

**IOP** Institute of Physics  
In Scotland

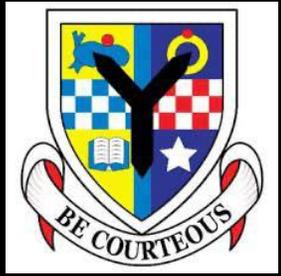


ASTRONOMY  
& PHYSICS  
EDUCATION

# SCIENCE in STEWARTON

## TUESDAY 30<sup>th</sup> JANUARY

### 1830-2000

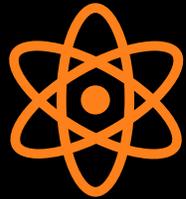


**Solar Flares and Space Missions: An Exciting Time for Space**  
**Samantha Cook, Astronomy & Astrophysics Group,**  
**University of Glasgow**

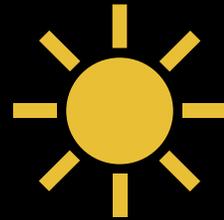
Information about this and other Science in  
Stewarton events can be found at:



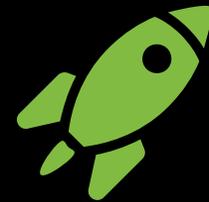
# WHAT I'LL BE TALKING ABOUT



**Why am I a physicist?**



**Space weather**



**Space missions**



# WHY ASTROPHYSICS?

- Space is cool!

# MY PATH TO PHYSICS



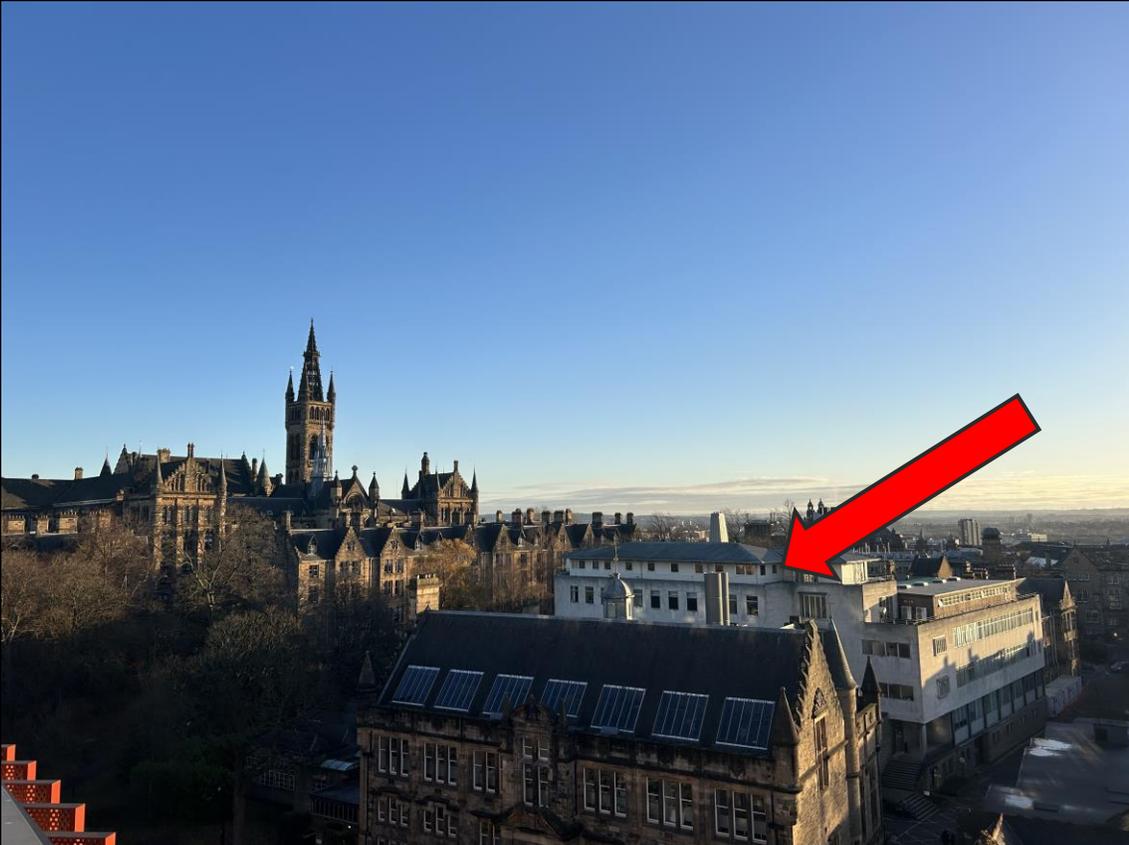
Astrophysics BSc at University of St Andrews

# MY PATH TO PHYSICS



Astrophysics MSc at Liverpool John Moores University

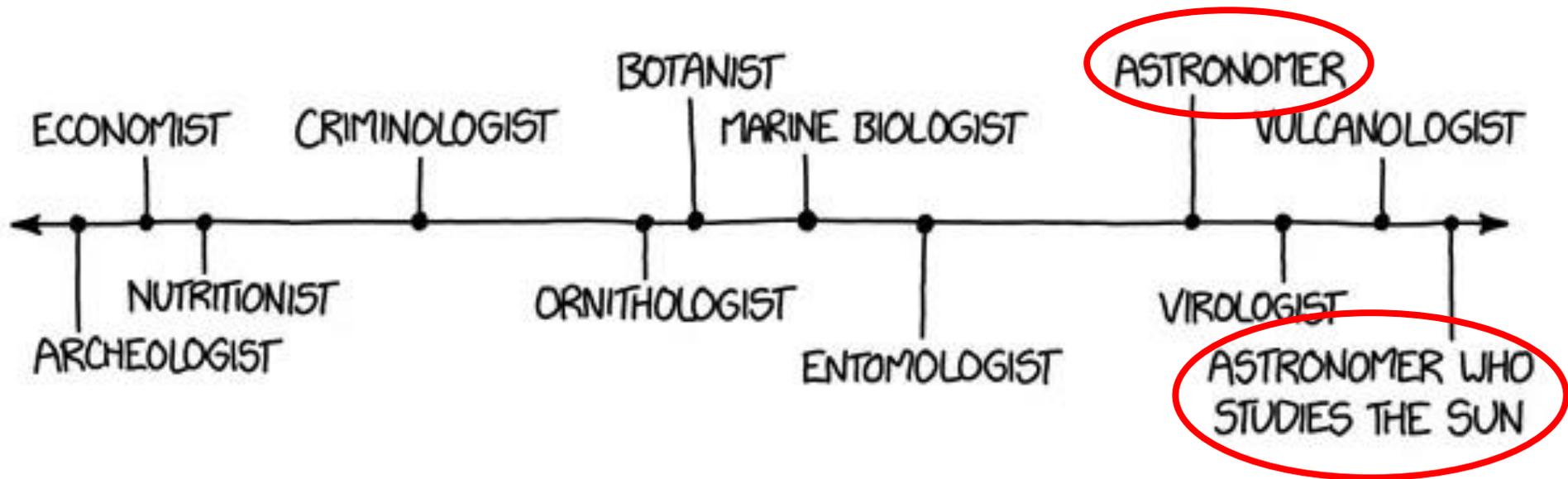
# MY PATH TO PHYSICS



Astrophysics PhD at University of Glasgow in Solar Flares

HOW WORRIED YOU SHOULD BE IF YOU SEE LOCAL REPORTERS INTERVIEWING SCIENTISTS ABOUT A BREAKING NEWS STORY, BY FIELD:

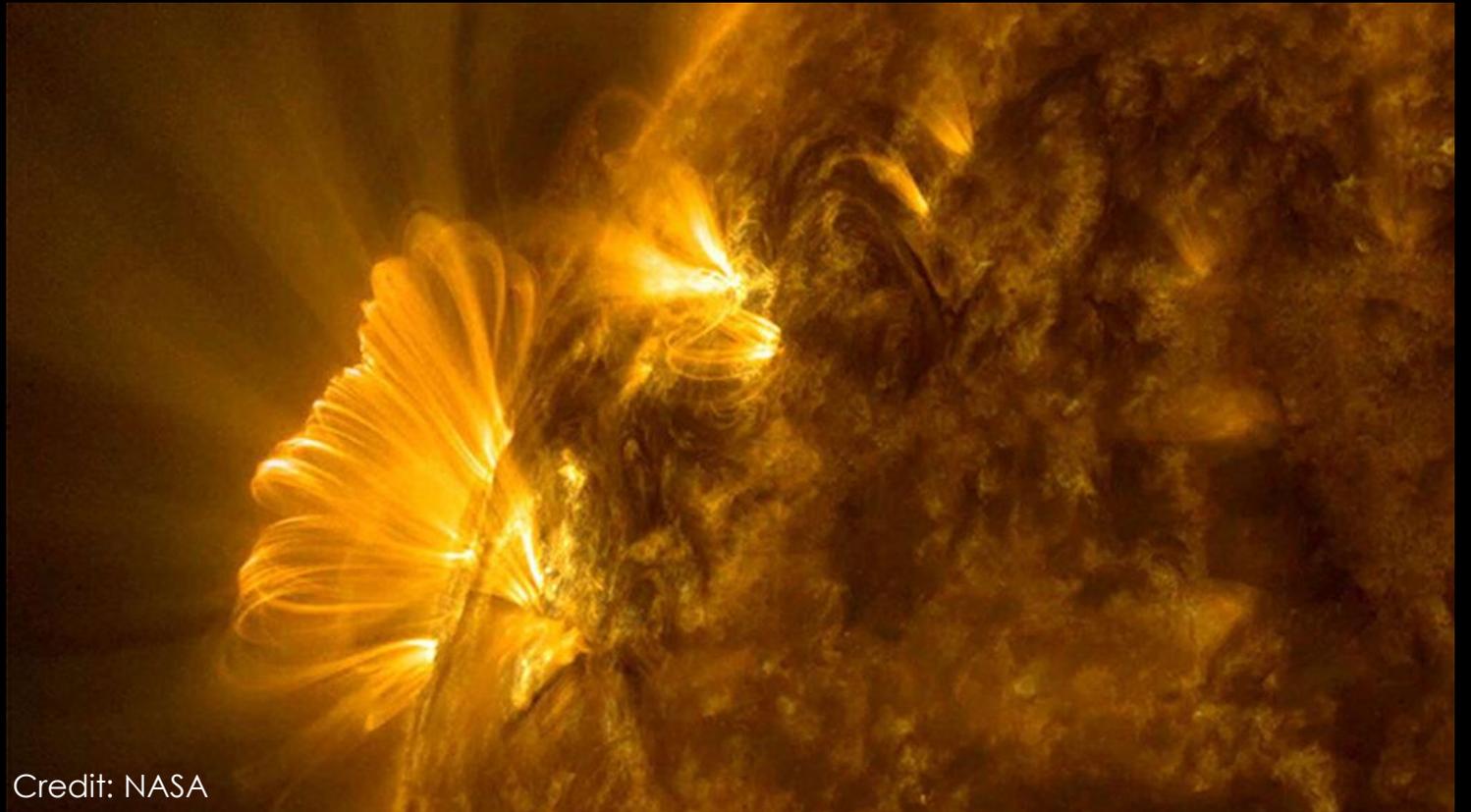
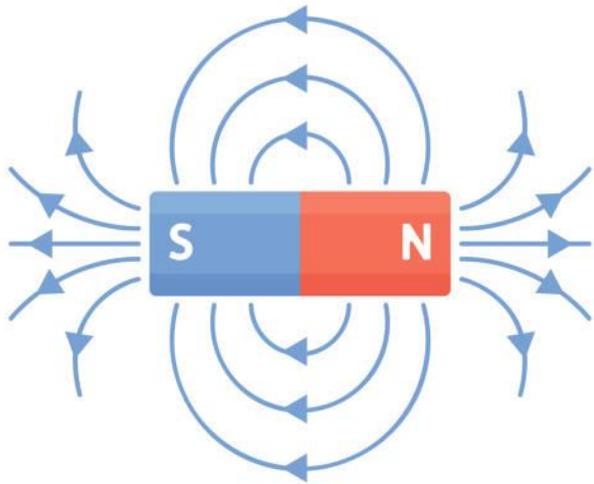
MORE WORRIED →



Credit: Randall Munroe

# THE SUN AND SPACE WEATHER

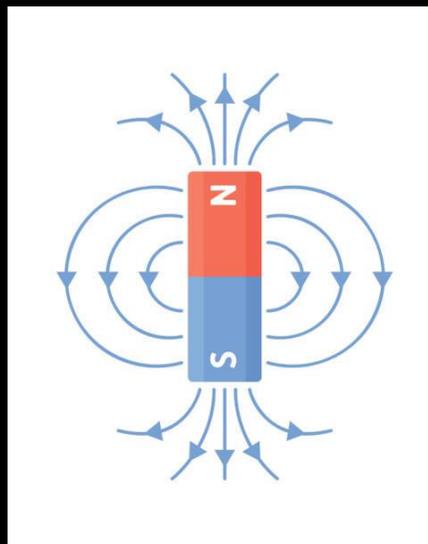
- The Sun is made up of hot plasma
  - Produces magnetic fields
  - Can see through things like coronal loops
  - Constant solar wind



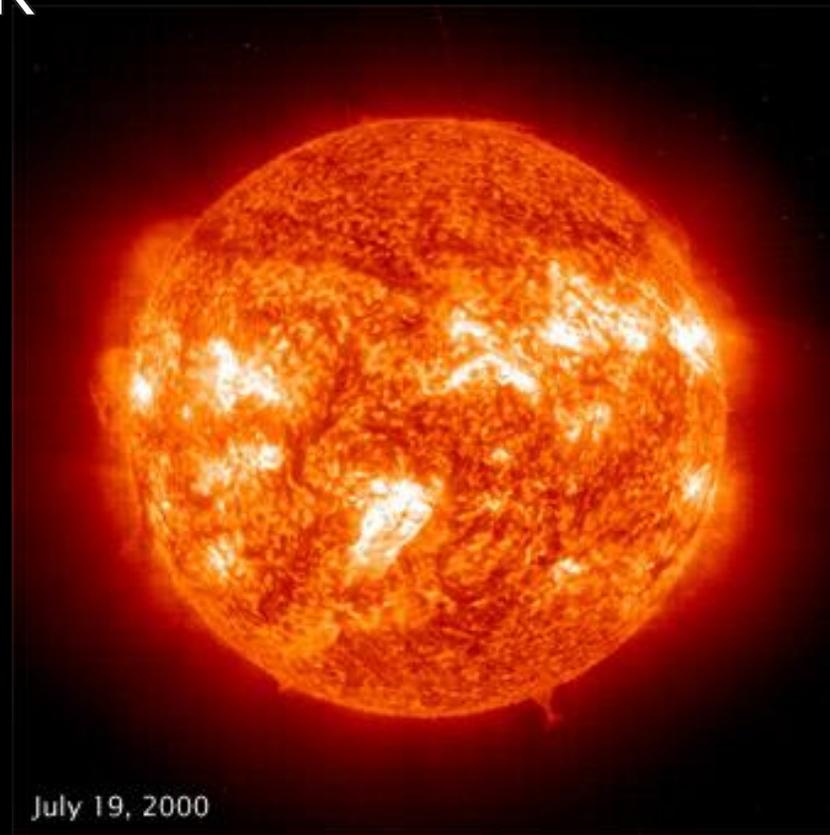
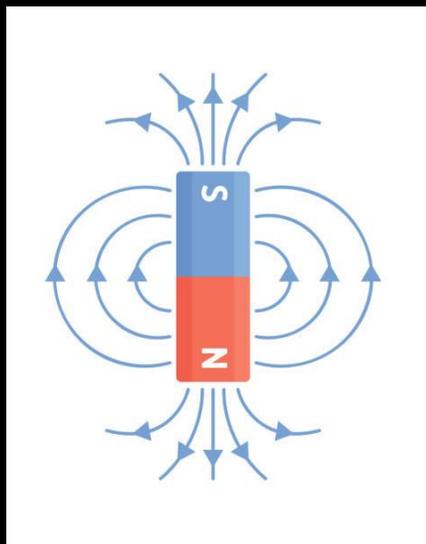
Credit: NASA

# THE SUN AND SPACE WEATHER

- Sun's magnetic field flips around every 11 years
  - Affects the number of sunspots we see
  - Solar maximum in 2024!



11 years->

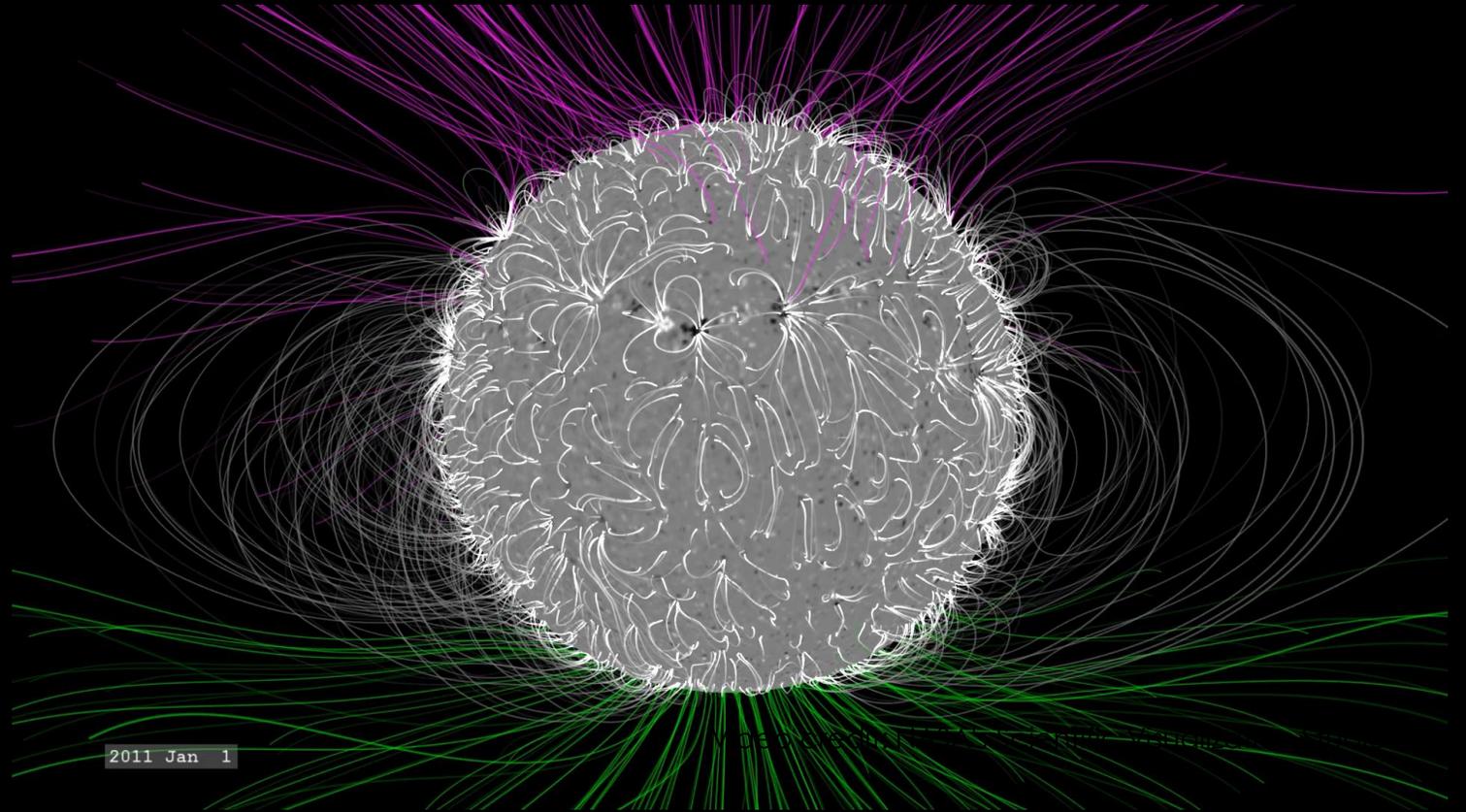


July 19, 2000

Credit: NASA

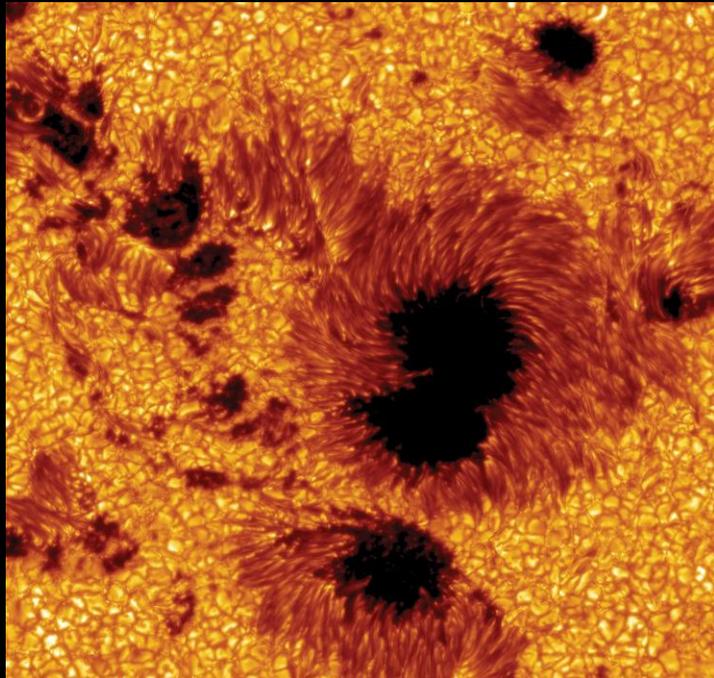
# THE SUN AND SPACE WEATHER

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# SUNSPOTS

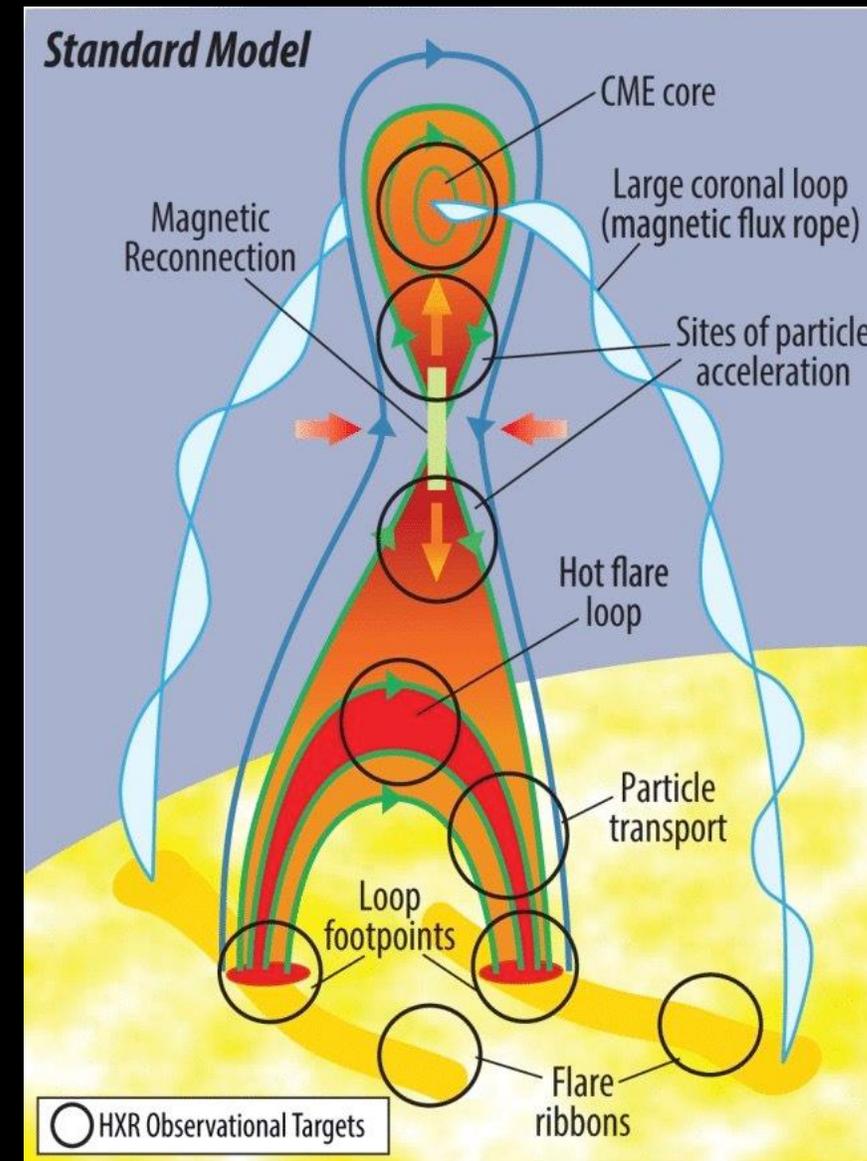
- Dark patches on the Sun's surface
  - Strong magnetic field
  - Only  $\sim 4000^{\circ}\text{C}$
- Magnetic reconnection leads to explosions



Credit: NASA

# SUNSPOTS

- Dark patches on the Sun's surface
  - Strong magnetic field
  - Only ~4000°C
- Magnetic reconnection leads to explosions



Adapted from Christie et al. (2017)

# SOLAR FLARES AND CORONAL MASS EJECTIONS

- Solar flares
  - Bursts of X-ray radiation
  - Flashes of light
  - Different classes of energy
- Coronal mass ejections
  - Bubbles of plasma
  - Stream of charged particles



# SOLAR FLARES AND CORONAL MASS EJECTIONS

- Effects on Earth:
  - Radiation damage
  - Satellite damage
  - Blackouts



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# SOLAR FLARES AND CORONAL MASS EJECTIONS

- Effects on Earth:
  - Radiation damage
  - Satellite damage
  - Blackouts
  - Auroras

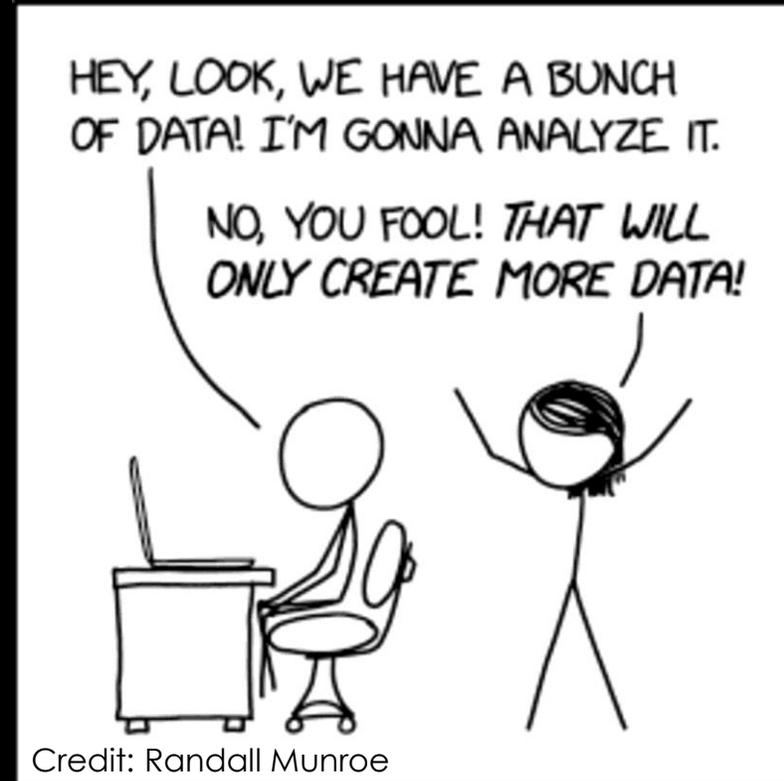


# WHAT DO I RESEARCH?

- Solar flares!
- Observational Analysis of Chromospheric Oscillations in Solar Flares



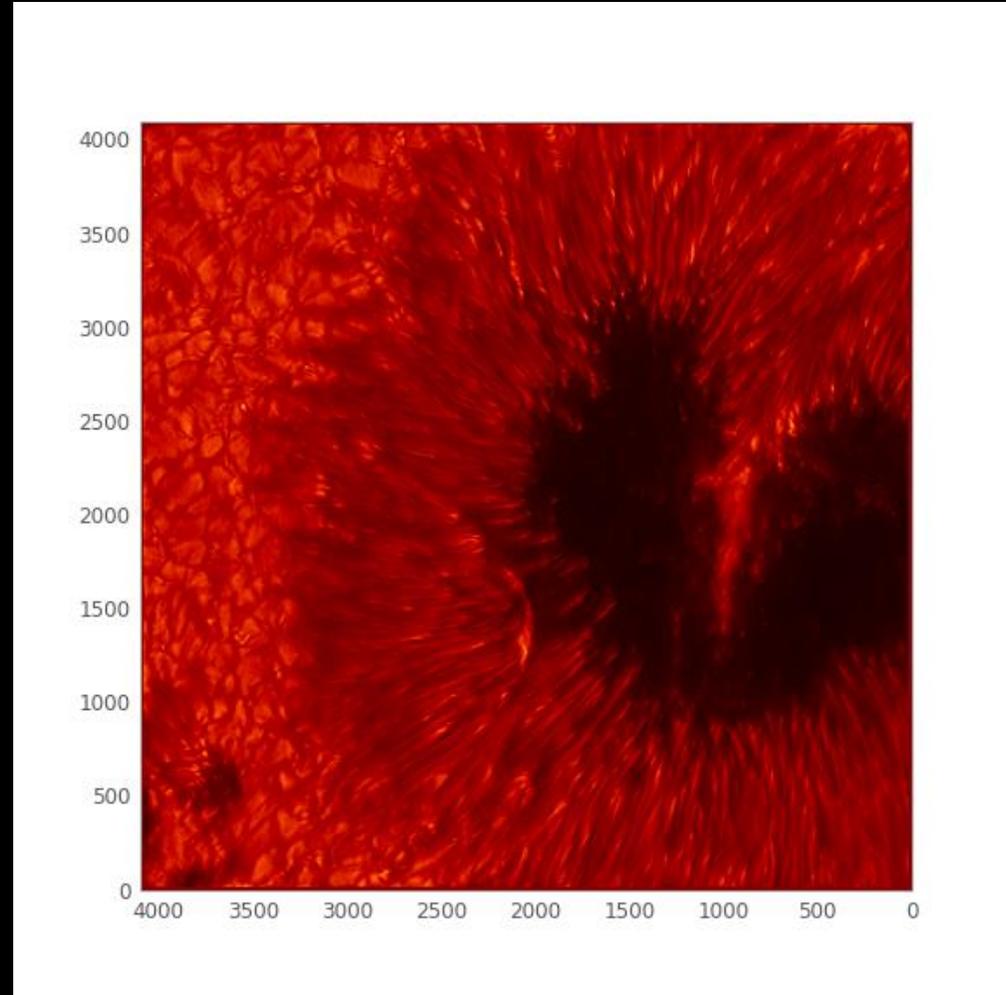
Daniel K. Inouye Solar Telescope



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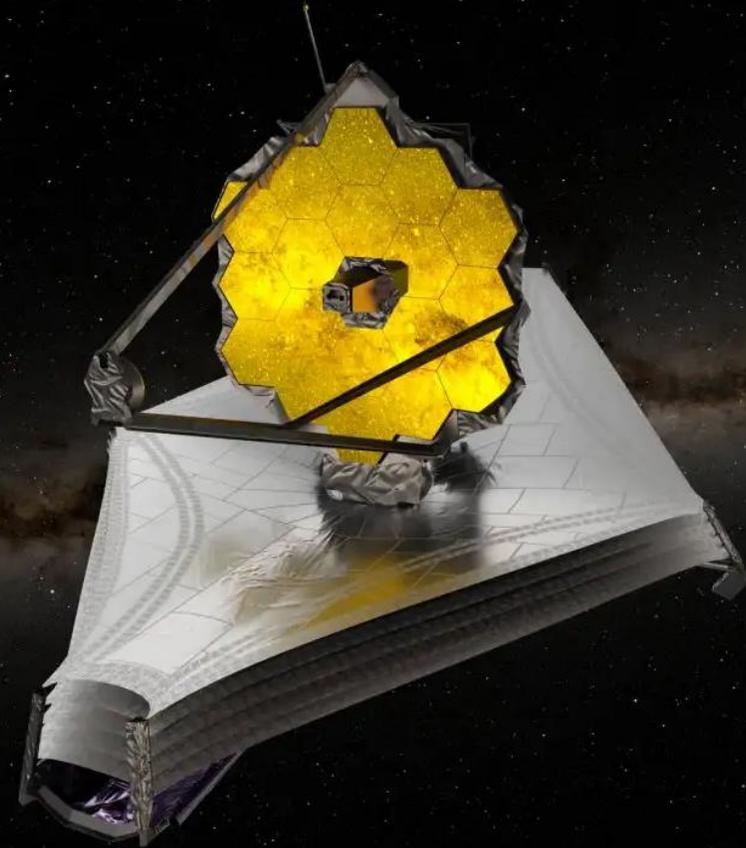
If anyone is interested, this flare occurs on 20<sup>th</sup> April 2022 at roughly 18:35, you can view it here:  
<https://helioviewer.org>





# SPACE MISSIONS – JAMES WEBB SPACE TELESCOPE

- Launched Christmas Day 2021
- Looking at early stars, galaxy formation, exoplanet atmospheres
- Update to Hubble



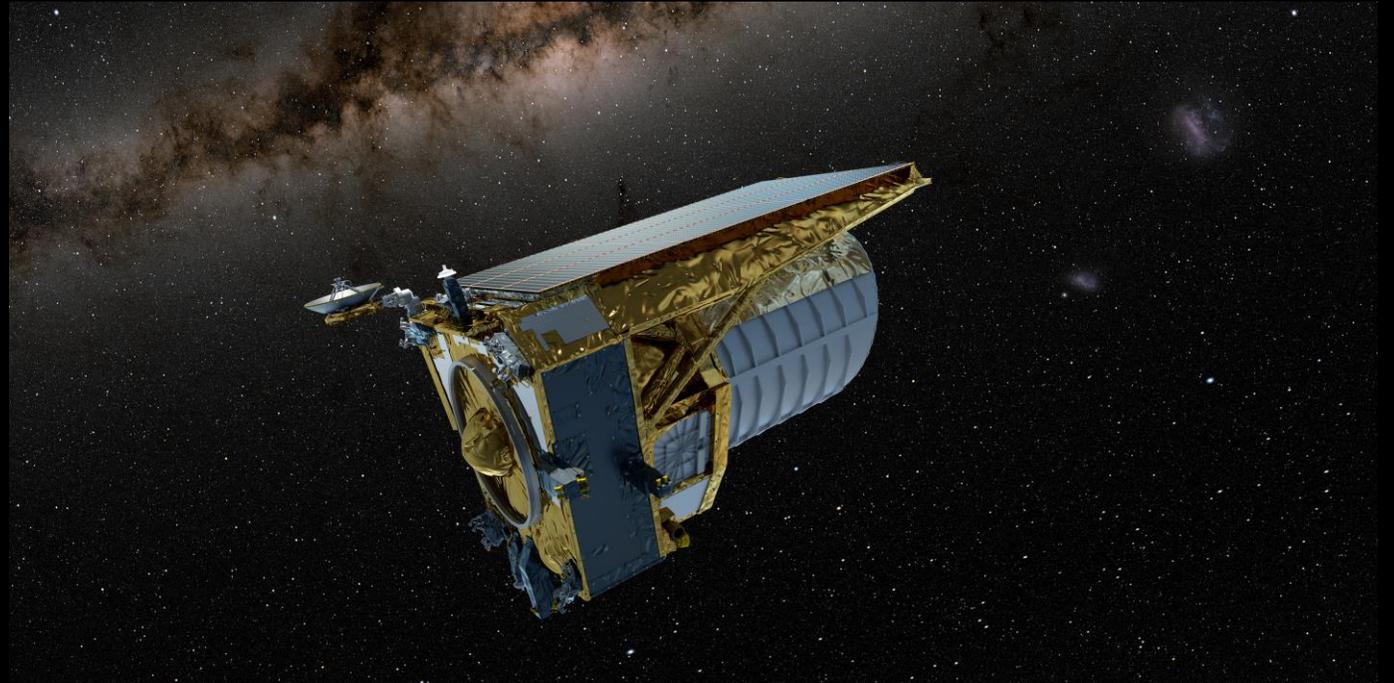
Credit: Randall Munroe





# SPACE MISSIONS - EUCLID

- Launched July 2023
  - Studying dark matter and energy
  - Making a 3D map of the universe





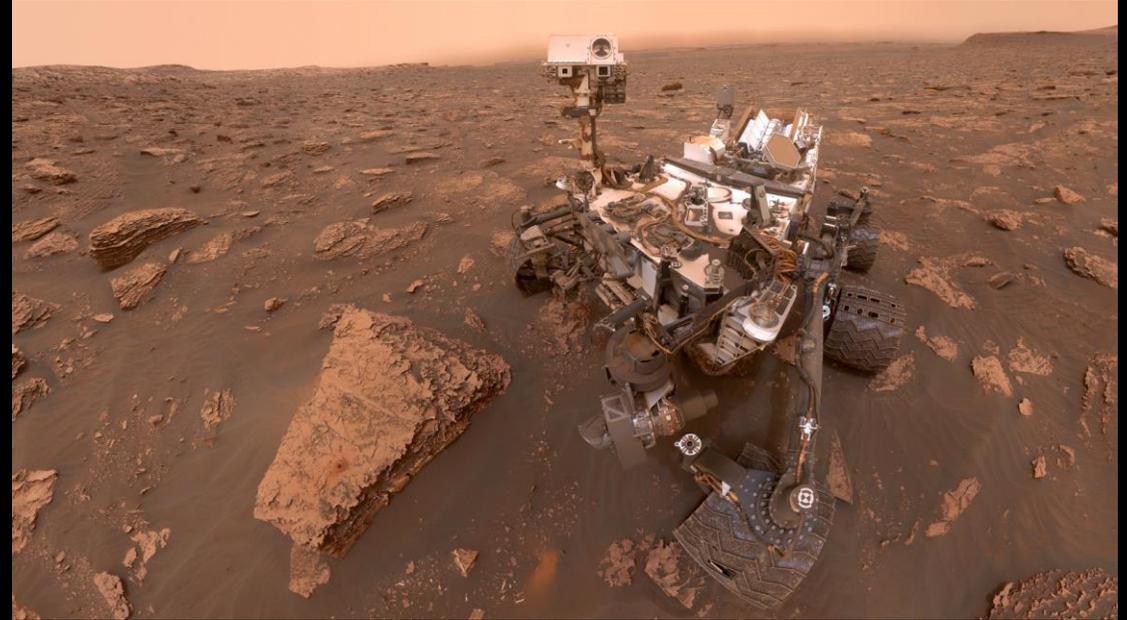
# SPACE MISSIONS - ARTEMIS

- We're going back to the Moon!
  - First woman and first POC
- Artemis II aiming for launch 2025
- Landing with Artemis III in 2026



# SPACE MISSIONS – MARS ROVERS

- Curiosity
  - Landed in Aug 2012
  - Taking samples to search for right environmental conditions for life
  - Only supposed to last 2 years

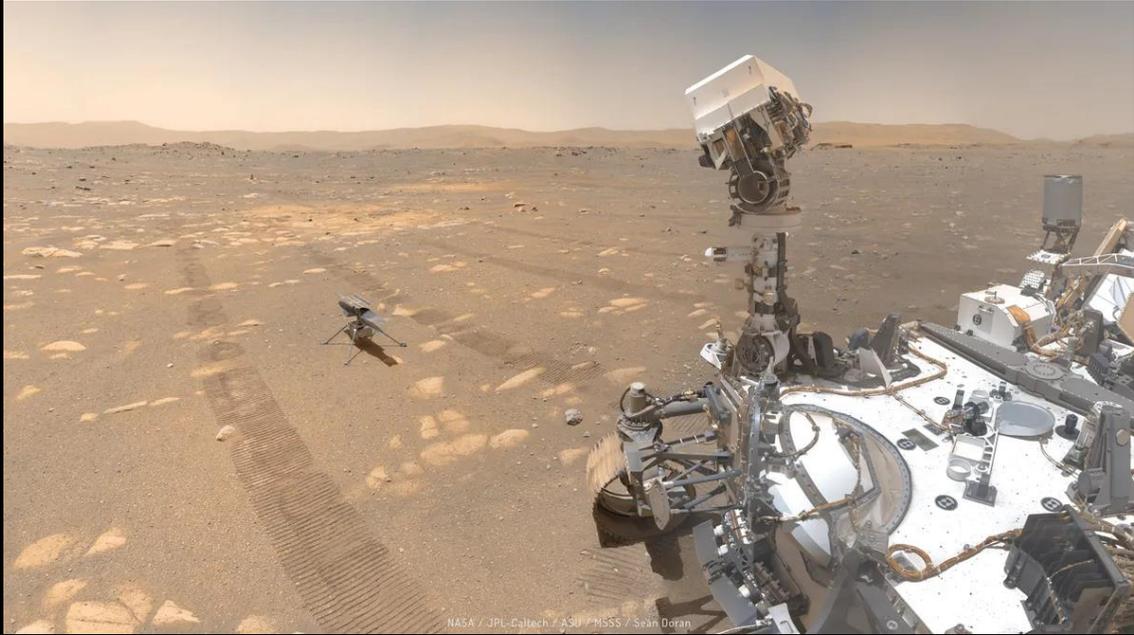




# SPACE MISSIONS – MARS ROVERS

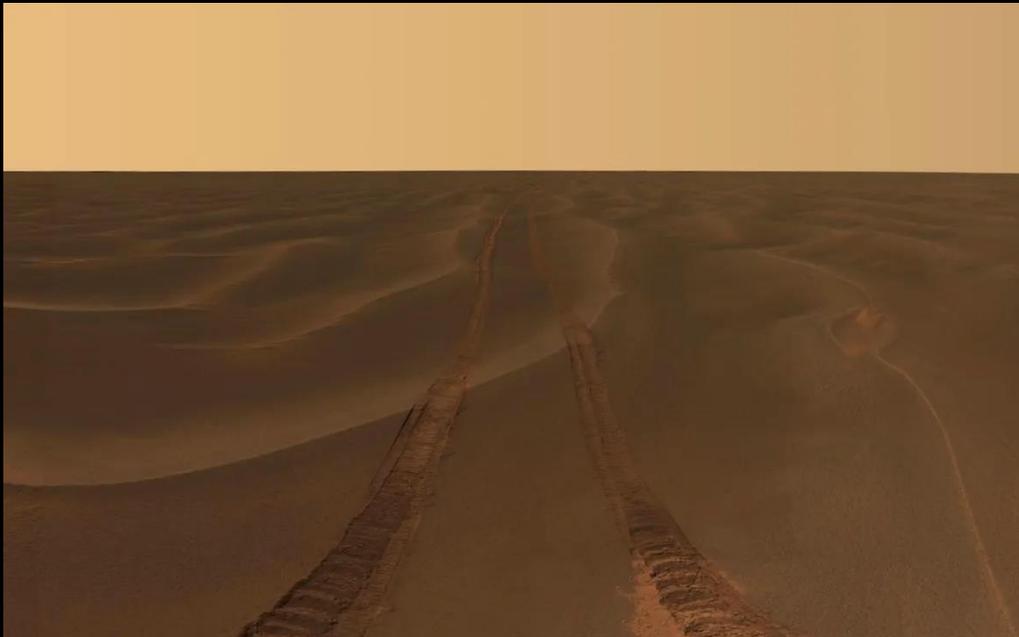
- Perseverance
  - Landed in Feb 2021
  - Hunting for ancient life signs
  - Ingenuity broke down 18<sup>th</sup> Jan 2024
  - Promising for Dragonfly mission





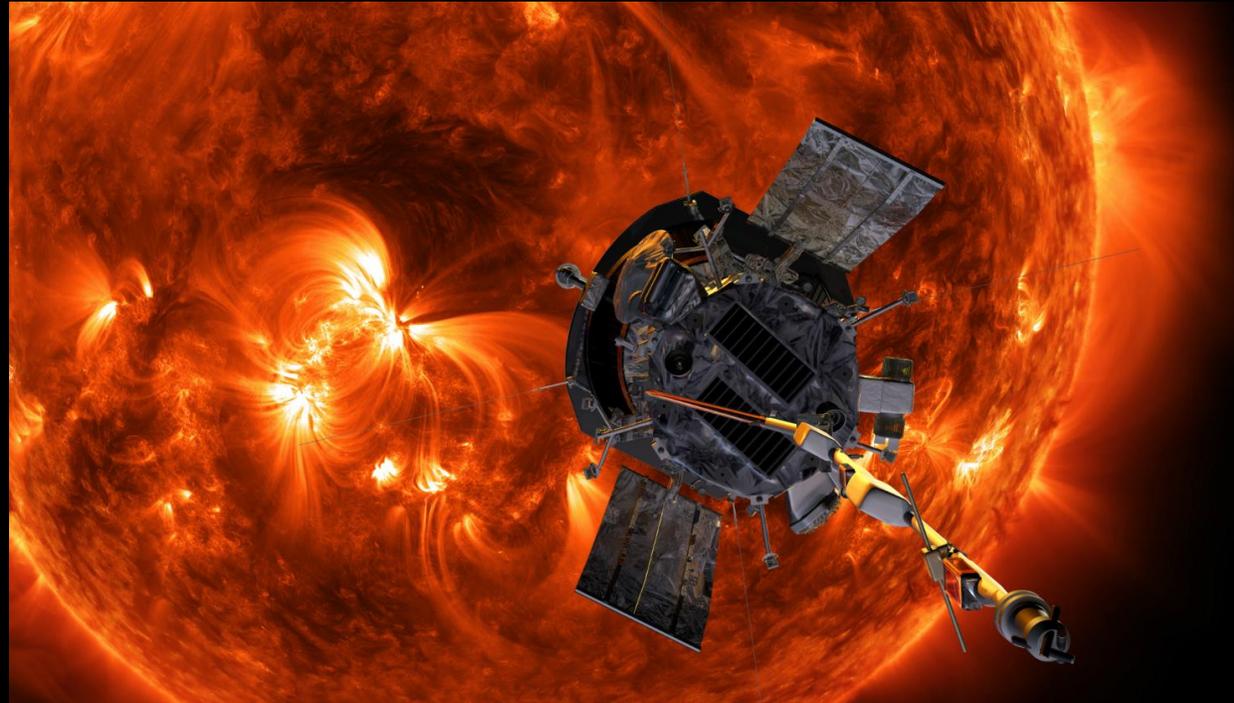
# SPACE MISSIONS – MARS ROVERS

- Opportunity
  - Landed in 2004
  - 90-day mission to 15 years
  - Succumbed to a dust storm



# SPACE MISSIONS – PARKER SOLAR PROBE

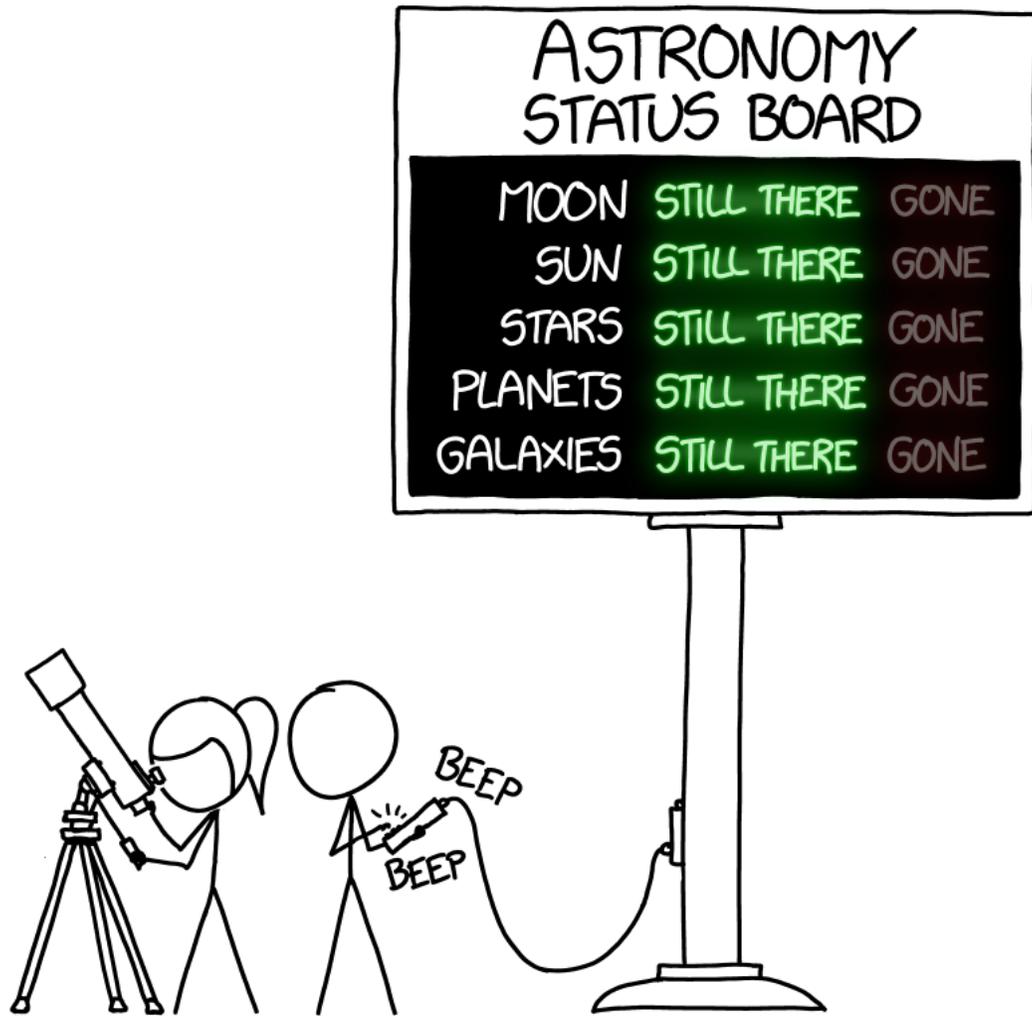
- Launched December 2021
- First attempt to measure star's atmosphere
- Looking at coronal heating and solar wind
- Could help forecast space weather



# SPACE MISSIONS – SOLAR ORBITER

- Launched February 2020
- Pictures of solar poles
- Looking at coronal heating and solar wind
- Researchers can use with ground-based telescopes, like DKIST...





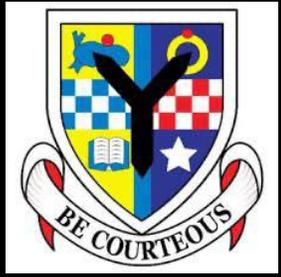
THANK YOU  
FOR  
LISTENING!

You can find me talking  
about astrophysics and my  
PhD on Instagram

@samtheastrophysicist

# SCIENCE in STEWARTON

Coming soon ...



**Tuesday 20th February**

Building new microscopes to study life

Prof Gail McConnell

University of Strathclyde

**Tuesday 12th March**

Magical Magnetism: How atomic physics can tell us about underground pipes, your brain, and the

Northern Lights

Dr Paul Griffin

University of Strathclyde

Information about this and other Stewarton In  
Science events can be found at:

