

NASA and Human Space Exploration *Radiation!*

Caitlin Nolby

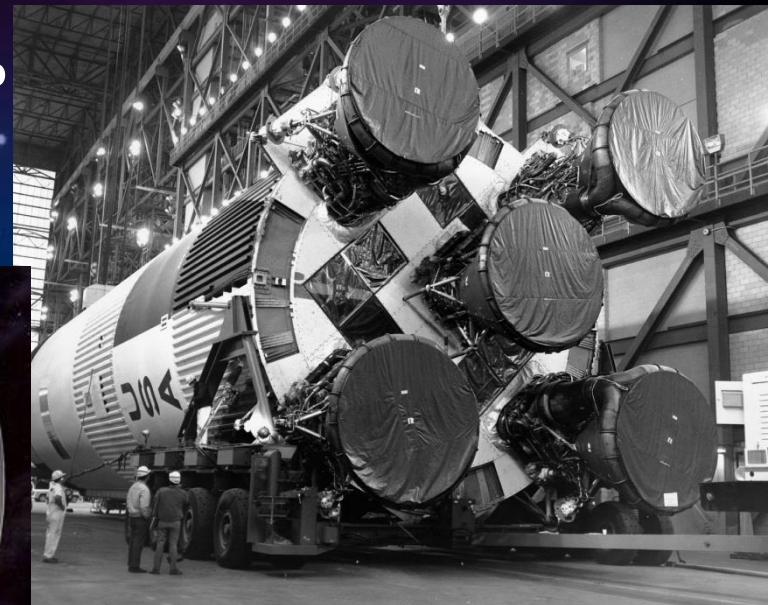
Space Studies Department, UND

North Dakota Space Grant Consortium

Apollo Program

- Apollo 11 was the first manned-lunar landing. When?
- Landing: July 20, 1969. Who?
- Neil Armstrong, Buzz Aldrin, Michael Collins
- Saturn V Rocket: 36 stories tall
- How many men walked on the Moon?
- 12! One geologist (Harrison “Jack” Schmitt)
- How much moon rock?
- 842 pounds!

- <http://www.youtube.com/watch?v=8V9quPcNWZE>
- <http://www.youtube.com/watch?v=MU0Rgpdjzo>
- <http://www.youtube.com/watch?v=ZP7AVBdJYOg\>
- <http://www.youtube.com/watch?v=f-FxhCZold0>
- http://www.youtube.com/watch?v=cOdzhQS_MMw&fe

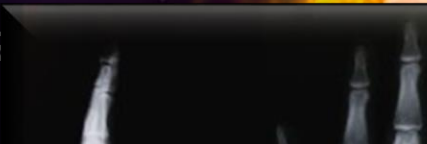


What is Radiation?

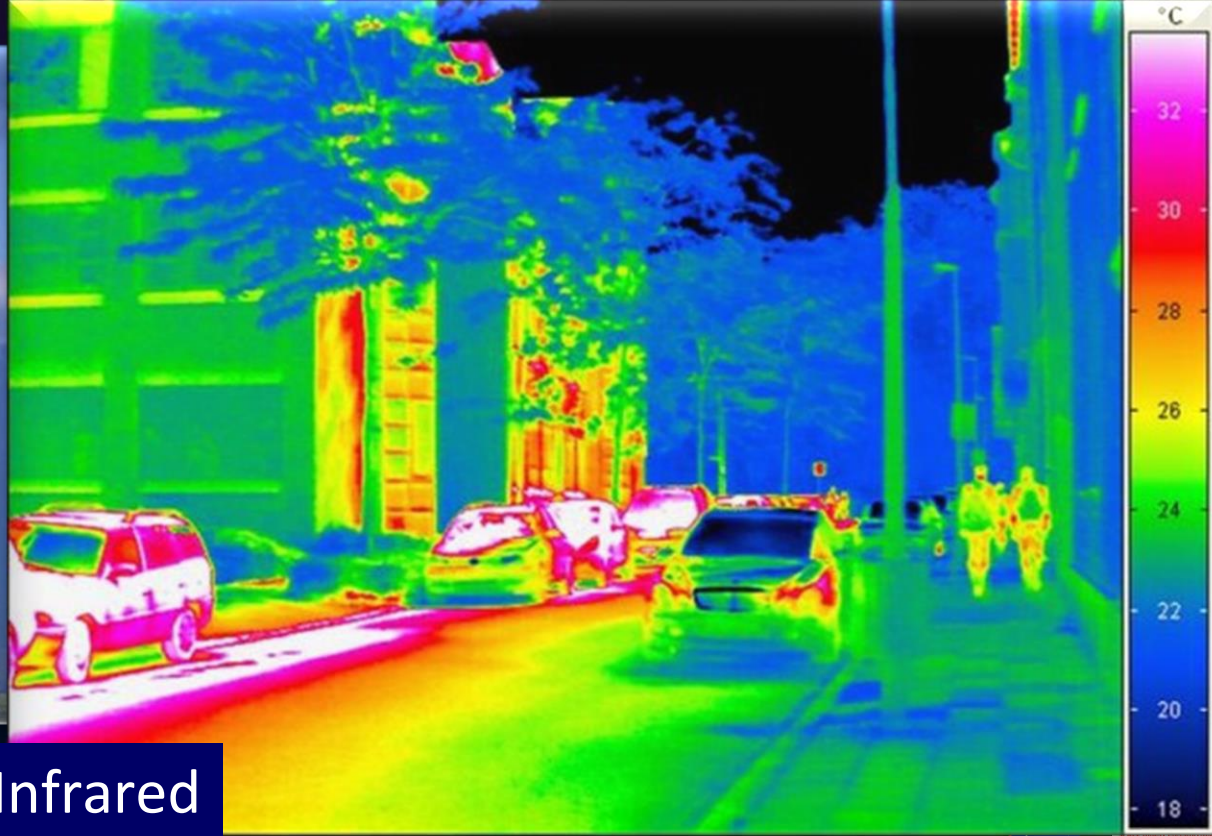
- Where does it come from?
- What do we get from the Sun?
- Energy – waves and particles
- Is all light the same?



X-rays



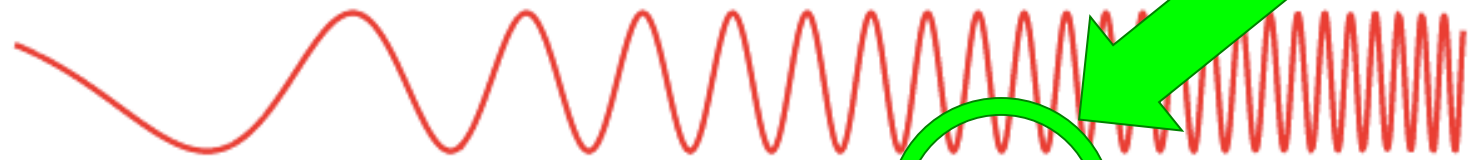
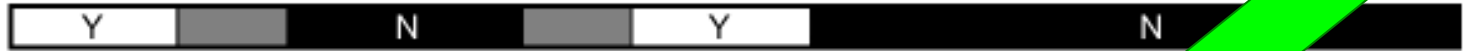
Visible Light



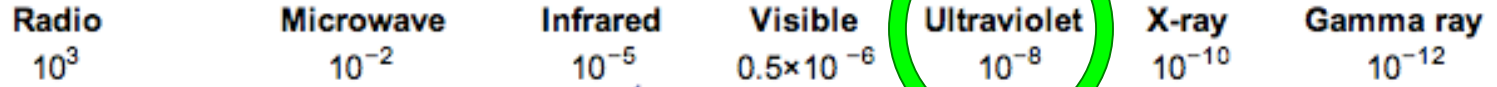
Infrared

Electromagnetic Spectrum

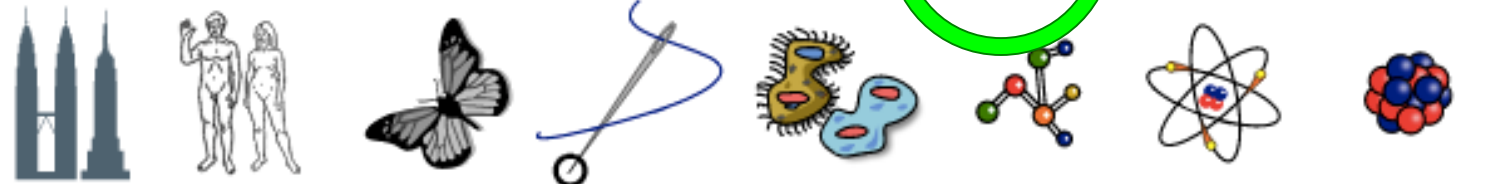
Penetrates Earth's Atmosphere?



Radiation Type
Wavelength (m)

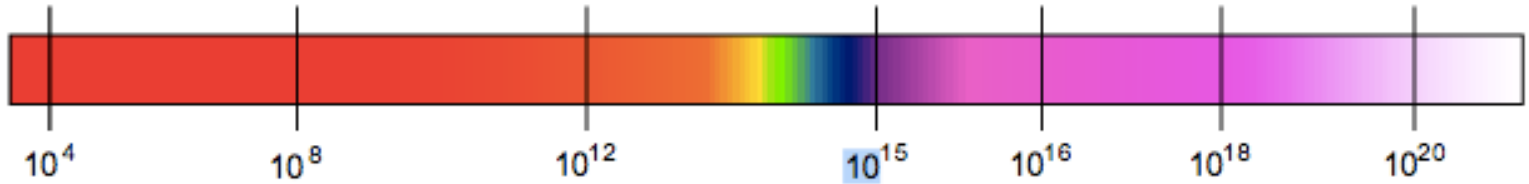


Approximate Scale of Wavelength

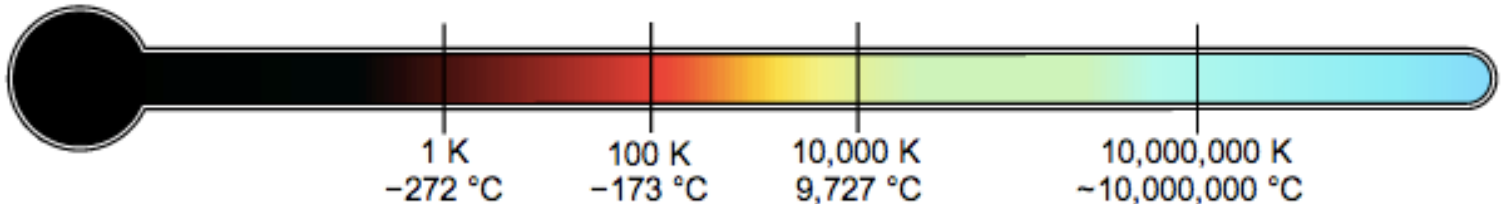


Buildings Humans Butterflies Needle Point Protozoans Molecules Atoms Atomic Nuclei

Frequency (Hz)



Temperature of objects at which this radiation is the most intense wavelength emitted



Ultraviolet Radiation

- Can be good – Vitamin D!
- Too much can be harmful
- How do we stay safe?
- Does Earth protect us?
- Ozone Layer absorbs UV



?



Radiation in Space

- No atmosphere – so what do astronauts do?



Visors



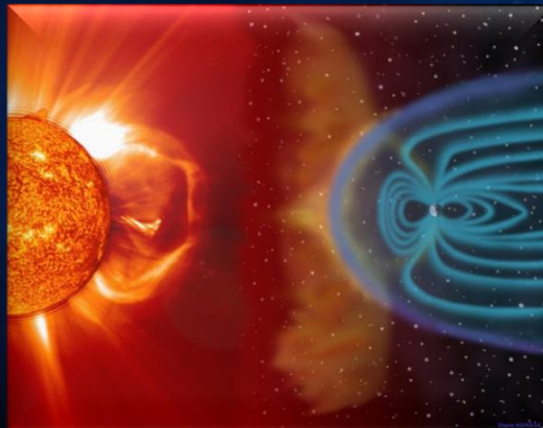
Wear Spacesuits



Live in stations

Radiation in Space

- Even with all of this protection, some radiation gets through
- Each day = 8 chest X-rays!
- 10x's what we experience on Earth
- Astronauts wear **dosimeters**
- High energy X-rays
- Gamma Rays
- Cosmic Rays



Spacesuit Requirements

In Space...

So, spacesuits have...

There is no air to breathe



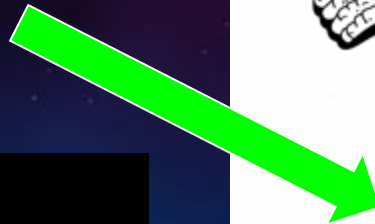
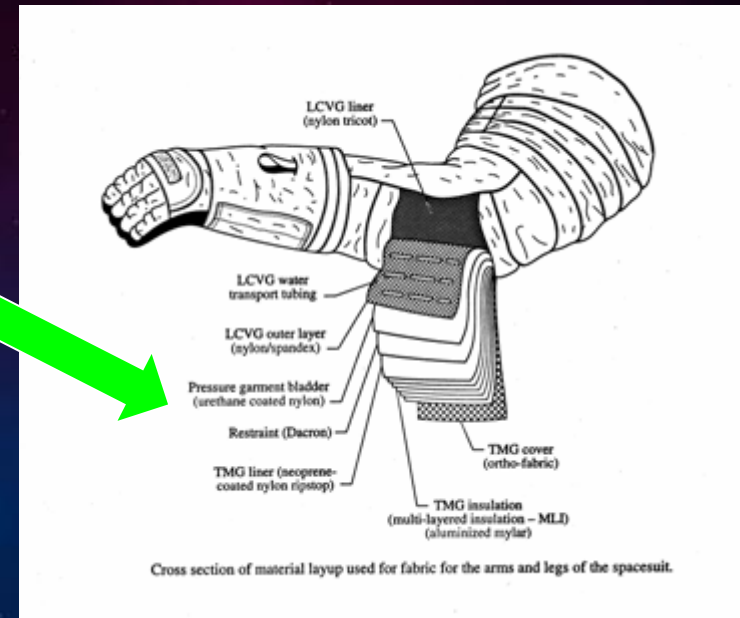
Oxygen tanks!

Spacesuit Requirements

In Space...

There is no air pressure to keep blood from boiling and gases in the body from expanding

So, spacesuits have...



A pressure layer to keep body fluids and gases in their proper state



Spacesuit Requirements

In Space...

So, spacesuits have...

Temperatures can reach
250 °F!



A layer with tubes
through which water flows
and cools the body

A suit made for moon walking Spacesuit Requirements

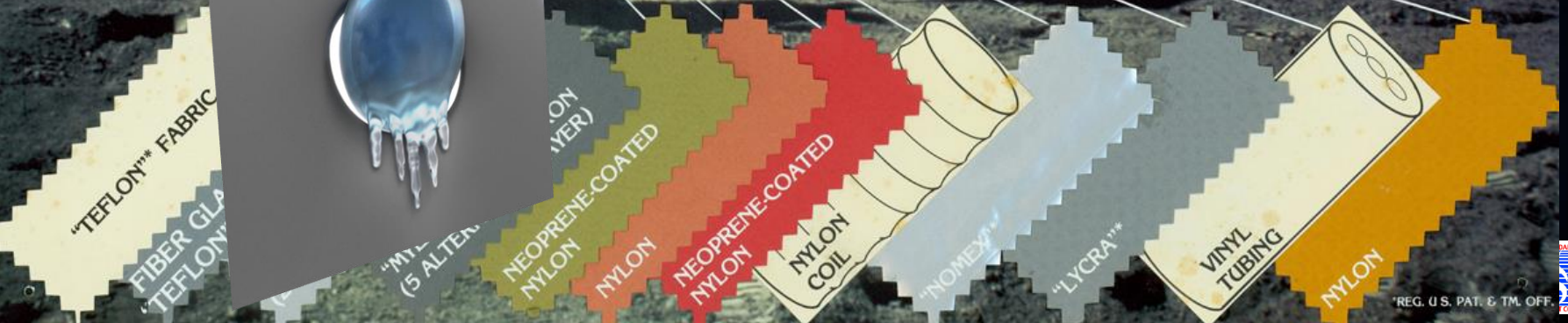
In Space...

So, spacesuits have...

A 21-layer moonsuit made almost entirely of materials developed by Du Pont.

Temperatures can also go down to $-250\text{ }^{\circ}\text{F}$!

Layers to insulate the body from cool temperatures



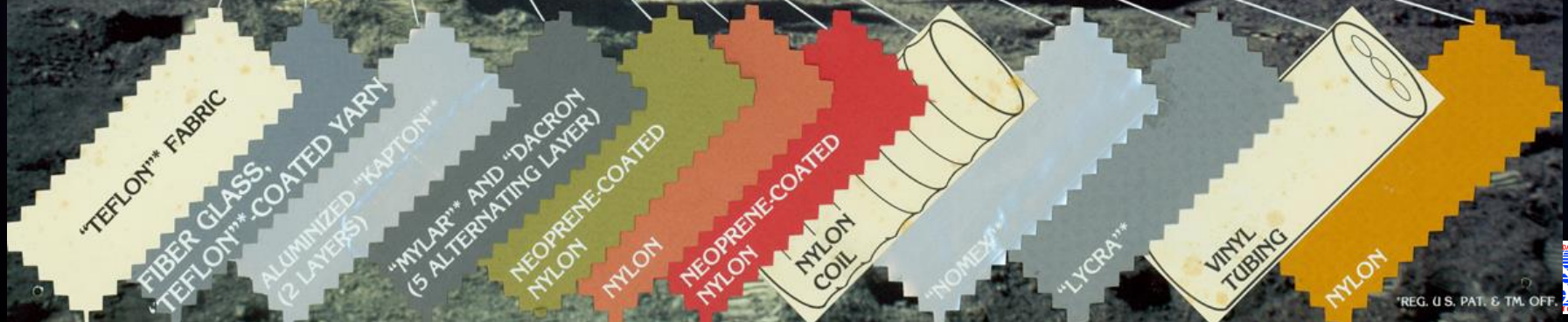
A suit made for moon walking Spacesuit Requirements

In Space...

So, spacesuits have...

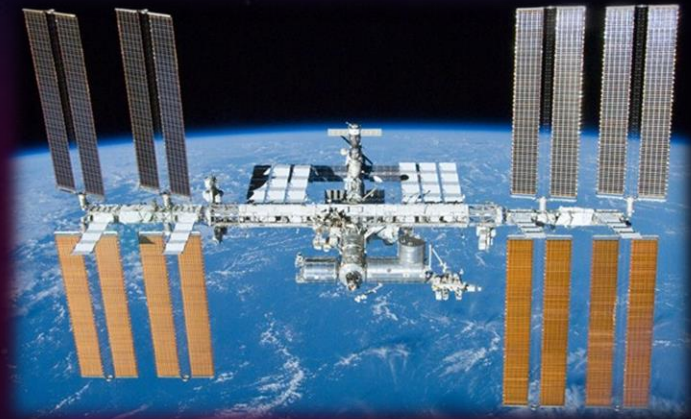
Tiny, high-speed rocks called micrometeoroids can injure astronauts

Several layers of protective materials to prevent damage from micrometeoroids



International Space Station

- In-orbit construction began 1998
- Continuously crewed since November 2000
- Space Shuttle missions delivered equipment and parts
- How high and how fast?
- Orbits the Earth at 230 miles up, (~Grand Forks to Minot)
- One orbit every 90 minutes
- Karen Nyberg: graduate of UND
- Spot the Station Website
- <http://spotthestation.nasa.gov/>



Activity

- It is your job to build a new space suit for NASA astronauts on their way to Mars!
- You must test out which material best blocks UV radiation!

