Create Your Own Astronomy Masterpiece to Inspire and Engage

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What are you hoping to learn from today's webinar?

Let us know in the chat!

Girls STEAM Ahead with NASA

Program Facilitator Guide & Program Theme 2

NASA's Universe of Learning

NASA's Universe of Learning is an integrated astrophysics STEM learning and literacy program funded by NASA

Learners of all ages and backgrounds are engaged and immersed in exploring the universe for themselves

Direct connection to the NASA's science & missions

Girls STEAM Ahead with NASA

*Our aim is to **empower** public libraries and community-based organizations to engage girls and their families in STEM*

PROGRAM FACILITATOR GUIDE

Program Facilitator Guide


EVENT ACTIVITIES & RESOURCES:
DATA AND IMAGE PROCESSING

Pick and choose from this menu to build your own program. Explore other paper & pencil activities, computer-based activities, and more in our online Resource Catalog. We put together some Sample Scenarios on the following pages to get you started.

ENGAGEMENT

AstroPix – database of astronomy images | ViewSpace Videos & Interactives – explore science content

= computer-based activity
= paper & pencil activity
= both

BACKGROUND BUILDERS

Coloring the Universe (info) | How to Talk to a Spacecraft: A Stream of 1's and 0's Reading (info) | NASA Observatory Communications (info) | Nuts & Bolts: Coding Videos | Observatory Communications Graphic (Virtual)

EXPLORATIONS

Coloring the Universe with False Color Images (info) | Decoding Starlight: Middle School: Pixels to images activity handout | How to Talk to a Spacecraft: Binary Code Activities, including Binary Bracelets, Name Tags, or Binary Pins (low-tech activities) | Recoloring the Universe: Act using coding images and u astronomical

EXTENSIONS

Create Images with Raw Data | Decoding Starlight: High School: Pixels to images activity handout | MicroObservatory /Observing with NASA: Capture and process your own image | Tinkercad: Universe in 3D: Use 3D printing to explore the universe

REAL-WORLD CONNECTIONS

How do you Make a Picture of a Galaxy? (Video) | NASA Astrophoto Challenges: Learn from Experts (M83) (videos) | NASA Astrophoto Challenges: Learn from Experts (Whirlpool Galaxy) (videos) | How to be a Scientist: Careers in Astronomy

THINGS TO TRY AT HOME

A Universe of Making and Doing: Paper Circuits (activities) | Behind the Scenes with the Image Makers (info) | MicroObservatory/ Observing with NASA: Capture and process your own image | ViewSpace Videos & Interactives | Walking Among the Stars VR Experience

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Activities and resources related to the topic


THEME 2: DATA AND IMAGE PROCESSING
Topic Overview

NASA scientists explore how the universe works by gathering and analyzing data by some of the world's foremost ground-based and space-borne observatories. But, how do you make images of things in space? Moreover, how do you make images of objects in space that are taken in a kind of light undetectable (not visible) to the human eye?

When a telescope captures data, they do not arrive as an assembled snapshot. Instead, the spacecraft streams data encoded in the form of 1's and 0's, which are eventually translated into various formats, including images. To understand this translation process, we need to discuss what astronomical data is – and is not. Satellite and spacecraft images are not really photographs, but pictorial presentations of measured data in different bands of the electromagnetic spectrum (i.e., radio, infrared, visible, ultraviolet, X-ray, gamma

When a satellite observes an object in space, its camera records light particles, c These photons come down to Earth from the spacecraft via a network in the for 0's. Scientific software then translates that data into an event table that contains energy and position of each photon that struck the detector during the observat is further processed with software to form the visual representation of the objec color image is then assembled from separate black and white images taken thro filters.

Computer-aided data collection and processing is an essential part of research s and ground-based telescopes. Scientists rely on computers, not only to do calcul also to change data into images. Astronomers use telescope images to gather ev learn how the universe works. Coding and programming are a just one of many astronomers need in order to study the information from our space telescopes.

With the following NASA's Universe of Learning resources, your event particip that:

- astronomical information and resulting images help inform scientists abou and characteristics of objects in space.
- astronomical images are produced from data. The data is typically from lig by telescopes.
- making astronomical images is a process, a translation of information fron another.

Background content for the facilitator

- Kid-friendly background on binary code – spaceplace.nasa.gov/binary-code/
- The meaning of light and color – hubblesite.org/contents/articles/the-meanir
- Illuminated Universe (illuminateduniverse.org) – blog posts about behind-the- astronomy images from NASA Space Telescopes are created

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Theme with background content for the facilitator

MATERIALS

- Internet-connected computer with a large screen or display
- Images from ViewSpace or AstroPix
- Coloring the Universe with False-Color Images background text
- Recoloring the Universe activity

OPTIONAL MATERIALS

- Coloring the Universe with False-Color Images, Create Images with Raw Data, or Observing with NASA.

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SCENARIO 2-3:
CREATING ASTRONOMICAL IMAGES

OVERV

In this event scenario the learn how black and whi colorized using compute

ACTIVITY I

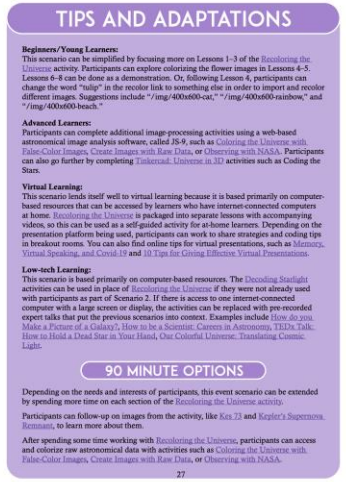
60 minutes. See the follo Adaptations" for a 90 mi

TARGET AU

Activities ideal for famili 12+, but can be adapted audiences.

The "Recoloring the Uni Starlight" activities in thi created and tested with d audiences, including fem Assessments (formative a ensured that these activit relevant, effective, and er audiences.

Sample event scenarios


TIPS AND ADAPTATIONS

Beginners/Young Learners:
This scenario can be simplified by focusing more on Lessons 1–3 of the Recoloring the Universe activity. Participants can explore colorizing the flower images in Lessons 4–5. Lessons 6–8 can be done as a demonstration. Or, following Lesson 4, participants can change the word "tulip" in the recolor link to something else in order to import and recolor different images. Suggestions include "/img/400x600-cat," "/img/400x600-rainbow," and "/img/400x600-beach."

Advanced Learners:
Participants can complete additional image-processing activities using a web-based astronomical image analysis software, called JS-9, such as Coloring the Universe with False-Color Images, Create Images with Raw Data, or Observing with NASA. Participants can also go further by completing Tinkercad: Universe in 3D activities such as Coding the Stars.

Virtual Learning:
This scenario lends itself well to virtual learning because it is based primarily on computer-based resources that can be accessed by learners who have internet-connected computers at home. Recoloring the Universe is packaged into separate lessons with accompanying videos, so this can be used as a self-guided activity for at-home learners. Depending on the presentation platform being used, participants can work to share strategies and coding tips in breakout rooms. You can also find online tips for virtual presentations, such as Memucrx, Virtual Speaking, and Covid-19 and 10 Tips for Giving Effective Virtual Presentations.

Low-tech Learning:
This scenario is based primarily on computer-based resources. The Decoding Starlight activities can be used in place of Recoloring the Universe if they were not already used with participants as part of Scenario 2. If there is access to one internet-connected computer with a large screen or display, the activities can be replaced with pre-recorded expert talks that put the previous scenarios into context. Examples include How do you Make a Picture of a Galaxy?, How to be a Scientist: Careers in Astronomy, TEDx Talk: How to Hold a Dead Star in Your Hand, Our Colorful Universe, Translating Cosmic Light.

90 MINUTE OPTIONS

Depending on the needs and interests of participants, this event scenario can be extended by spending more time on each section of the Recoloring the Universe activity.

Participants can follow-up on images from the activity, like Kes 73 and Kepler's Supernova Remnant, to learn more about them.

After spending some time working with Recoloring the Universe, participants can access and colorize raw astronomical data with activities such as Coloring the Universe with False-Color Images, Create Images with Raw Data, or Observing with NASA.

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2-3

Program Theme 2

Data and Image Processing

Did you know any of these resources?

Let us know in the chat! Also, feel free to drop any questions you have in the chat.

MicroObservatory

Promoting STEM Identity & Enabling Authentic Inquiry

Astronomers' Toolbox for the 21st Century:

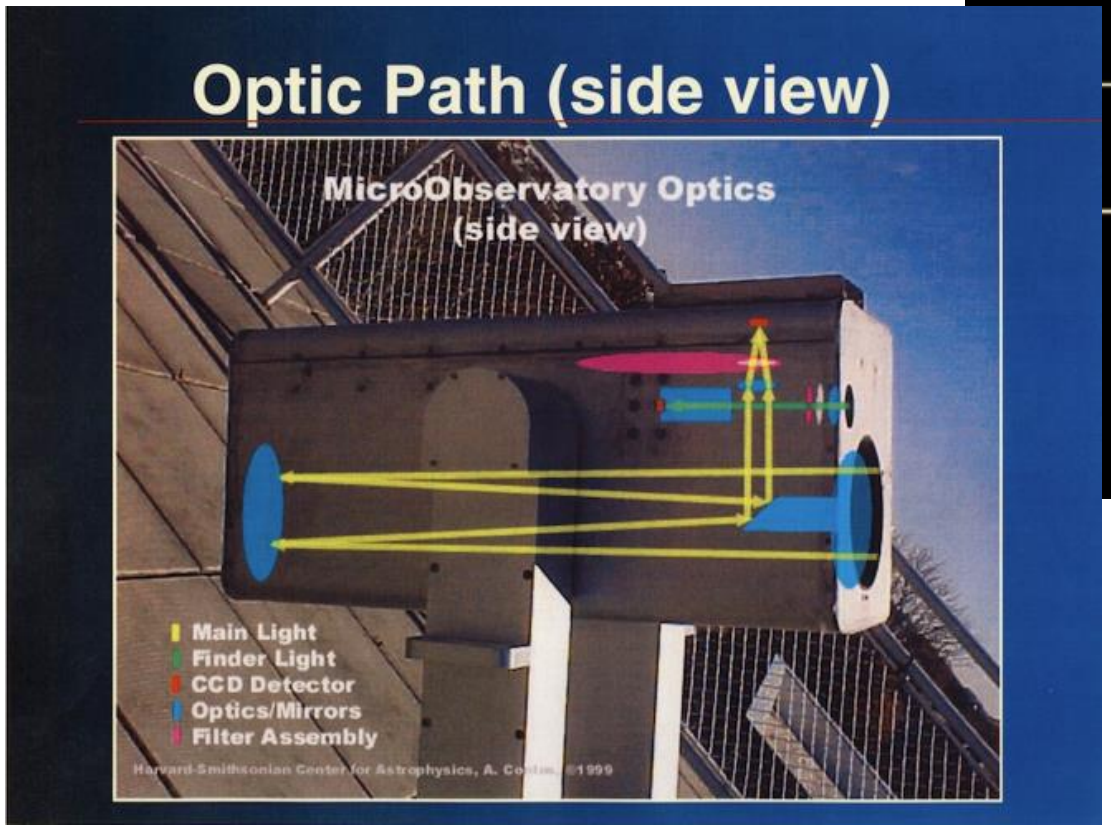
1. Robotic (remotely operated) telescopes
2. Digital Data and Image Processing

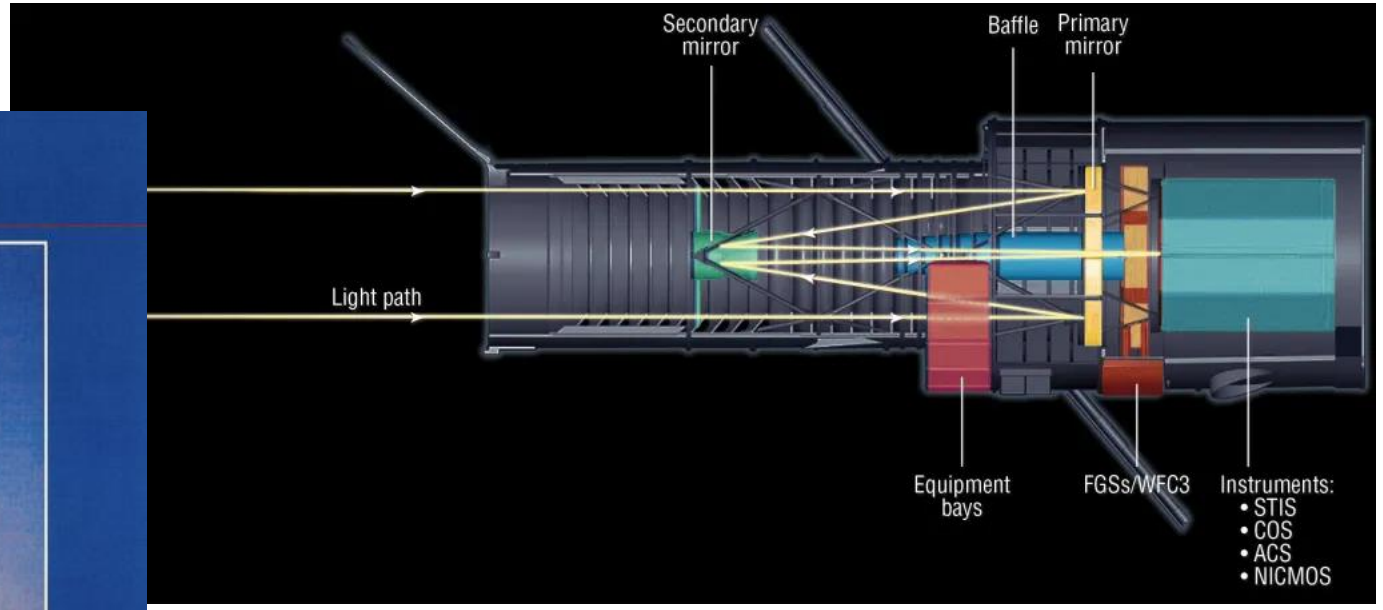
Be an Astronomer (and Data Visualizer)

- Learning Goals: GSAWN Participants will…

1. Understand NASA imagery
2. Gain new astronomy knowledge
3. Practice data visualization skills
4. Learn science as they do science
5. Want to explore more
6. Build STEM identity over time

Reflecting telescopes that detect visible light





Let's send a command to one!

1. Choose Target
2. Set Exposure Time
3. Select Filter

MicroObservatory Robotic Telescope Network

Welcome to the MicroObservatory Robotic Telescope Network operated by Center for Astrophysics | Harvard & Smithsonian.

Explore

the Universe with telescopes you control over the internet!

Follow Us

The Summer Edition of NASA's Astrophoto Challenges is LIVE! Submissions Due August 5th.

MicroObservatory Access Portals

- OBSERVING WITH NASA — MicroObservatory for everyone!
- DIY Planet Search — Exoplanets for everyone!
- YouthAstroNet
- MicroObservatory Online Telescopes — Full access legacy portal — *Login required*

Recent Image Directory | JS9-4L Image Application | YouthAstroNet Portal | Privacy Statement | Contact Us

CENTER FOR ASTROPHYSICS HARVARD & SMITHSONIAN · NASA'S UNIVERSE OF LEARNING · NSF

MicroObservatory is operated by the Center for Astrophysics | Harvard & Smithsonian with generous funding from NASA and NSF.

Select Your Target

The telescope will take an image of your selected target.
Prior to selecting your target, you can click on the thumbnail to see a detailed view.

Solar System

Moon OBSERVE | Saturn OBSERVE | Mars OBSERVE | Sun OBSERVE

Stars & Nebulae

Hercules Cluster OBSERVE | Ring Nebula OBSERVE | Milky Way OBSERVE | Sagittarius A OBSERVE | Dumbbell Nebula OBSERVE | Trifid Nebula OBSERVE | Lagoon Nebula OBSERVE | Eagle Nebula OBSERVE

Crab Nebula OBSERVE | Cyg X-1 OBSERVE | Messier 46 OBSERVE | Messier 15 OBSERVE | Beehive Cluster OBSERVE | CQ Cep OBSERVE | Delta Cephei OBSERVE | Beta Lyr OBSERVE

Veil Nebula East OBSERVE | Veil Nebula West OBSERVE | Cassiopeia A OBSERVE | Rosette Nebula OBSERVE | TCoronae Borealis OBSERVE | SS Cygni OBSERVE | Helix Nebula OBSERVE

Galaxies & Beyond

Andromeda Galaxy OBSERVE | Whirlpool Galaxy OBSERVE | Pinwheel Galaxy OBSERVE | Messier 81 OBSERVE | Messier 82 OBSERVE | 3C 273 OBSERVE | NGC 4013 OBSERVE | NGC 254 OBSERVE

Adjust Your Telescope Settings

The options you choose will be sent to the telescope and it will take your image tonight using these settings.


Lagoon Nebula
Object Type: Star forming region Distance: 4100 light-years Constellation: Sagittarius

Field of View

Normal View - 1°
Good setting for most objects

There is only one field of view option for this object.

Exposure Time

- 0.1 seconds
- 1 second
- 30 seconds
- 60 seconds

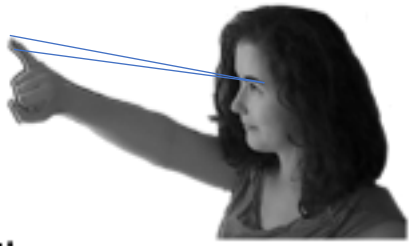
Filter Selection

- No Filter — all light let through
- Red Filter — only red light let through
- Green Filter — only green light let through
- Blue Filter — only blue light let through
- Multiple Filters — multiple images to make color picture

CONTINUE

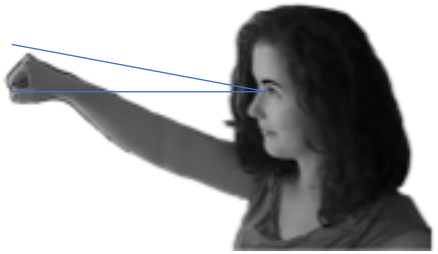
Field of View (measured in degrees)

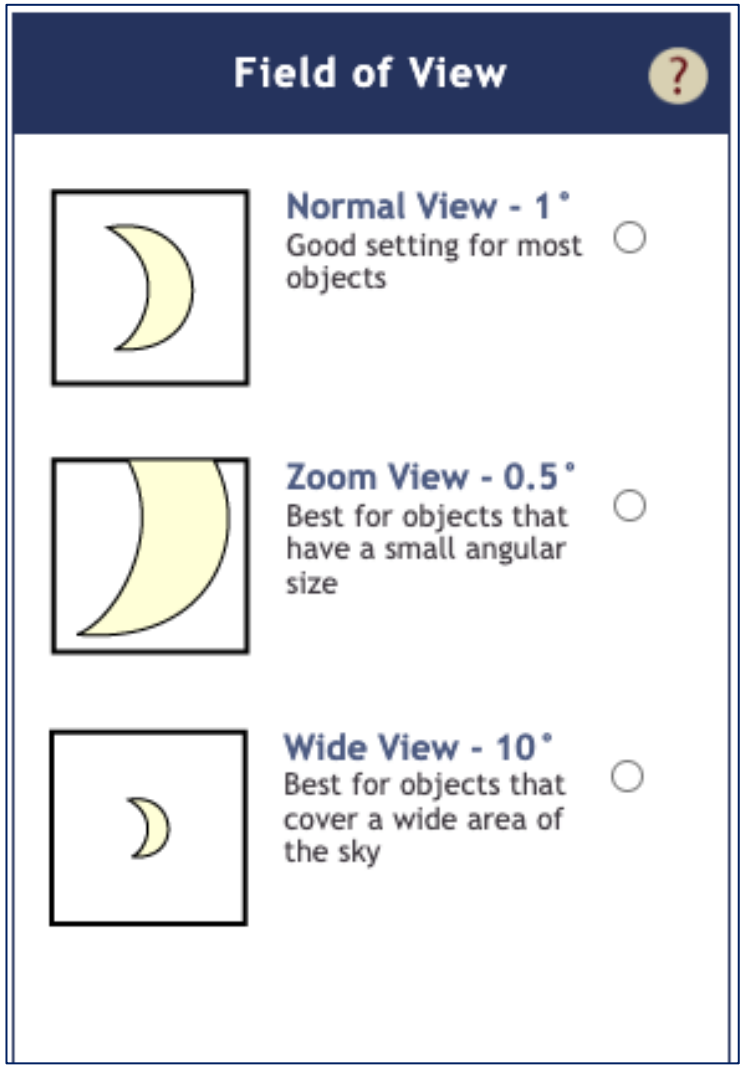
1˚ ~ your pinky fingernail



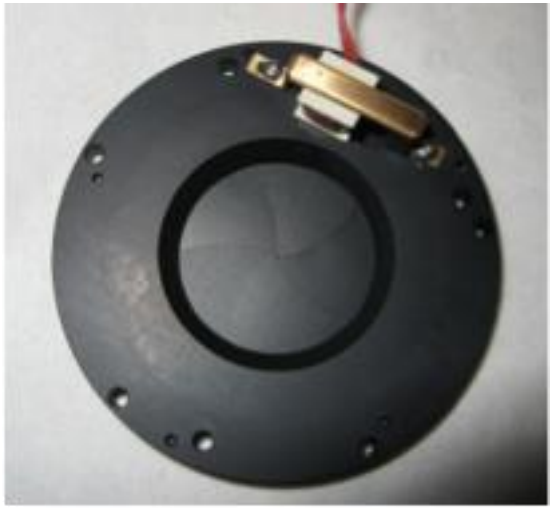
0.5˚ ~ half of your pinky fingernail

10˚ ~ your fist

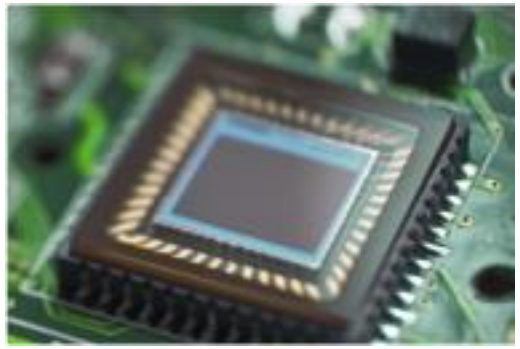


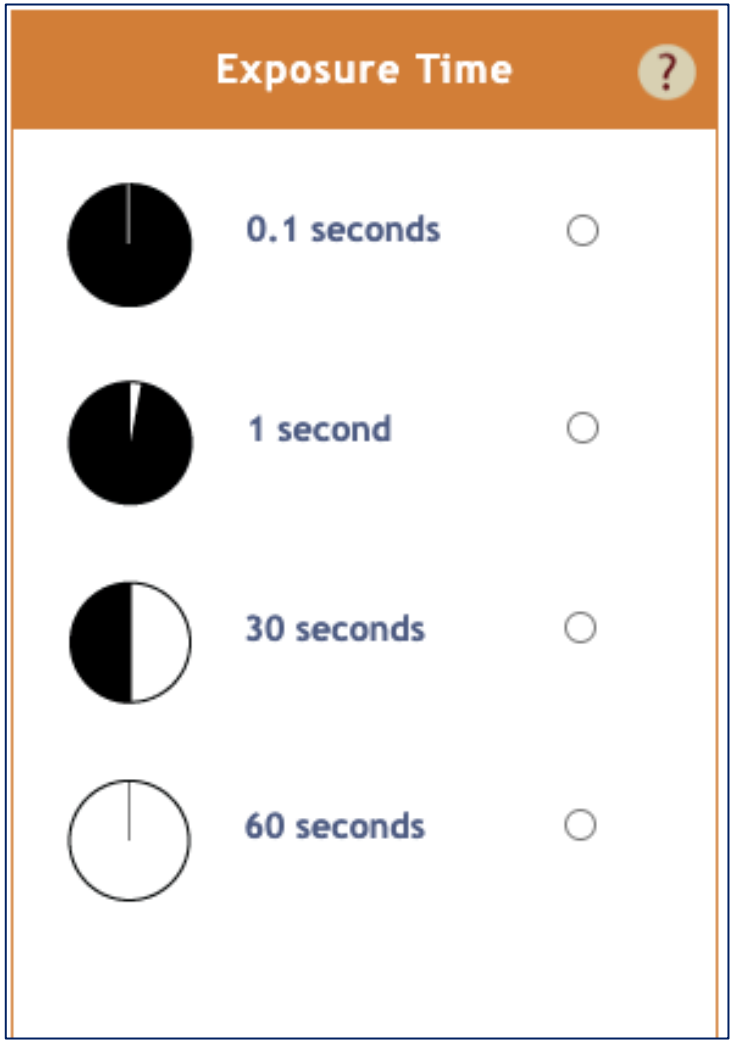


How Long the Shutter Stays Open



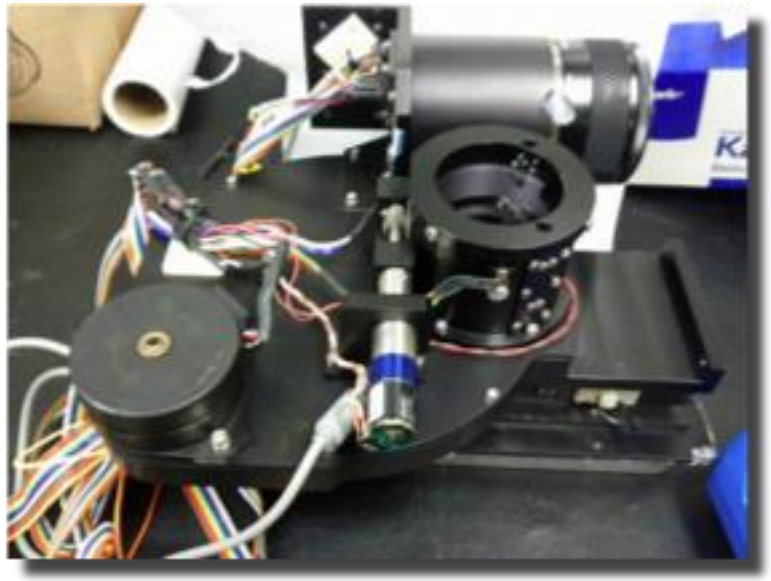
The longer the **Exposure Time,** the more photons of light fall on the digital detector

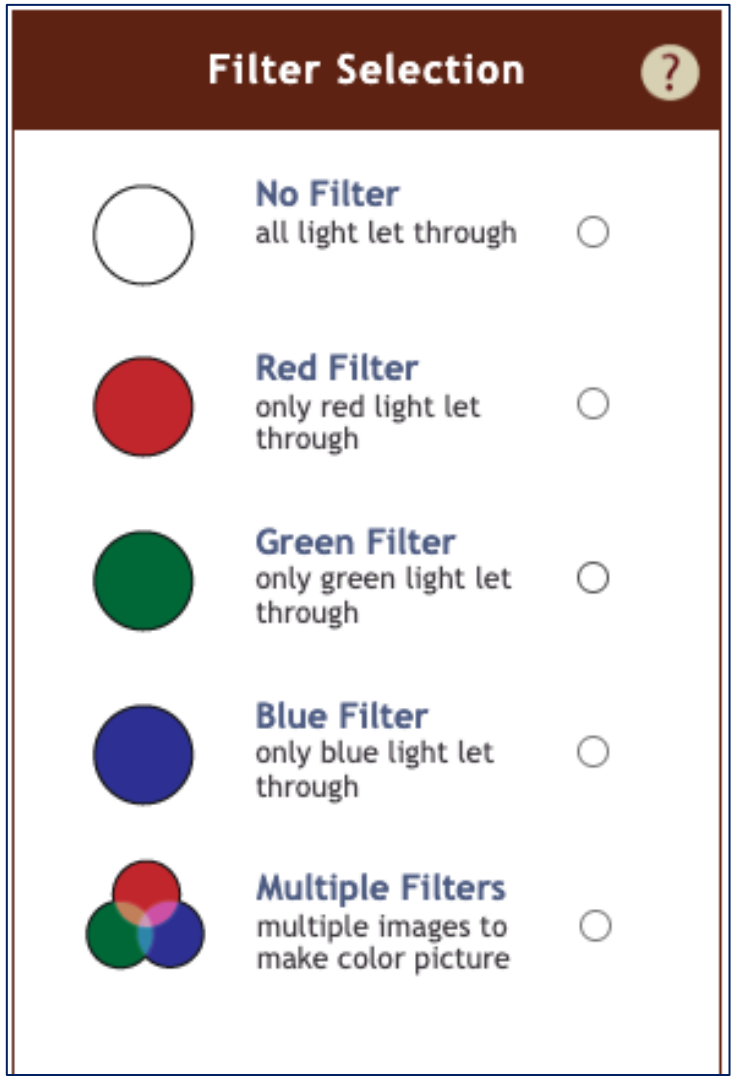


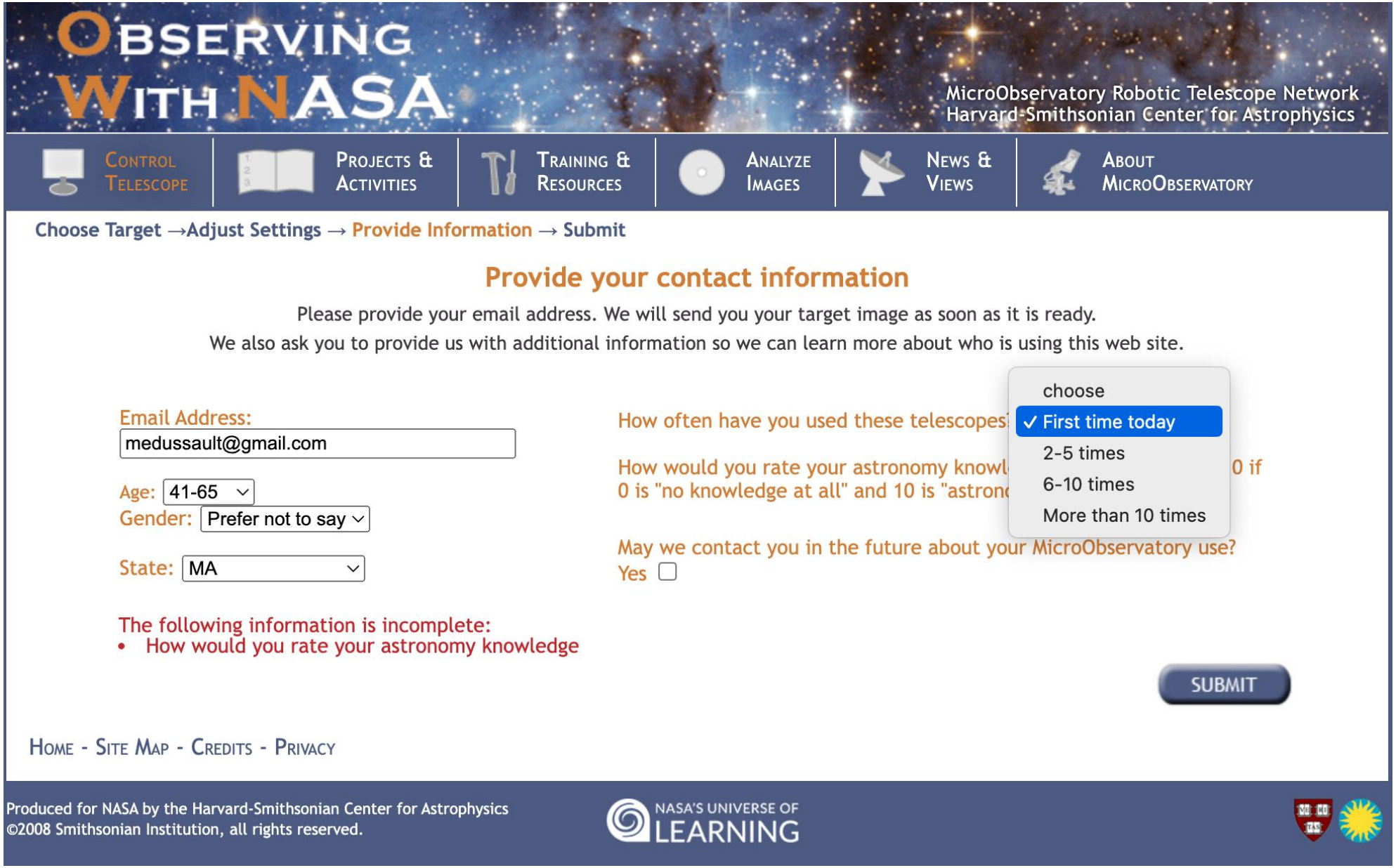


Filter Wheel

The digital detector does NOT ”see” in color






OBSERVING WITH NASA
MicroObservatory Robotic Telescope Network
Harvard-Smithsonian Center for Astrophysics
CONTROL TELESCOPE
PROJECTS & ACTIVITIES
TRAINING & RESOURCES
ANALYZE IMAGES
NEWS & VIEWS
ABOUT MICROOBSERVATORY
Choose Target →Adjust Settings → Provide Information → Submit
Provide your contact information
Please provide your email address. We will send you your target image as soon as it is ready.
We also ask you to provide us with additional information so we can learn more about who is using this web site.
Email Address:
medussault@gmail.com
Age: 41-65
Gender: Prefer not to say
State: MA
How often have you used these telescopes?
choose
First time today
2-5 times
6-10 times
More than 10 times
How would you rate your astronomy knowl
0 if
0 is "no knowledge at all" and 10 is "astron
May we contact you in the future about your MicroObservatory use?
Yes
The following information is incomplete:
How would you rate your astronomy knowledge
SUBMIT
HOME - SITE MAP - CREDITS - PRIVACY
Produced for NASA by the Harvard-Smithsonian Center for Astrophysics
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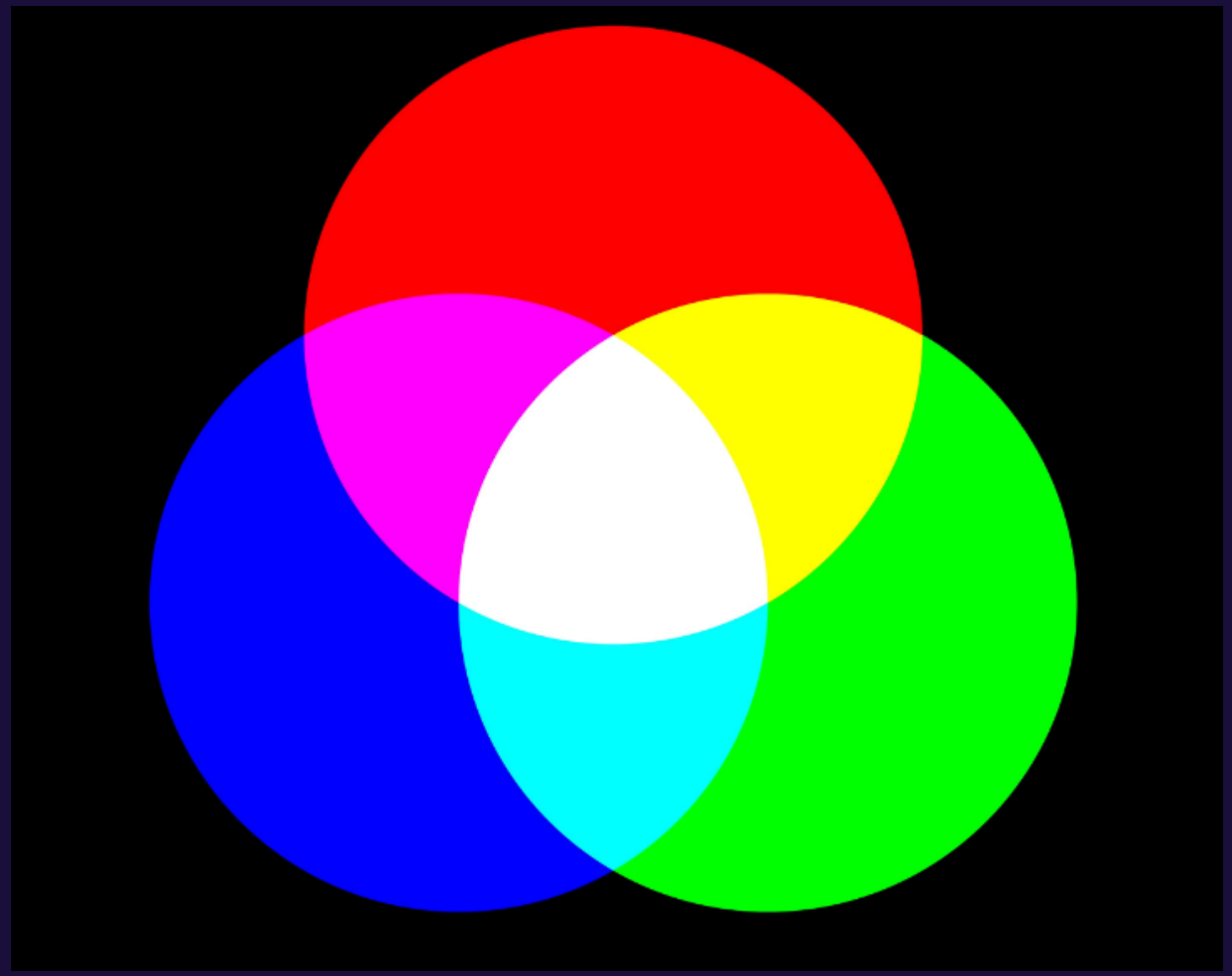
NASA'S UNIVERSE OF LEARNING

A word about light, color and filters

Make a prediction

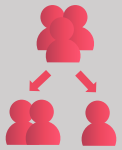
Do NOT look through any of the colored gels before making your prediction!



How would you facilitate taking images with MicroObservatory?

What questions do you have?

How might you engage your participants' interests and ideas around the use of these telescopes?



Discuss with other facilitators!

DIGITAL IMAGE PROCESSING

- What does data from a telescope look like?

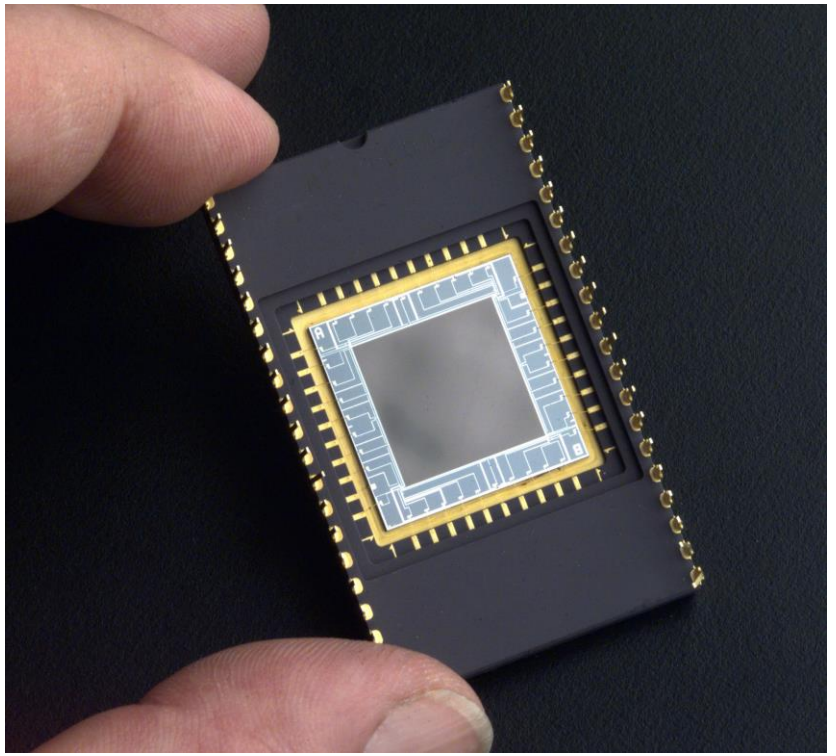
What does data from a telescope look like?

Supernova Remnant Image Grid

	A	B	C	D	E	F	G	H	I	J	K
1	0	1	1	1	1	1	1	1	1	1	1
2	2	5	35	42	48	48	50	51	46	18	7
3	23	36		35	30	27	21	31	38	13	0
4	41	43	24	8	216	155	126	120	54	21	3
5	36	58	37	44	36	20	33	105		23	4
6	32	60	34	106	12		18	96	24	50	17
7	24	65	32	141	41	17	12	126	64	67	21
8	18	69	36	237		146	155	114	22	74	6
9	16	75	38	34	26	12	14	21	77	37	4
10	8	71	63	54	42	23	64		31	16	2
11	3	3	2	1	0	0	2	0	1	0	0

Legend

Average number of photons	< 40	40-80	81-120	121-160	>160
Color					



What does data from a telescope look like?

Supernova Remnant Image Grid

	A	B	C	D	E	F	G	H	I	J	K
1	0	1	1	1	1	1	1	1	1	1	1
2	2	5	35	42	48	48	50	51	46	18	7
3	23	36		35	30	27	21	31	38	13	0
4	41	43	24	8	216	155	126	120	54	21	3
5	36	58	37	44	36	20	33	105		23	4
6	32	60	34	106	12		18	96	24	50	17
7	24	65	32	141	41	17	12	126	64	67	21
8	18	69	36	237		146	155	114	22	74	6
9	16	75	38	34	26	12	14	21	77	37	4
10	8	71	63	54	42	23	64		31	16	2
11	3	3	2	1	0	0	2	0	1	0	0

Legend

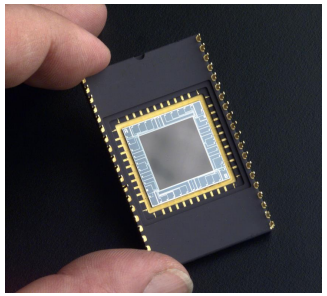
Average number of photons	< 40	40-80	81-120	121-160	>160
Color					

Supernova Remnant Image Grid

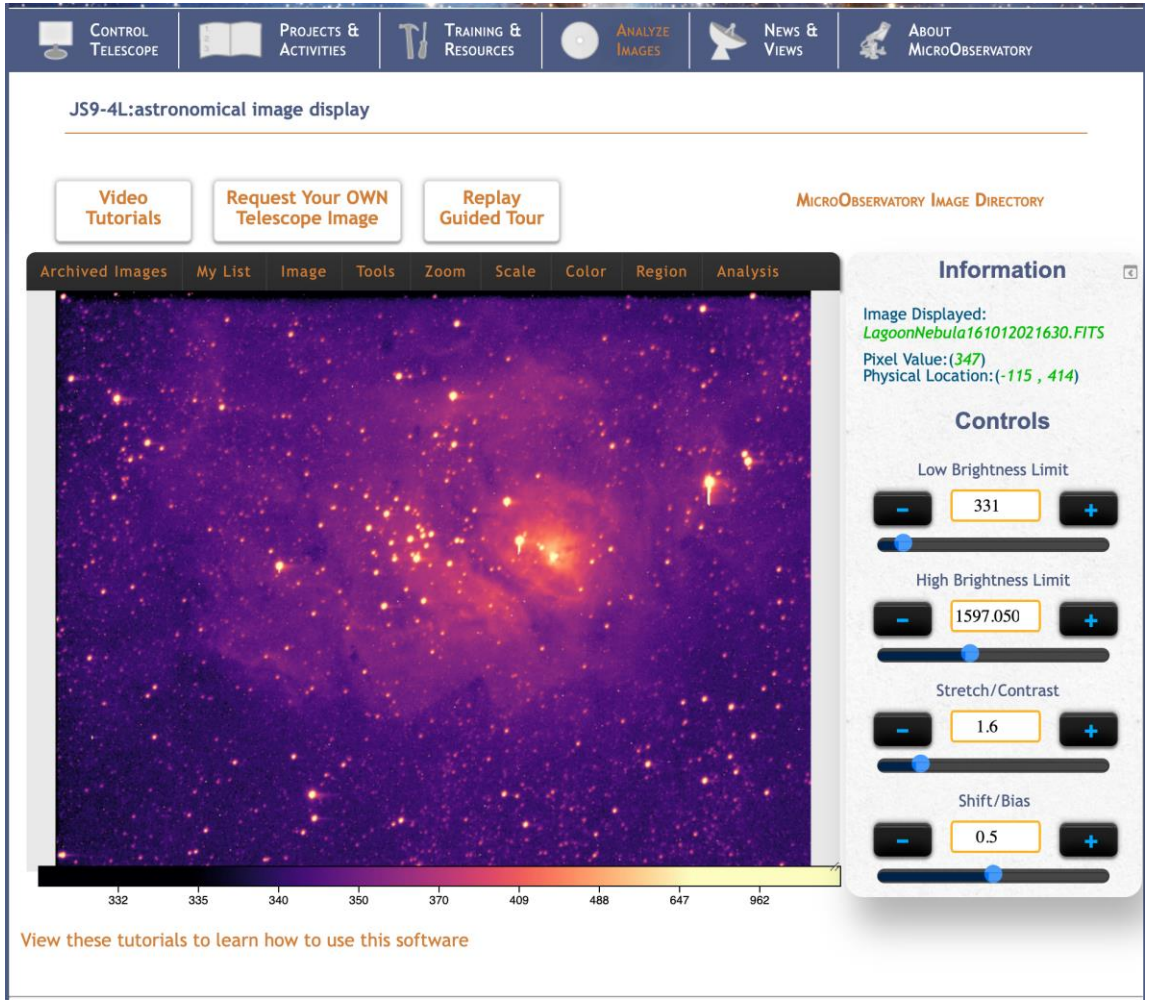
	A	B	C	D	E	F	G	H	I	J	K
1	0	1	1	1	1	1	1	1	1	1	1
2	2	5	35	42	48	48	50	51	46	18	7
3	23	36	52	35	30	27	21	31	38	13	0
4	41	43	24	8	216	155	126	120	54	21	3
5	36	58	37	44	36	20	33	105	62	23	4
6	32	60	34	106	12	138	18	96	24	50	17
7	24	65	32	141	41	17	12	126	64	67	21
8	18	69	36	237	212	146	155	114	22	74	6
9	16	75	38	34	26	12	14	21	77	37	4
10	8	71	63	54	42	23	64	79	31	16	2
11	3	3	2	1	0	0	2	0	1	0	0

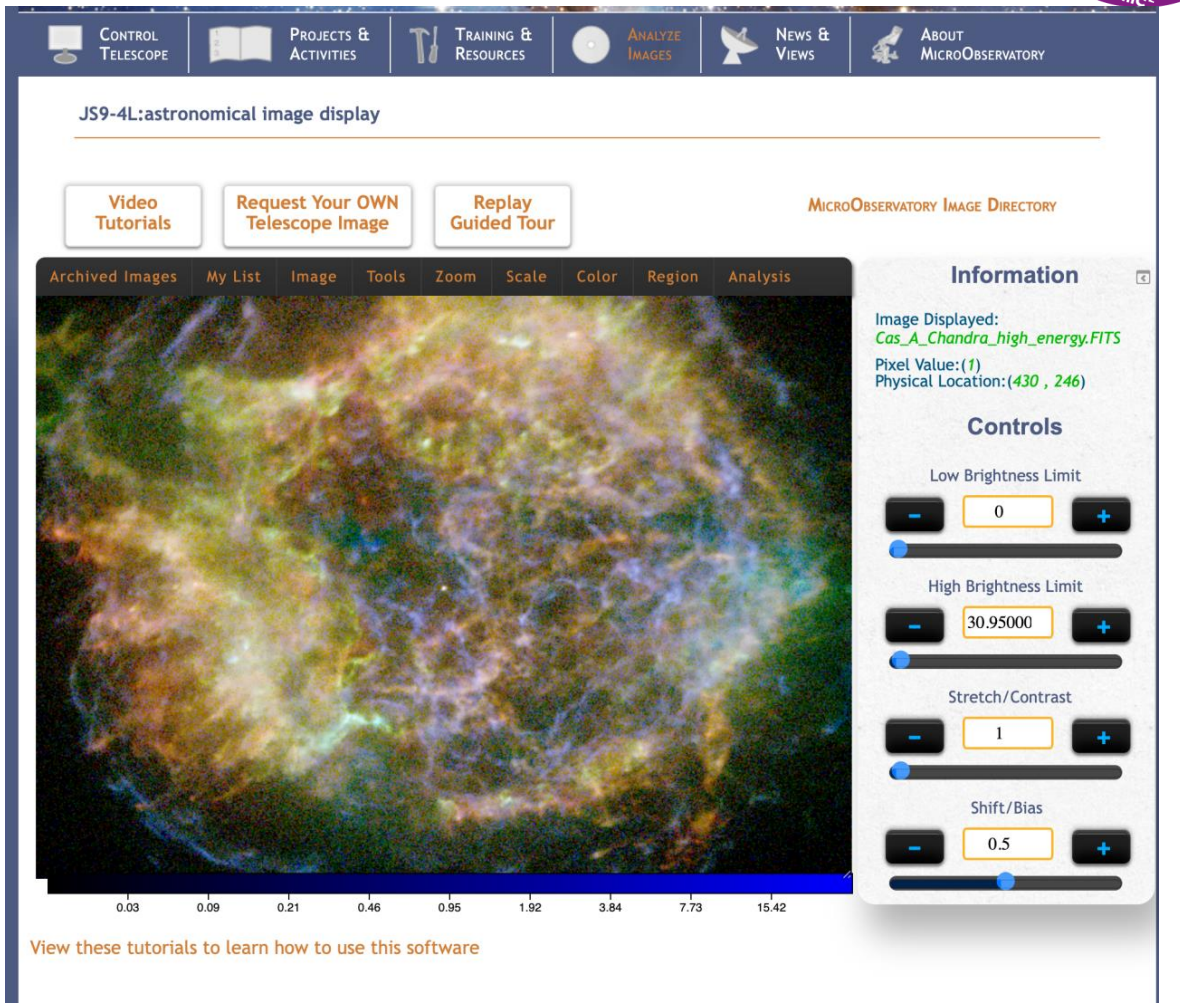
Legend

Average number of photons per sec	< 40	40-80	80-120	120-160	>160
Color					



Digital Image Processing with JS9

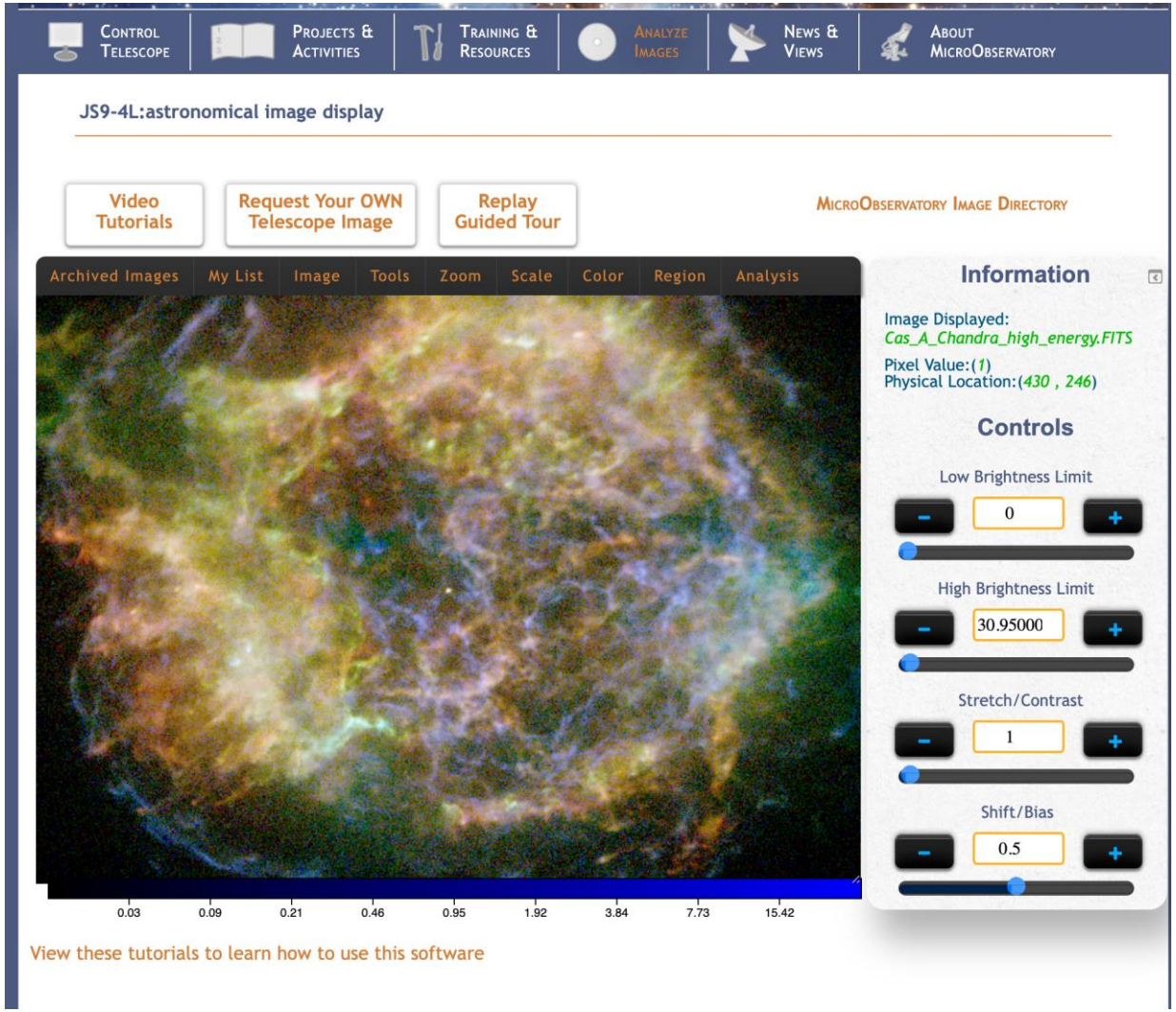




Digital Image Processing with JS9

Bit.ly/JS9Image

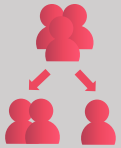
Cassiopeia A – RGB image from X-ray data



What questions do you have?

How might you encourage participants to do some sense-making around their images?

How could you facilitate participants sharing their image masterpieces with peers/ community, others?



Discuss with other facilitators!

Program Theme 2

Data and Image Processing

GSAWN Program Opportunity:

Winter 2024/2025
Dec 2024 – Feb 2025

How can you plan an event around this?

Let us know in the chat!

Did you like this webinar?

Let us know using the QR code below

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This product is based upon work supported by NASA under award number NNX16AC65A to the Space Telescope Science Institute, working in partnership with Caltech/IPAC, Center for Astrophysics | Harvard & Smithsonian, and Jet Propulsion Laboratory.

STScI | SPACE TELESCOPE SCIENCE INSTITUTE

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JPL Jet Propulsion Laboratory California Institute of Technology