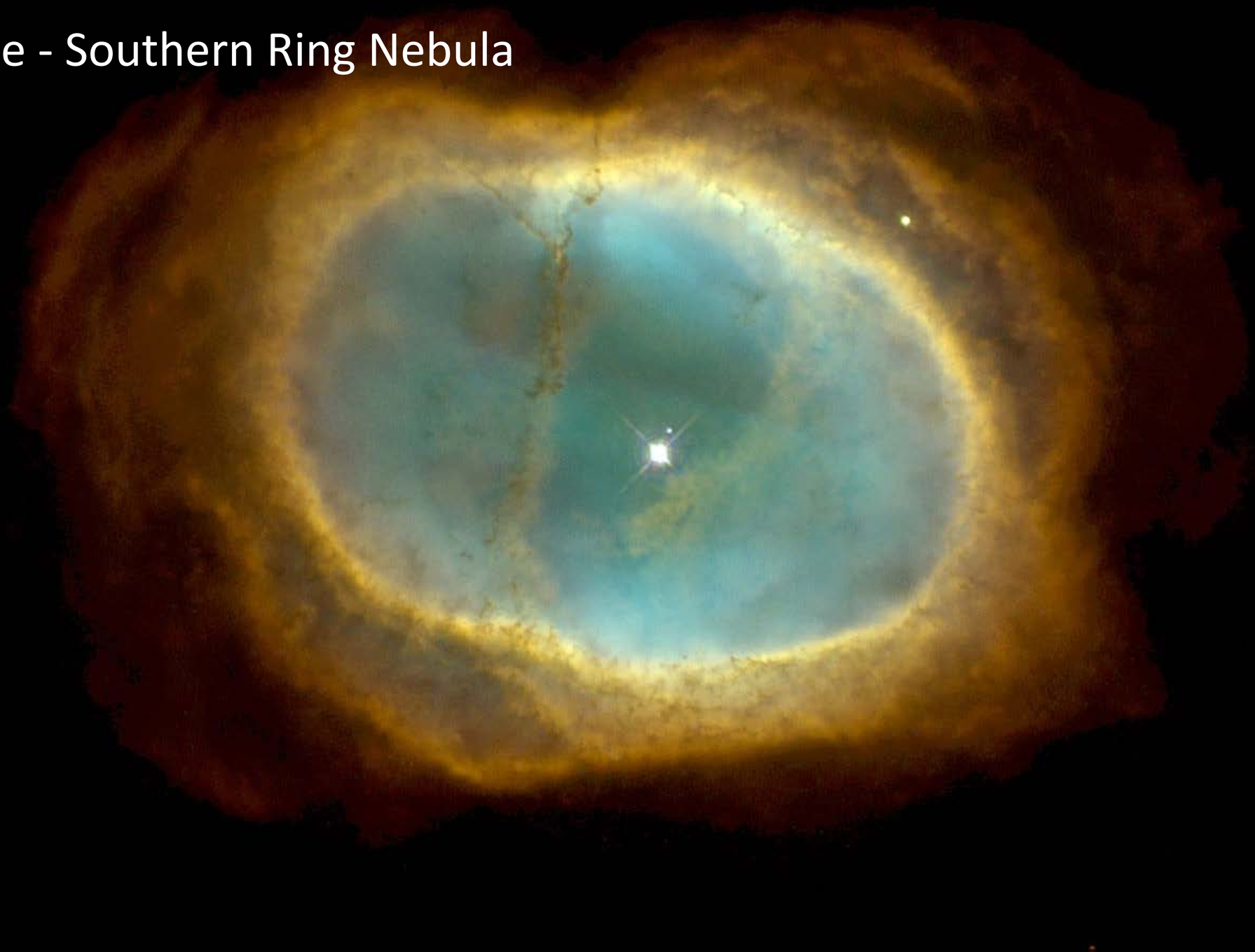
Hubble Image – Carina Nebula



NGC 3324, also known as The Gabriela Mistral Nebula is located in the Southern constellation Carina at a distance of 9,100 light-years from Earth. It can be found at the northwest corner of the Carina Nebula complex.

This landscape of "mountains" and "valleys" speckled with glittering stars is actually the edge of a nearby, young, star-forming region called NGC 3324 in the Carina Nebula. Captured in infrared light by NASA's new James Webb Space Telescope, this image reveals for the first time previously invisible areas of star birth.

Hubble Image - Southern Ring Nebula



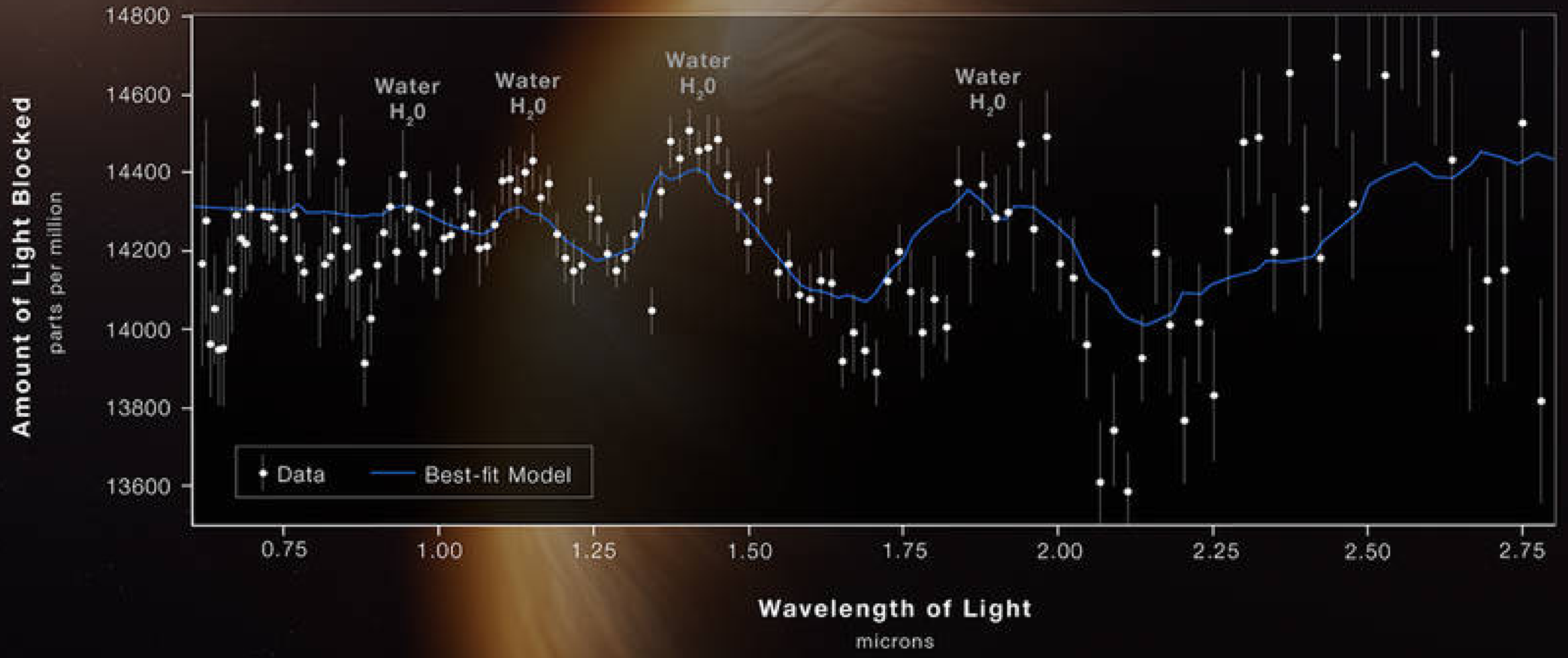
Southern Ring Nebula: This planetary nebula, an expanding cloud of gas that surrounds a dying star, is approximately 2,000 light years away. Here, Webb's powerful infrared eyes bring a second dying star into full view for the first time. From birth to death as a planetary nebula, Webb can explore the expelling shells of dust and gas of aging stars that may one day become a new star or planet.

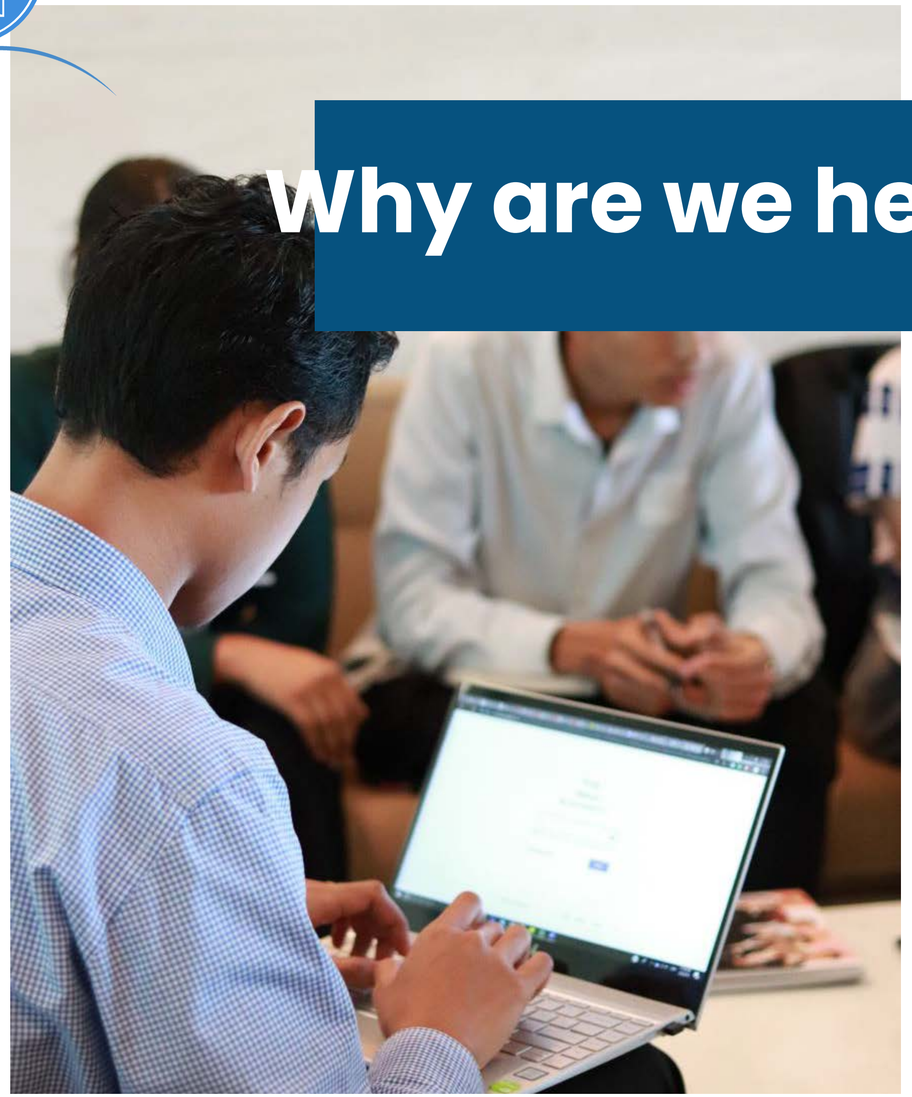
Stephan’s Quintet: Webb’s view of this compact group of galaxies, located in the constellation Pegasus, pierced through the shroud of dust surrounding the center of one galaxy, to reveal the velocity and composition of the gas near its supermassive black hole. Now, scientists can get a rare look, in unprecedented detail, at how interacting galaxies are triggering star formation in each other and how the gas in these galaxies is being disturbed.

HOT GAS GIANT EXOPLANET WASP-96 b

ATMOSPHERE COMPOSITION

NIRISS | Single-Object Slitless Spectroscopy





Why are we here

No… I am not about to explain any cosmic reasons for our presence on Earth

We are here to discuss agile and how STScI is using the framework. Companies adopt agile for reasons usually stemming from a dissatisfaction with how things are currently working and a desire to improve. Most are struggling with the reality of ever-changing environments, customer needs, technological advancements and competitor pressure.

- So why is STScI using agile? Because like most organizations we need to deliver faster, be more productive, improve customer satisfaction, reduce costs, improve employee engagement, provide better quality, continuously improve, and reduce risks.

Goals of Agile

More than 70% of Agile practitioners recently surveyed by Scrum Alliance reported tension between their teams and the rest of the organization

The ultimate goal of an Agile is being able to rapidly respond to change while establishing a culture of continuous improvement and innovation. This requires equal focus on:

- building organizational alignment **THINK CULTURE!**
- establishing teams that create value quickly **NOT JUST IT & ENGINEERING TEAMS!**
- implementing engineering practices that allow for rapid feedback and delivery to the customer

Importance of an Agile Culture

ORGANIZATIONAL ALIGNMENT

Frameworks, structures, and approaches that align teams, reduce impediments, and enable people.

Parallel efforts involving people, process, and technology lay the foundation for agility.

Creating organizational alignment for Agile transformation is a total transformation in culture. Senior leadership is essential in establishing a vision for Agile transformation, leading the organization through change, and aligning the organization to deliver value.

Establishing a Lean-Agile Center of Excellence (LACE) or Enterprise Agility Team (EAT) ensures that the organization is continually aligned, delivering valuable business outcomes and responding to the constantly changing internal and external forces of the environment.

Importance of an Agile Culture

Achieving agility requires formalizing a culture of continuous improvement.

Incorporating feedback loops + regular retrospectives

The learning and testing that happens every day in an Agile environment lends itself to doing more of what works and building upon past success. Incorporating short feedback loops and establishing regular retrospectives builds trust within teams, sustains acceleration, enables collaboration, fosters innovation, and reduces risk..

Establish meaningful metrics

Setting up a meaningful metrics program will help you improve the agility of your organization. Without clear goals and metrics, you will not be able to tie the output of your Agile transformation to those objectives. Other metrics include team member satisfaction, reducing dependency count, time to production, and production bug count.

Compare Agile metrics to past reporting

Tracking your progress requires differential analysis between historical and current metrics. At all levels of the organization, focus improvement discussions and decisions around both KPIs, OKRs, and team feedback through anecdotal observations and sprint retrospectives.

Importance of an Agile Culture

An Agile transformation requires an entire organization to embrace an Agile mindset and Agile principles.

Socialize success

Socialize early success stories and paint a clear vision of the virtuous cycle of value creation that can result from using Agile. Team members love that when using the scrum framework, they know exactly what they are going to be working on during a sprint, and they have the permission to focus on their work. This allows teams to self-manage, build trust, and incorporate work at a sustainable pace. Product owners and stakeholders appreciate that they are able to easily adapt the product roadmap and backlog to meet the changing needs of the customer, optimize value delivery, and ultimately increase customer satisfaction.

Introduce Agile concepts to everyone

Encourage adoption of Agile principles and practices by non-development functions. Adopting Agile practices for organizational process improvements, for example, or a Kanban board for special projects in Human Resources, not only improves the output of those functions but instills an Agile mindset and Agile practices across the organization. Visualizing work, increasing transparency, identifying bottlenecks and minimizing hand-offs improves the overall efficiency of an entire organization. It also leads to ideas from all corners of an organization around improving processes to support Agile development teams.

Importance of an Agile Culture

Agile requires a shift in processes, mindset, and collaboration to succeed at scale.

Distinguish between organizational mindset and cultural transformation vs. execution

It's important to note the difference between organizational transformation and Agile scaling. Transformation is how your company organizes and empowers its employees to embrace agility, whereas scaling is how your organization will execute.

Embrace mindset of continuous improvement

Expect that there will be a bumps in the road initially. Create a cultural so teams can embrace failure while learning from it. As sprints improve and adoption gains momentum, you will see stakeholders build trust in the methodology, and in response, allow teams to self-manage around a problem. Incorporating regular retrospectives will give teams the opportunity to reflect on what went well and what didn't so that they can continually improve.

Collaborate across the organization

Changes across a transformed organization will be reflected in resource planning, product funding, accounting practices, and even deciding how Sales and Marketing will hit their goals based on available product. Teams will be cross-functional, so your business stakeholders will be comfortable talking to your development teams and vice versa, which brings ideas to the forefront and makes them a reality through Agile development

Final Thoughts:

A leader's role is to facilitate education and infrastructure improvements, empower teams, and manage change as the entire organization works to continuously improve.

Achieving agility is a major investment, but the beauty of Agile is in its team-driven momentum. When done well, driving innovation doesn't involve pushing teams as much as it does getting out of their way.

Actual picture of JWST Team in the MOC running the Webb Telescope

Questions & Answers… sreed@stsci.edu