Physics Honors: Extraterrestrials and The Drake Equation

What does life need to exist?

- Liquid Water
- Source of Energy
- A Stable Environment to Evolve



https://evolution.berkeley.edu/a-place-for-life/ingredients-for-life/raw-materials/ https://www.ontarioparks.com/parksblog/the-goldilocks-zone/

Extremophiles

Extremophiles are organisms that thrive in extreme environments. They tell us about the most dramatic environments where life can exist

A group of Tardigrades were taken into the vacuum of space for 10 days, and almost 70% of them survived!





https://oceanservice.noaa.gov/facts/extremophile.html https://www.nationalgeographic.com/animals/invertebrates/facts/tardigrades-water-bears

Little Green Men from Mars

- In 1877, a scientist named Schiaparelli used a telescope to observe Mars.
- He saw what he called "Canali" which means "channels." This got mistranslated into "canals"
- HG Wells used this research when he wrote "War of the Worlds"



https://www.nasa.gov/audience/forstudents/postsecondary/features/F_C anali_and_First_Martians.html



Mars

• Once had an atmosphere and liquid water

• Couldn't contain life now, but we still might find fossils/history of life

• Does still have Polar Ice caps

https://exoplanets.nasa.gov/news/1665/life-in-our-solar-systemmeet-the-neighbors/ https://solarsystem.nasa.gov/planets/mars/overview/



Europa

• Ocean moon of Jupiter

• Top mile of water is frozen

 Rocky interior with strong suggestions of tectonic plates

https://www.theguardian.com/science/2022/ apr/19/jupiters-moon-europa-may-havewater-life-could-exist





Titan

• Moon of Saturn

• Has a mostly nitrogen atmosphere

• The only other planet in the solar system that has a hydrologic cycle (methane and carbon)

https://www.space.com/study-explains-why-titan-looks-likeearth



https://exoplanets.nasa.gov/news/1350/are-we-alone-in-the-universe-revisiting-the-drake-equation/

Exoplanets

- Exoplanet: any planet that orbits around a star that isn't our sun
- The first exoplanet wasn't discovered until 1992.
- Spitzer, Kepler, K2, and JWST are space based telescopes looking for exoplanets
- Currently 5338 confirmed exoplanets



https://www.schoolsobservatory.org/learn/astro/exoplanets/history#:~:text=The%20first%20exoplanet %20was%20discovered,in%20the%20system%2C%20named%20Draugr. https://exoplanetarchive.ipac.caltech.edu/docs/counts_detail.html

5 Ways to Find a Planet

RADIAL VELOCITY Watching for Wobble

1036 planets discovered

TRANSIT Searching for Shadows 3986 planets discovered

DIRECT IMAGING Taking Pictures 66 planets discovered

GRAVITATIONAL MICROLENSING

Light in a Gravity Lens 187 planets discovered

ASTROMETRY

Minuscule Movements 2 planets discovered

https://exoplanets.nasa.gov/alien-worlds/ways-to-find-a-planet/#



https://www.kpcc.org/2017-06-22/as-nasa-s-kepler-mission-nears-end-scientists-pass