

How do humans study space???

Studying Space

- Human Travel - People are bad at space travel...it's hard on the body..

*Twins and space study

HOW DOES SPACE AFFECT THE HUMAN BODY?

Space has tremendous effects on the human body! As we prepare for journeys to more distant destinations like Mars, humankind must tackle these risks to ensure safe travel for our modern explorers.

The impacts of microgravity mirror aging and the complications of a sedentary lifestyle. By studying astronauts' health, we also help people on Earth.

BRAIN
Astronauts' sense of perception and orientation can become confused. They sometimes misinterpret the direction and speed of their movements. Some even experience "space sickness."

HEART & BLOOD VESSELS
Blood vessels stiffen and age faster, and astronauts can develop insulin resistance, which may lead to Type 2 diabetes. These factors increase the risk of cardiovascular disease.

MUSCLES & NERVOUS SYSTEM
Muscles lose mass and strength. Reflexes slow down and exercise tends to be less effective in space.

BONES
When they don't bear weight, bones lose density and strength. While adults past age 50 typically lose about 1% each year, astronauts in space can lose up to 1.5% of their bone mass each month.

BLOOD
Blood cell production in the bone marrow is affected. Reduced red blood cells can cause anemia. Low white blood cell count leaves the body vulnerable to infection and is also linked with increased sensitivity to radiation.

RADIATION
Radiation doses are much higher. Overexposure can cause cataracts in the eyes, damage DNA, and increase the risk of cancer.

Canadian Space Agency / Agence spatiale canadienne

Canada

Humans can't go yet, so....

- Rovers - robotic vehicles that move across surfaces in space (moon, Mars)
- Probes - collect data in space and transmit it back to earth
- Electromagnetic Waves!!! - many objects in space give off EM waves that we can study through telescopes

The distance that an EM wave can travel in one year

5,878,499,810,000 miles

(A light year)

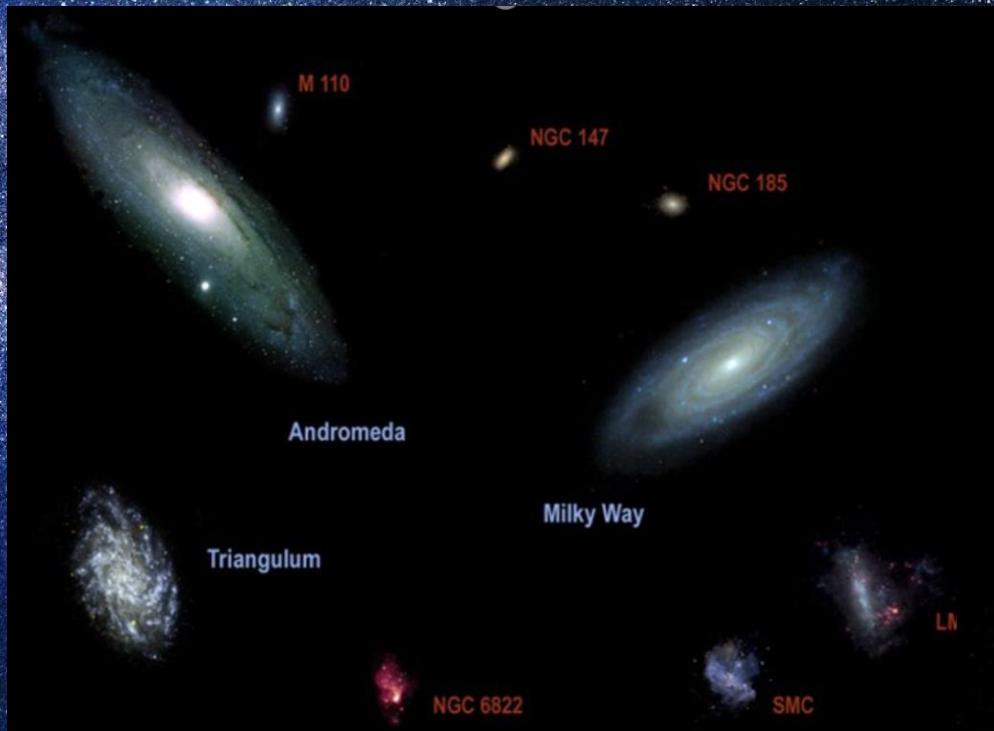
That equals:

129,329,760,000,000,000,000,000,000,000 years at current
human travel speed!

129 septillion, 329 sextillion, 760 quadrillion years

Closest galaxy to Milky Way = 2,200,000 Light Years

Next Closest Major Galaxy = Andromeda



Images courtesy of <http://mrdobsonified.weebly.com/galaxies2.html> (left) and Photo by Guillermo Ferla on Unsplash (left)



Image courtesy of <https://ecuip.lib.uchicago.edu/multiwavelength-astronomy/astrophysics/05.html>

Types of EM Telescopes

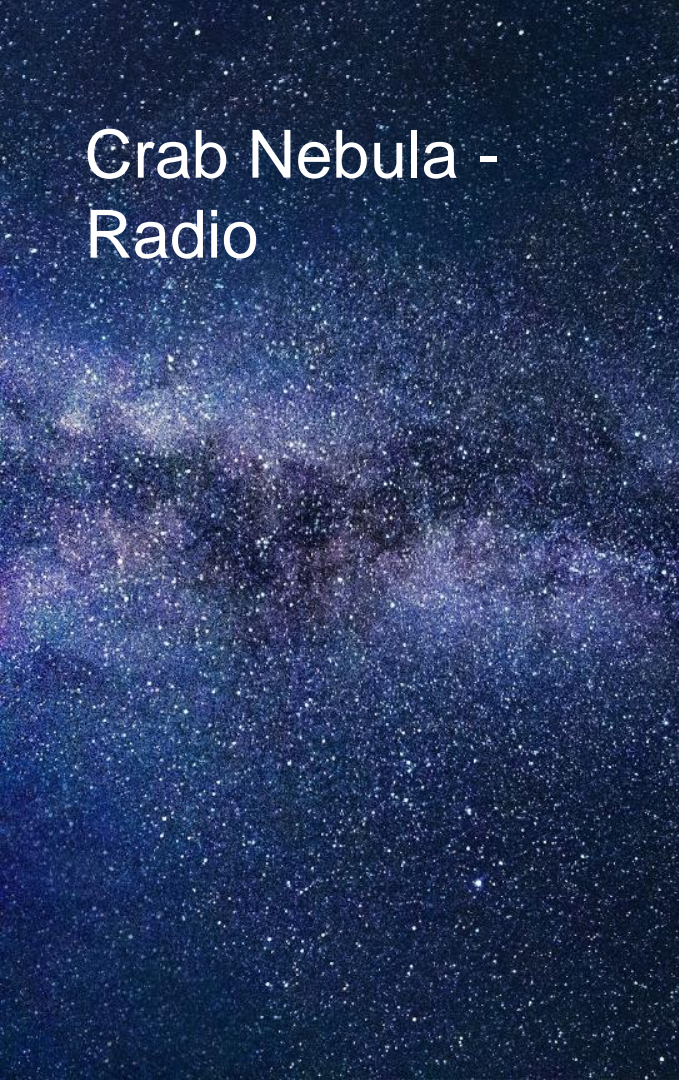
- Take note of what they have in common and what is different.

Radio Telescopes

Greenbank Radio Telescope, WV



Crab Nebula -
Radio



Microwave Telescopes

Wilkinson Microwave Anisotropy Probe

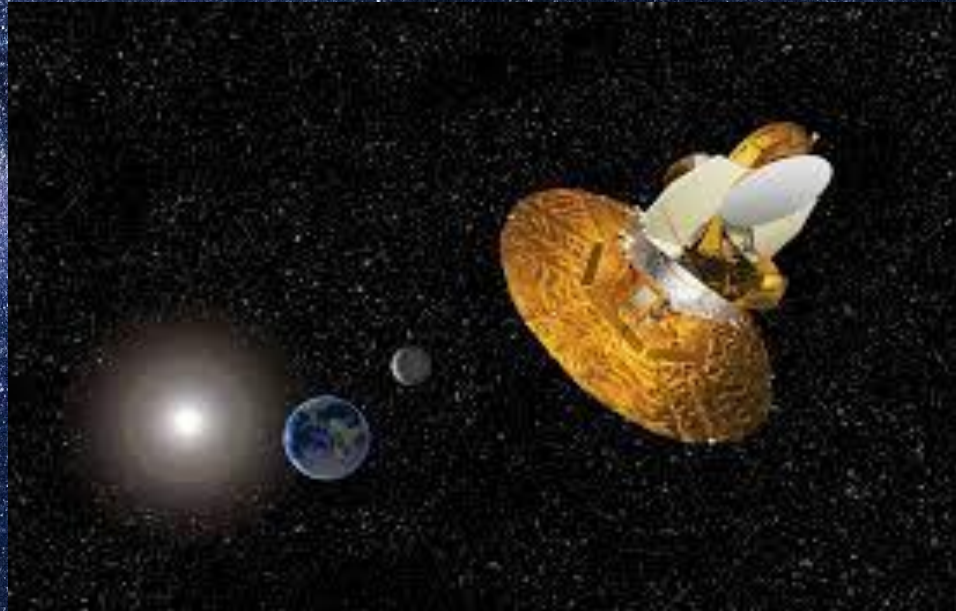
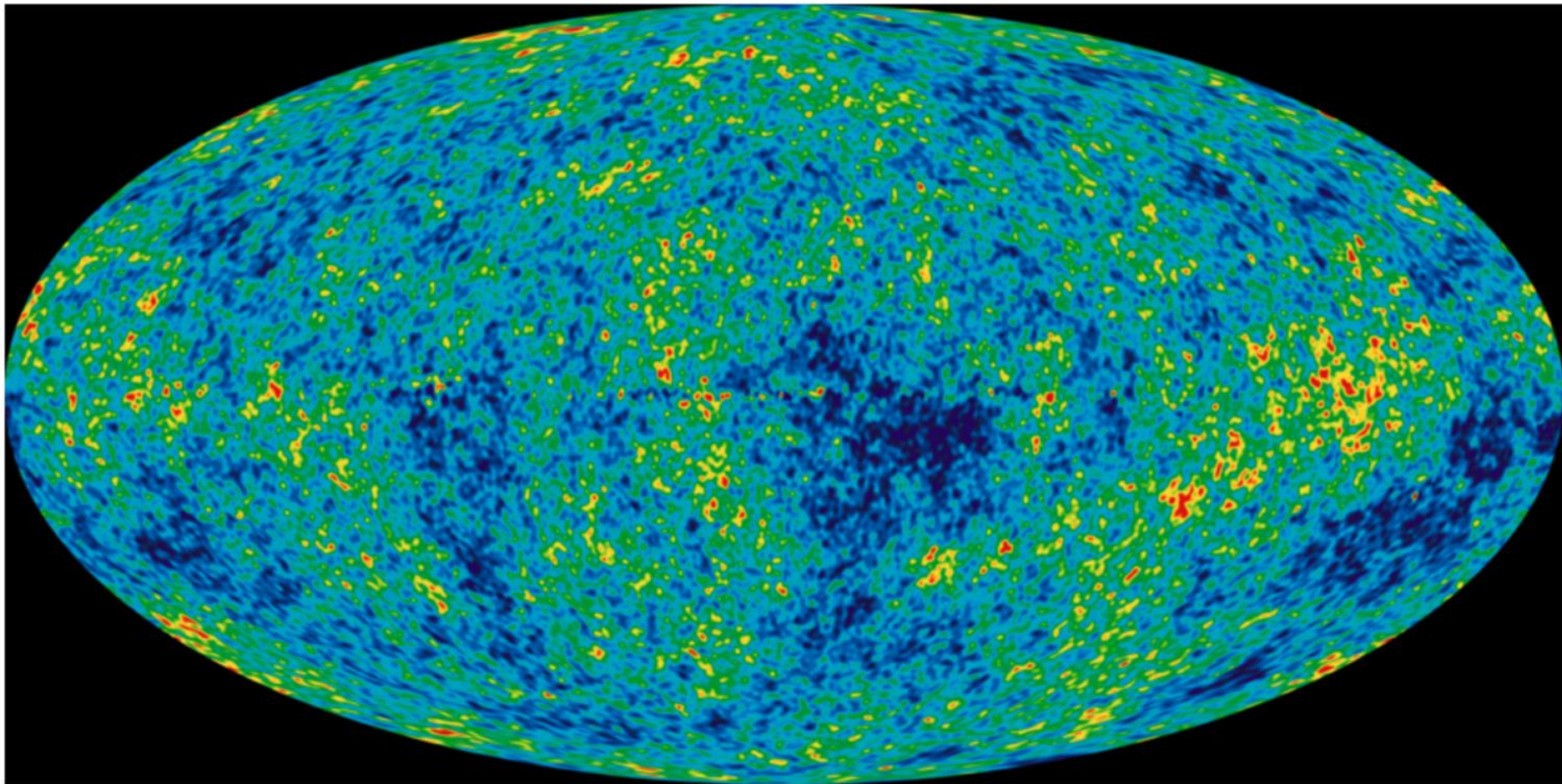


Image courtesy of NASA.gov



The full-sky image of the temperature fluctuations (shown as color differences) in the cosmic microwave background, made from nine years of WMAP observations. These are the seeds of galaxies, from a time when the universe was under 400,000 years old.

Credits: NASA

Infrared Telescopes

Spitzer Space Telescope



Image courtesy of NASA.gov

Infrared - Sombrero Galaxy



Image credit: NASA/JPL-Caltech/University of Arizona/STScI.

Visible Light Telescopes

Great Canary Telescope





Credits: NASA, ESA and the Hubble Heritage (STScI/AURA)-ESA/Hubble Collaboration

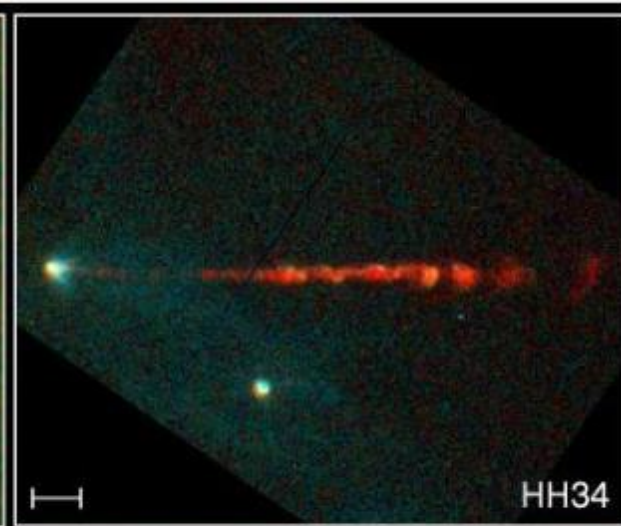
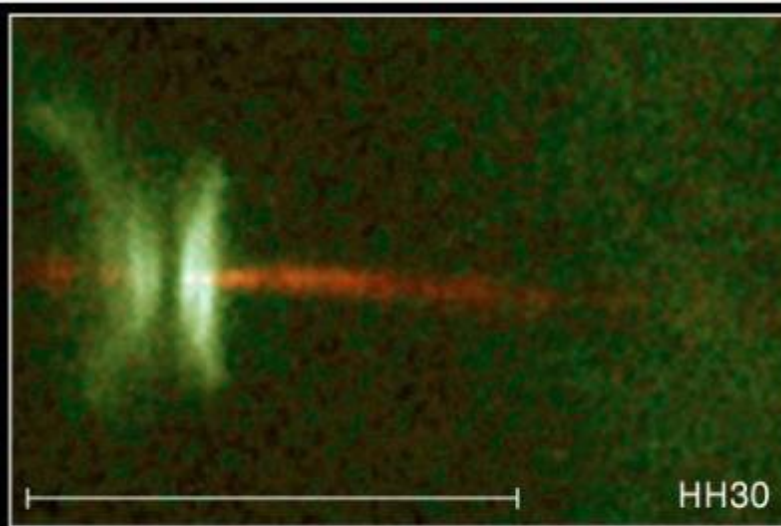
Ultraviolet Telescopes

The Hopkins Telescope



Image courtesy of NASA.gov

Ultraviolet Telescopes



Jets from Young Stars

HST · WFPC2

PRC95-24a · ST Scl OPO · June 6, 1995

C. Burrows (ST Scl), J. Hester (AZ State U.), J. Morse (ST Scl), NASA

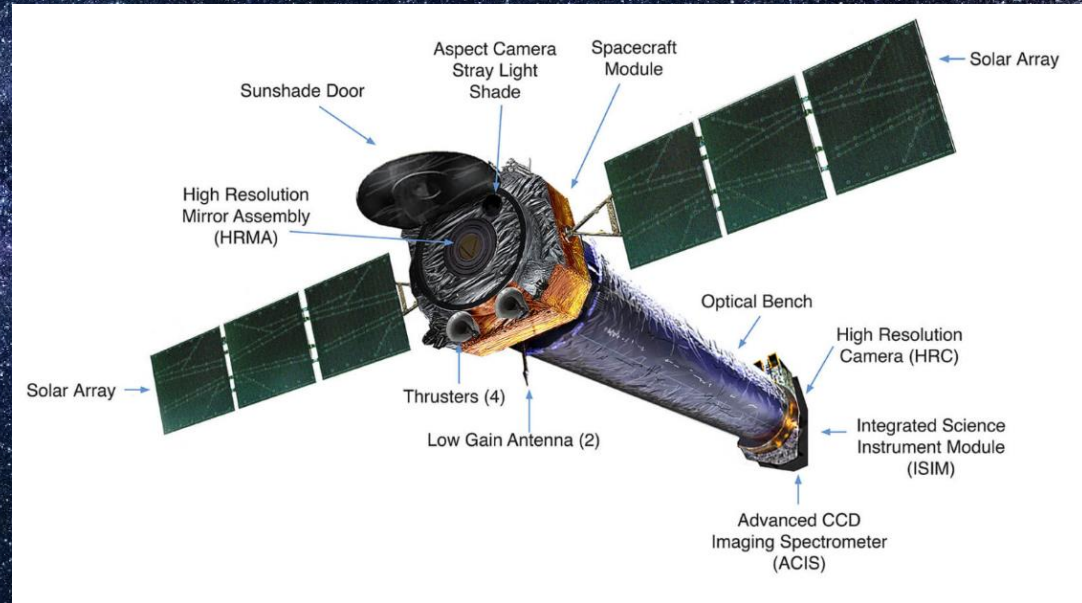
X-Ray Telescopes

Chandra XRT Telescope - Coloring Our Universe:

Part 1

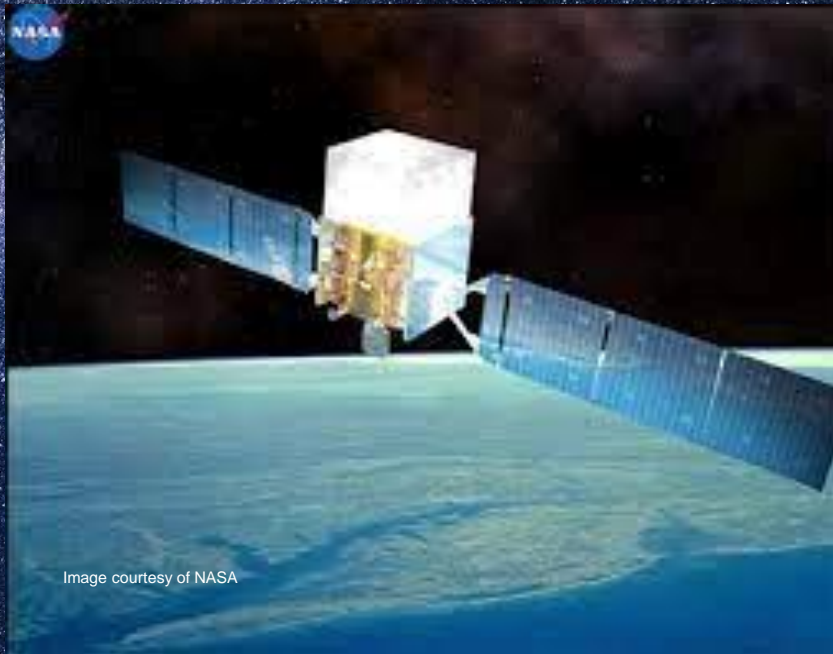
Part 2

Image courtesy of NASA



Gamma Telescopes

Fermi Gamma Ray Telescope



Pulsars are rotating neutron stars observed to have pulses of radiation at very regular intervals that typically range from milliseconds to seconds. Pulsars have very strong magnetic fields which funnel jets of particles out along the two magnetic poles. These accelerated particles produce very powerful beams of light.

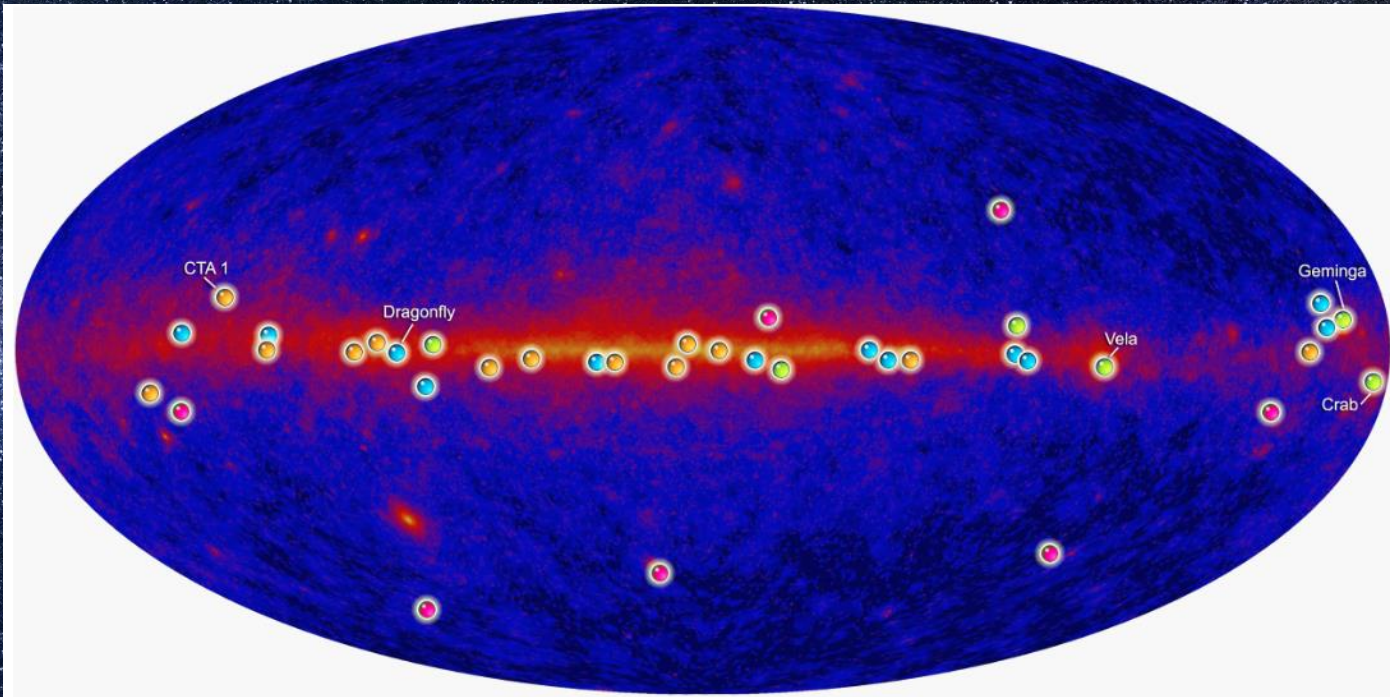
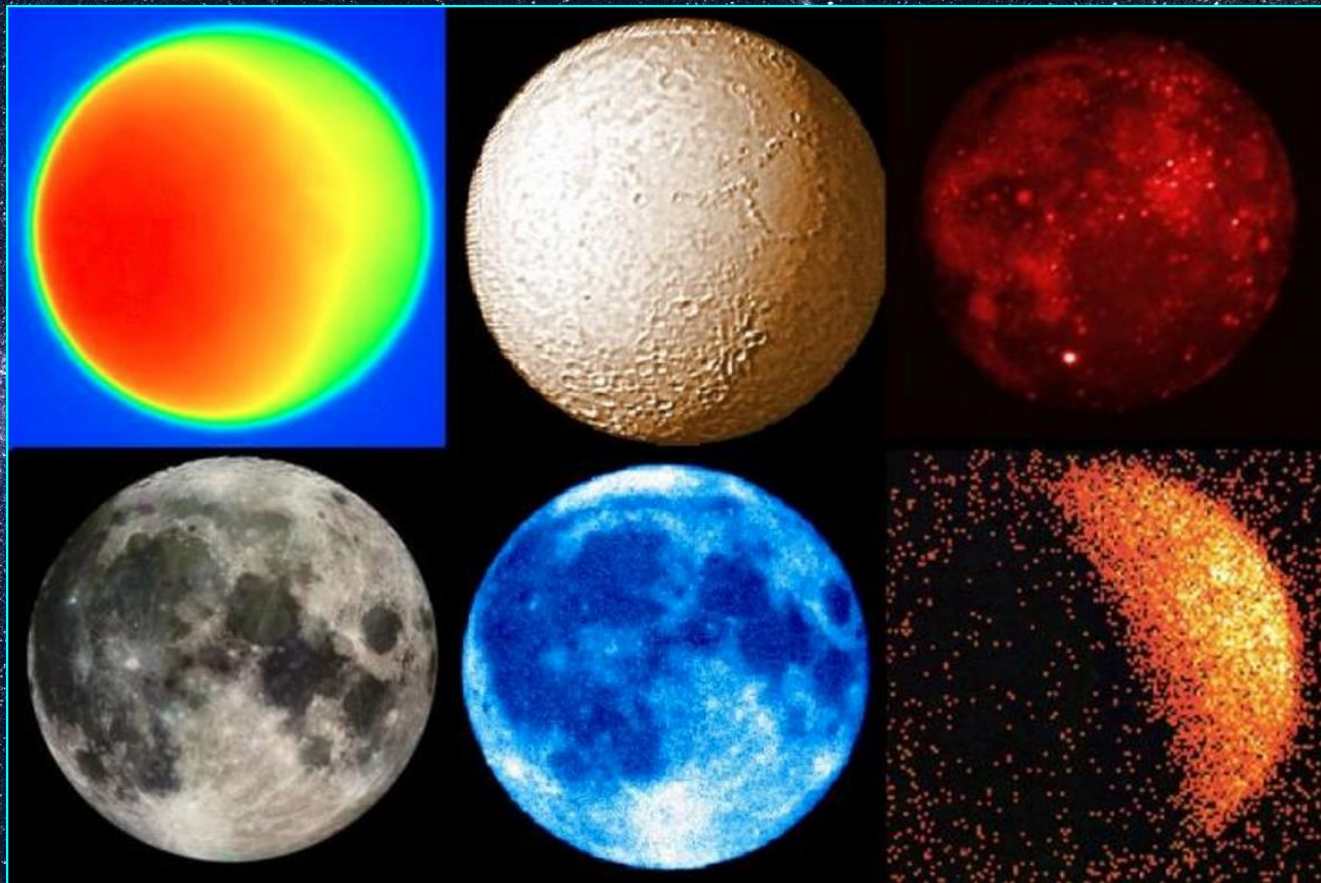


Image courtesy of NASA

Fermi Pulsar Detections

- New pulsars discovered in a blind search
- Millisecond radio pulsars
- Young radio pulsars
- Pulsars seen by Compton Observatory EGRET instrument

Multi-Wave Moon



Types of EM Telescopes

- What did you notice? Did they have anything in common? Anything different?
- Radio Window

Can they go together? Cosmic Coloring

*If you want to learn more about the different types of telescope follow the NASA link.

The Radio Window

Remember [Radio Waves](#)???

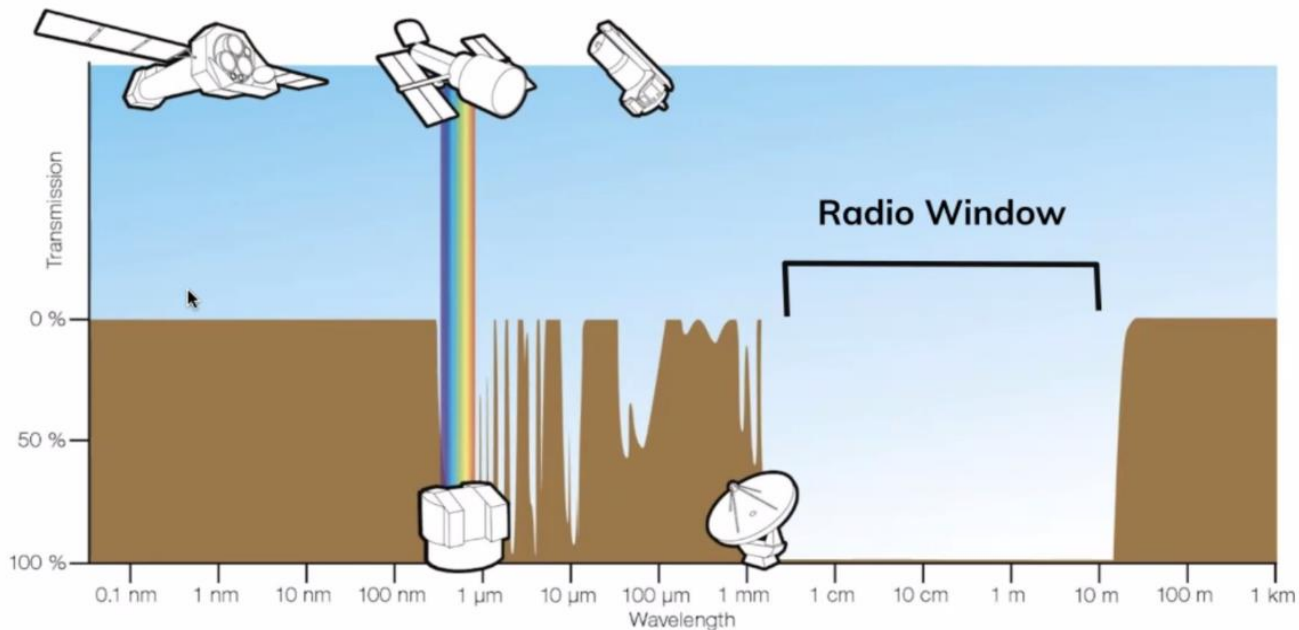


Image Credit: ESA/Hubble (F. Granato)

What is Radio Astronomy???

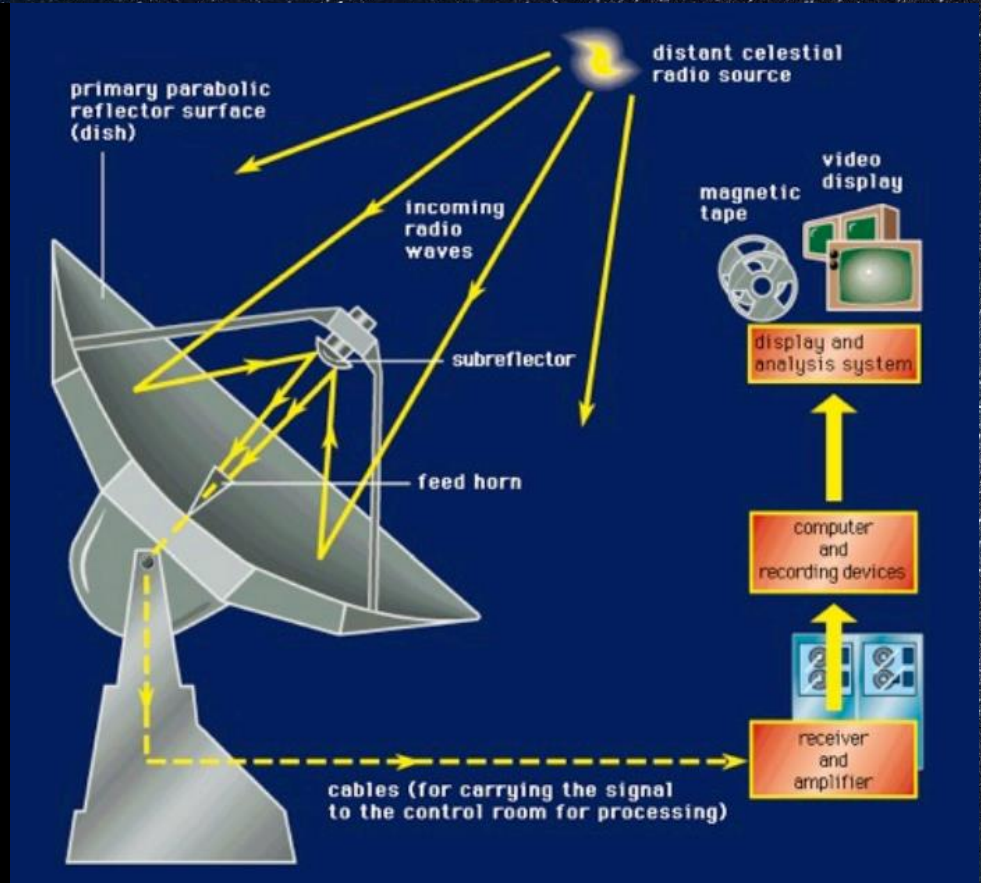
Video link

What's it like to be a radio telescope???

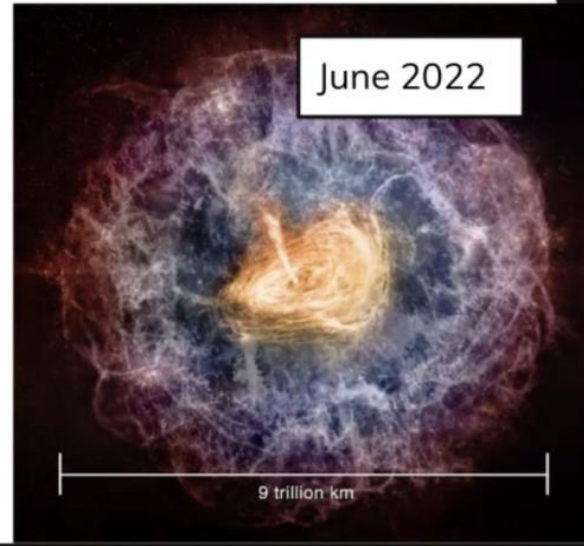
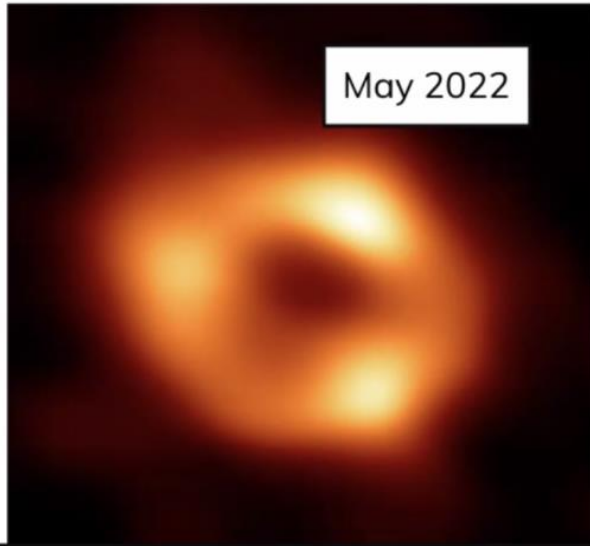
We will go outside for our activity.

*This is not a satellite dish.

Image courtesy of <http://scipp.ucsc.edu/~tesla/lecture15.pdf>



Present state of Radio Astronomy



Sgr A*, the black hole at the center of our galaxy, imaged by the Event Horizon Telescope- made up of 8 radio observatories across the globe!

Scientists found a new neutron star as young as 14 years old using the VLA through the pulsar signals

Image courtesy of NRAO

Future - Next Generation Very Large Array



US states and territories with ngVLA antennas, based on Revision D of the array configuration.

Radio Facilities



Radio Telescope Jigsaw

1. Five-hundred-meter Aperture Spherical radio Telescope
2. Greenbank Observatory
3. Very Large Array
4. Effelsberg
5. Parkes