

# Is There Anyone Out There?



Peterborough Astronomical Association  
Novice Astronomy Class  
February 6, 2026  
Brett Hardy

## UFO Phenomena

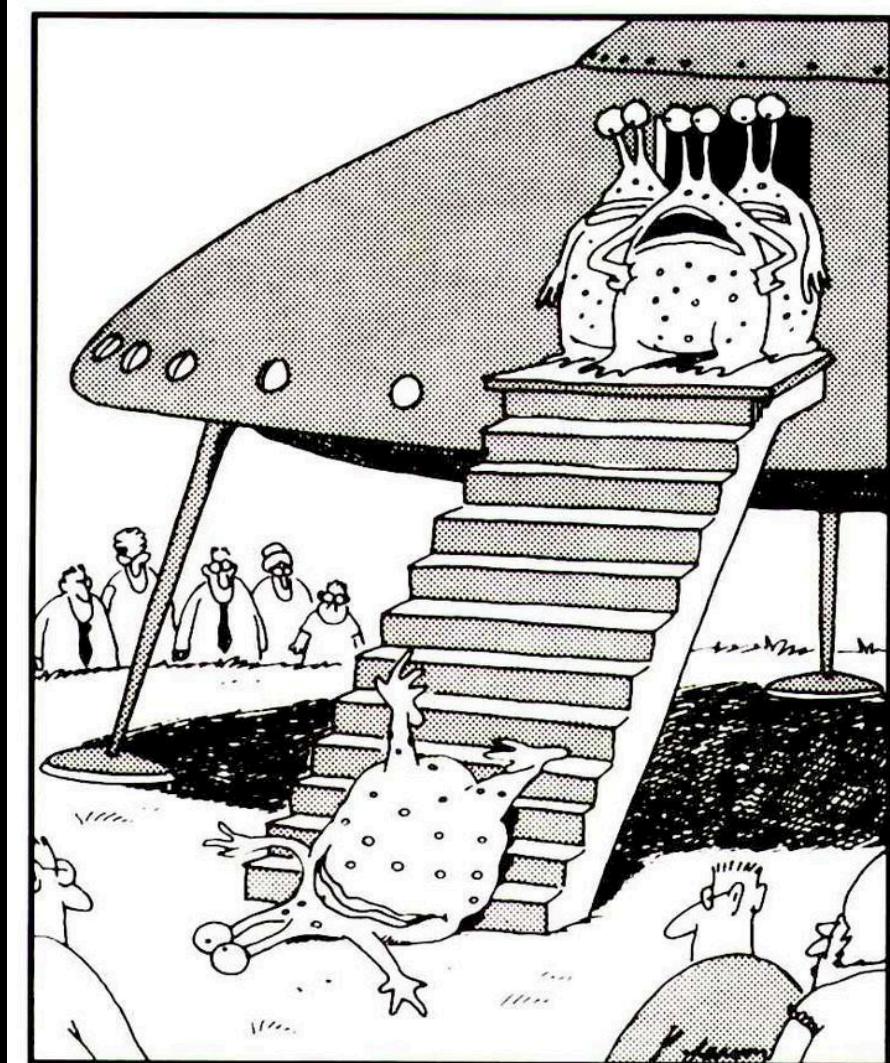
- Roswell incident June 14, 1947
- June 24, 1947 & Kenneth Arnold
- Are *they* already here?



Inadvertently, Roy dooms the entire earth to annihilation when, in an attempt to be friendly, he seizes their leader by the head and shakes vigorously.

## Fermi's Paradox

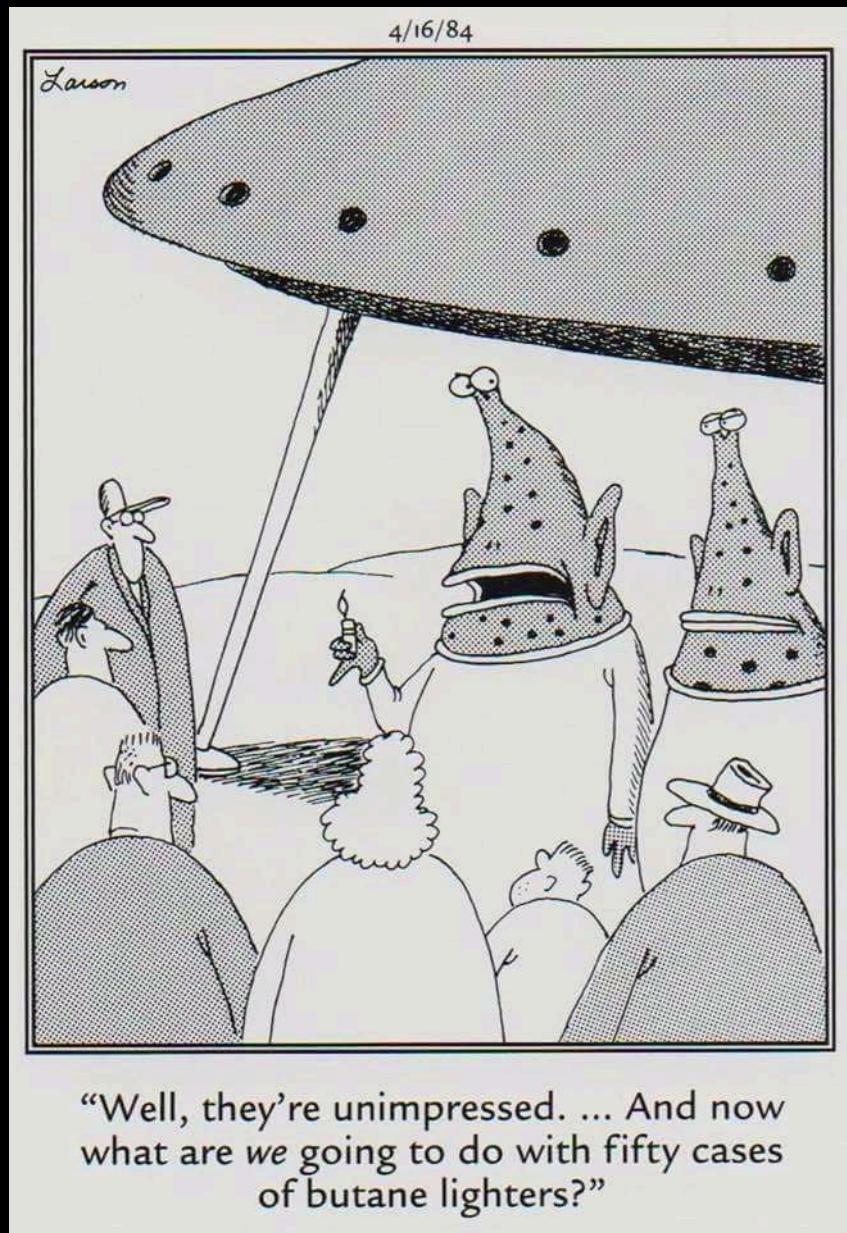
- Los Alamos, New Mexico 1950
- “But where is everybody?”



“Wonderful! Just wonderful! ... So much for instilling them with a sense of awe.”

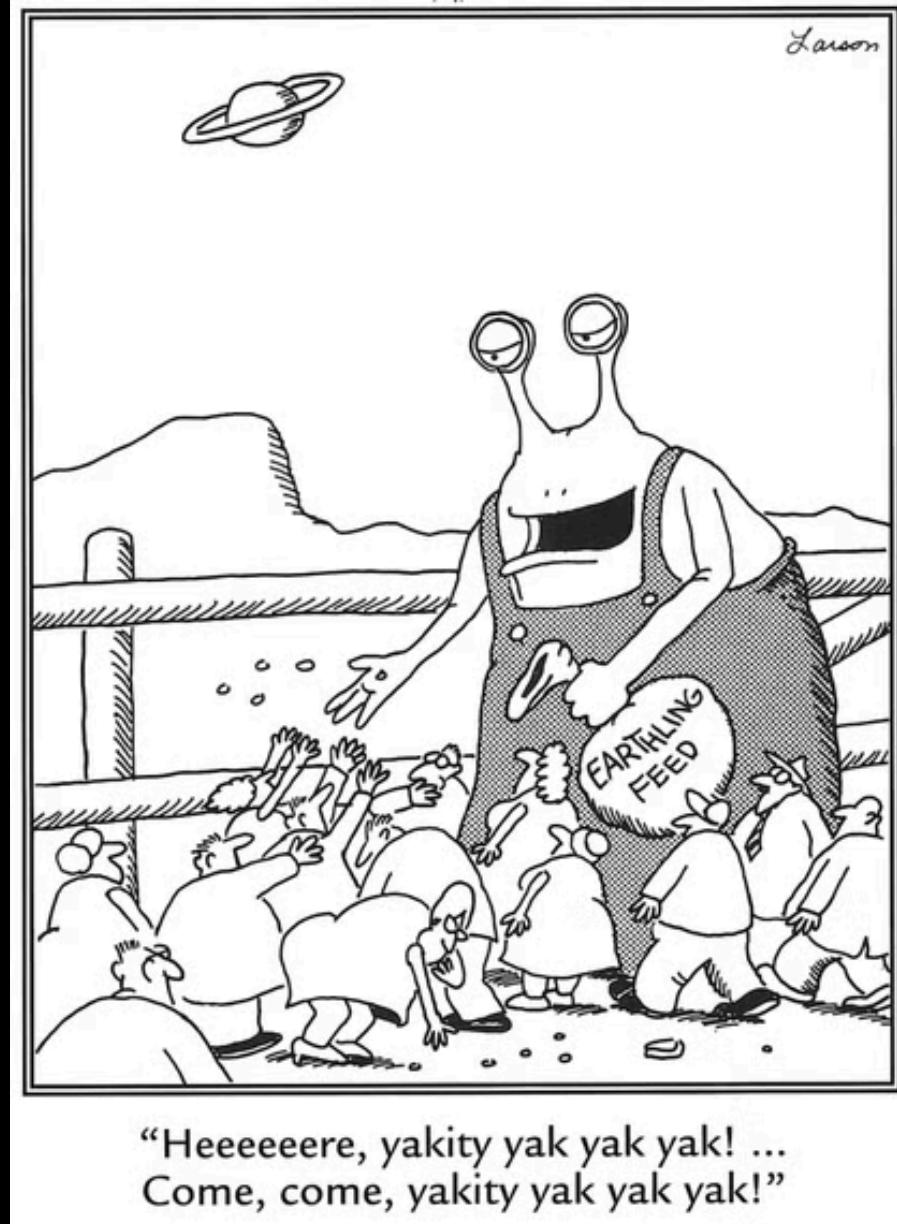
## The Drake Equation

- Frank Drake
- Project Ozma 1960 (April – July)  
Green Bank Observatory, West  
Virginia
- National Academy of Sciences  
1961
- How many advanced  
technological civilizations are  
there in the Milky Way Galaxy?
- $N = R_* \cdot f_p \cdot n_e \cdot f_l \cdot f_i \cdot f_c \cdot L$
- Search for Extraterrestrial  
Intelligence - SETI



## Cosmological & Geological Accidents

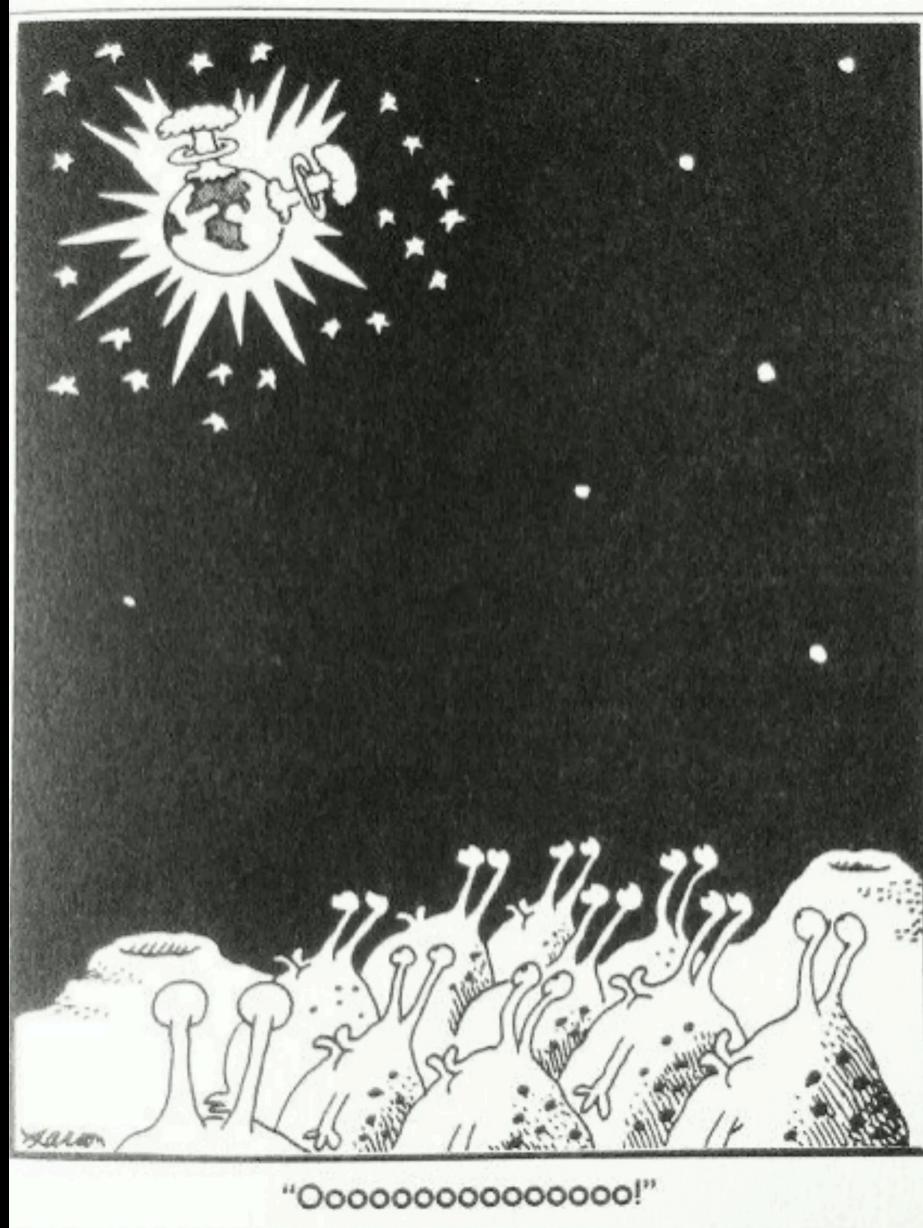
- Galactic Location
- Solar system formation
- Solar activity
- Volatile delivery
- Orbital evolution
- Metallicity
- UV shielding
- Atmospheric composition
- Interior composition
- Plate tectonics
- Mass extinctions
  - Volcanism
- K – Pg boundary



“Heeeeeere, yakity yak yak yak! ...  
Come, come, yakity yak yak yak!”

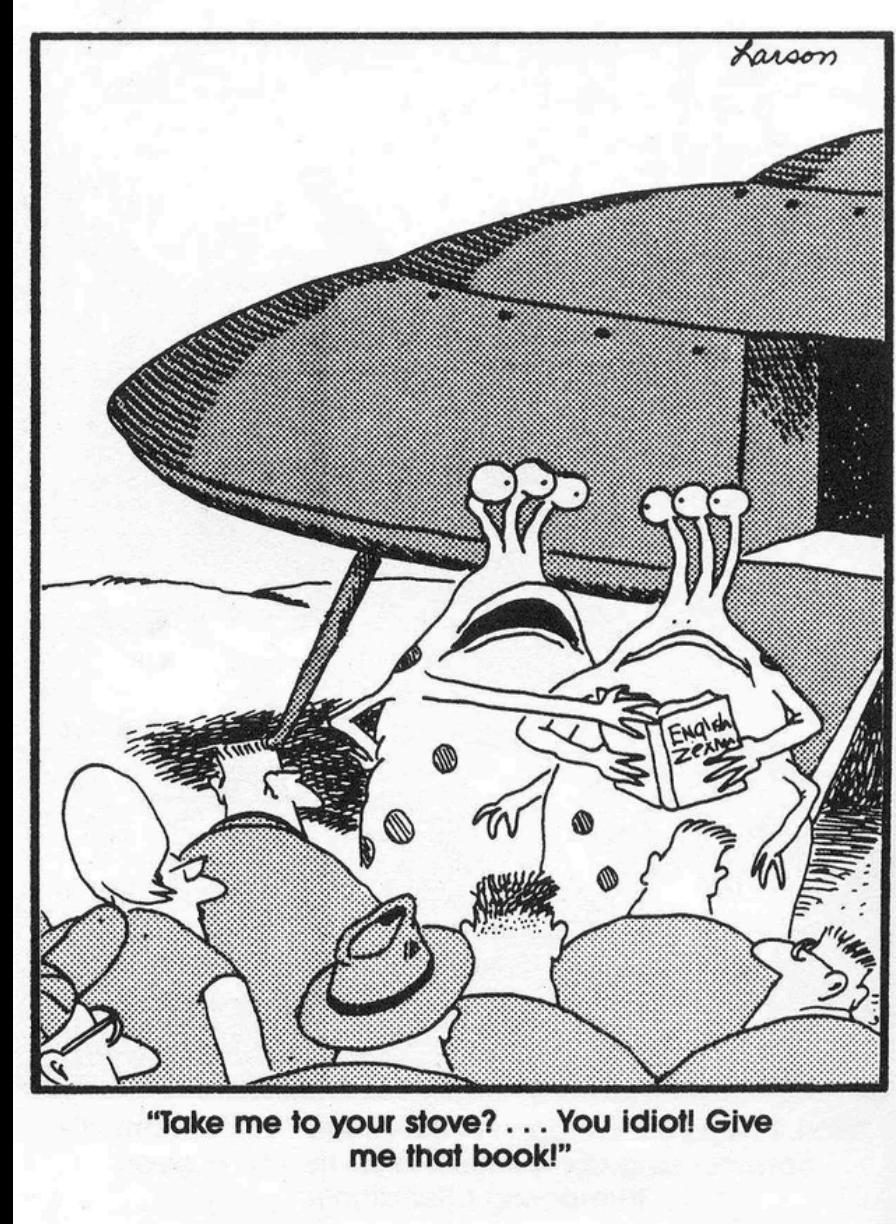
## The Great Filter

- Barriers to technological civilization longevity
- Are we one of the luck few – **ONLY** one?



## A Universe Primed for Life

- Physical constants
- Periodic table of elements
- A place for life to take hold
- Abiogenesis
- Time



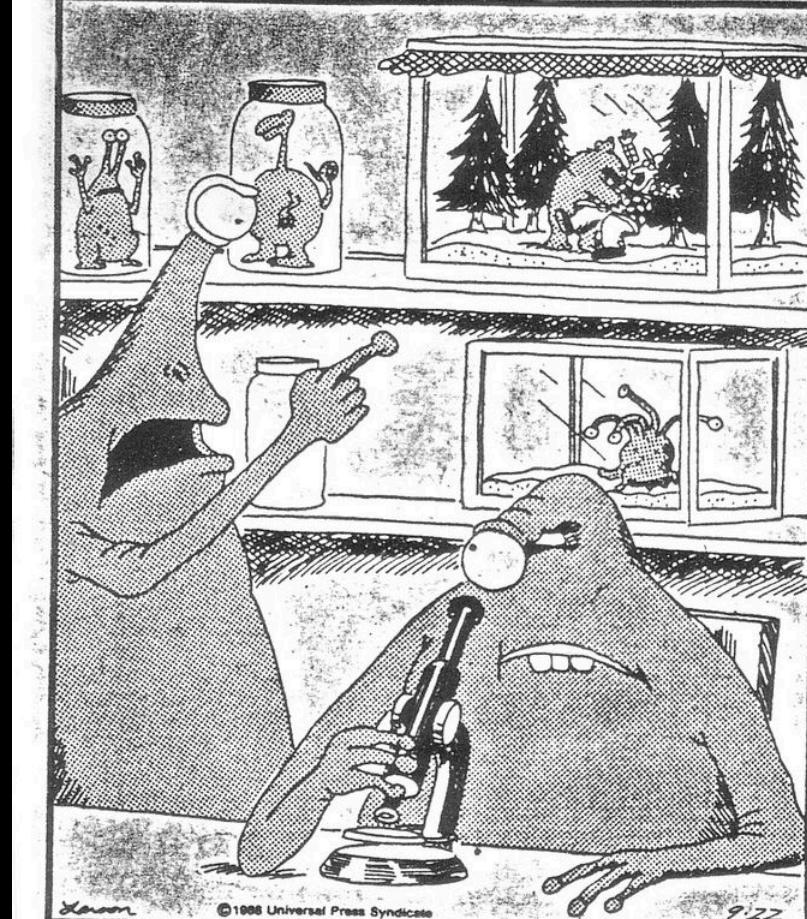
## A Change in Direction

- The giggle factor
  - UFOs
  - SETI
- What brought about this change?
- Astrobiology

ay, Sept. 22, 1988

THE FAR SIDE

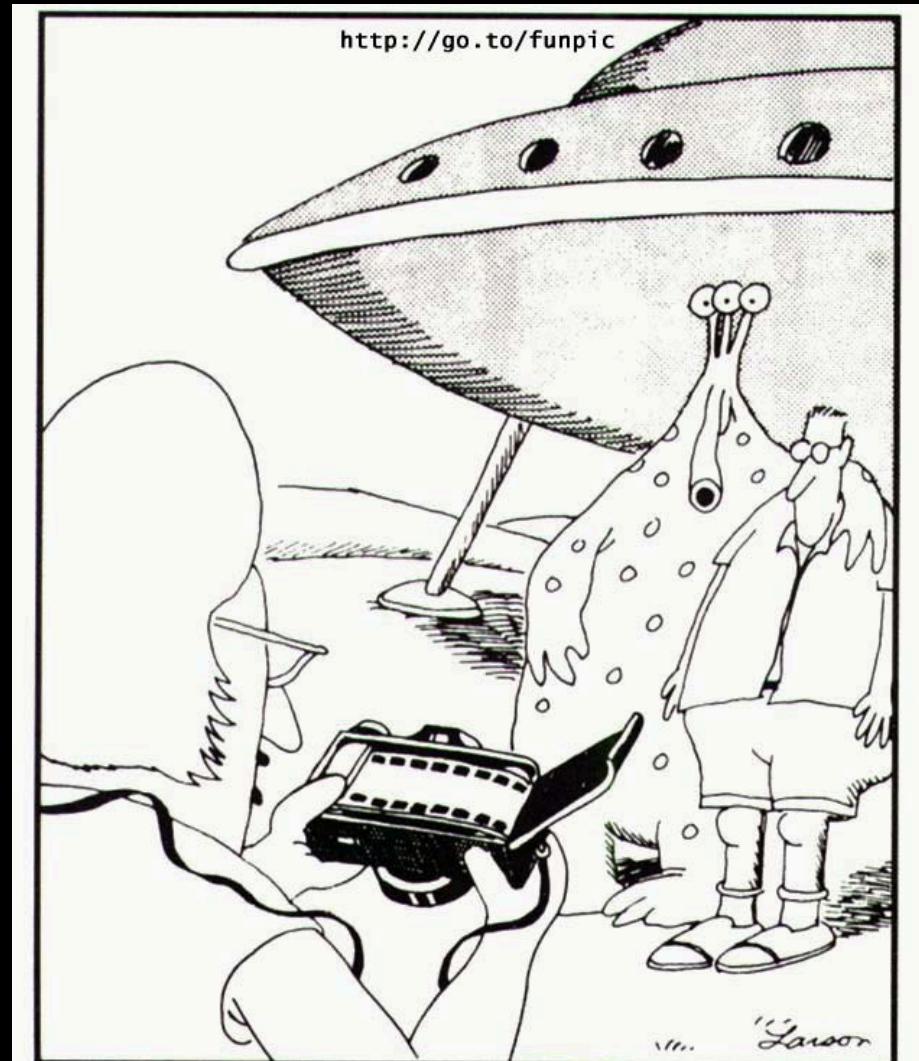
By Gary Larson



"Zorak, you idiot! You've mixed incompatible species in the earth terrarium!"

## Exoplanets

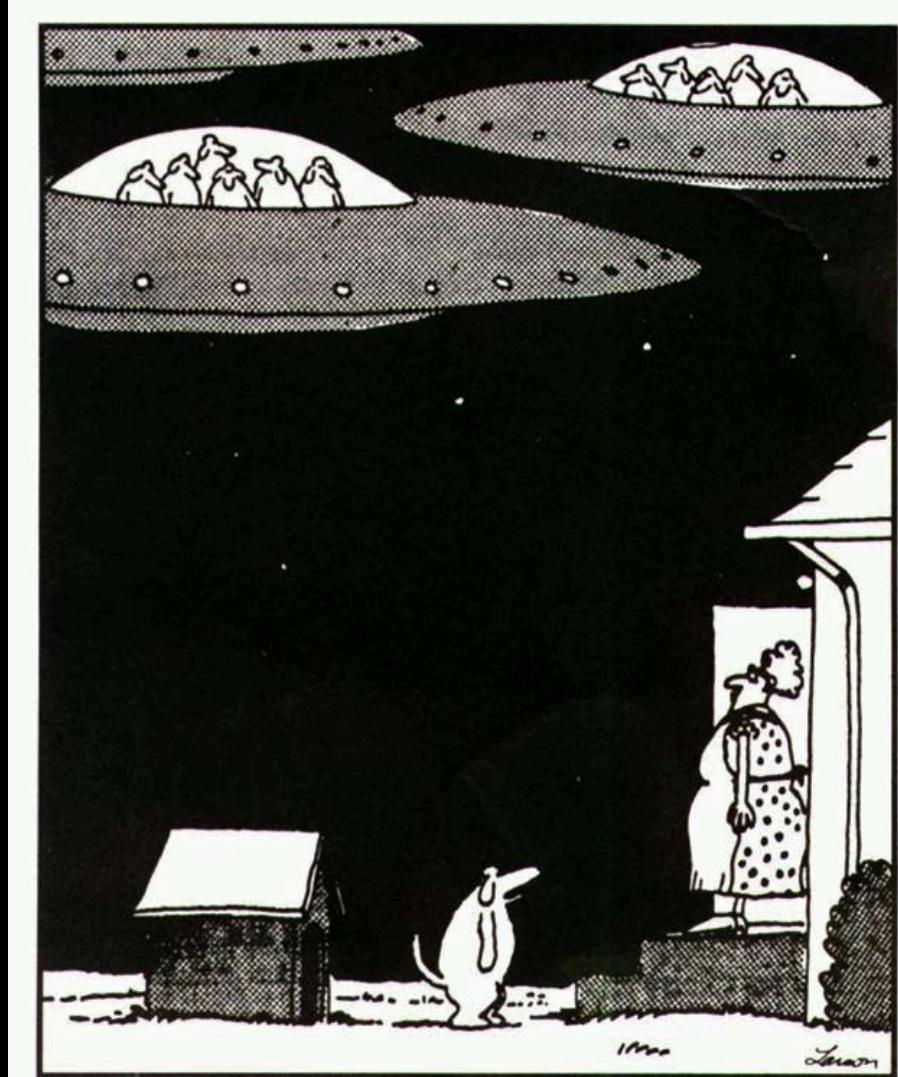
- First exoplanet discovery 1995
- Radial velocity method
- transit method
- Ground based telescopes
- Habitable Zone
- Space telescopes
  - Hubble
  - Kepler
  - TESS
  - Gaia
  - JWST
  - Habitable Worlds
- Where to look?
  - small rocky worlds
  - hycean (water) worlds
  - heat source
  - atmosphere
  - water



"Yes, yes, already, Warren! ... There is film in the camera!"

## Atmospheric Modeling

- Characterization of exoplanet atmospheres
- Transit spectroscopy
  - Hubble – water vapour only
  - JWST – H<sub>2</sub>O, CO, CO<sub>2</sub>, CH<sub>4</sub>, H<sub>2</sub>S

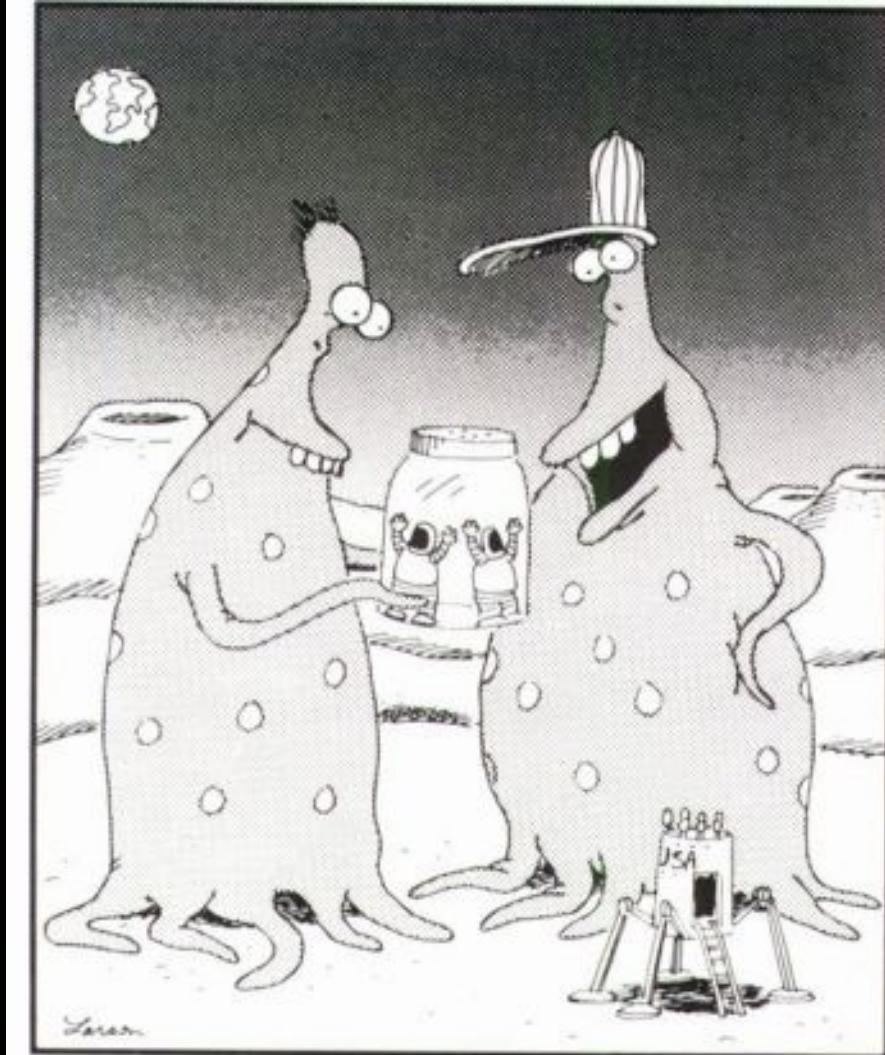


“Well, they finally came. ... But before I go,  
let's see you roll over a couple times.”

<http://go.to/funpic>

## Biosignatures

- How life hijacks and changes atmospheres
- photosynthesis
  - oxygen
- Does habitability = inhabited?
- Does life always evolve complexity over time?

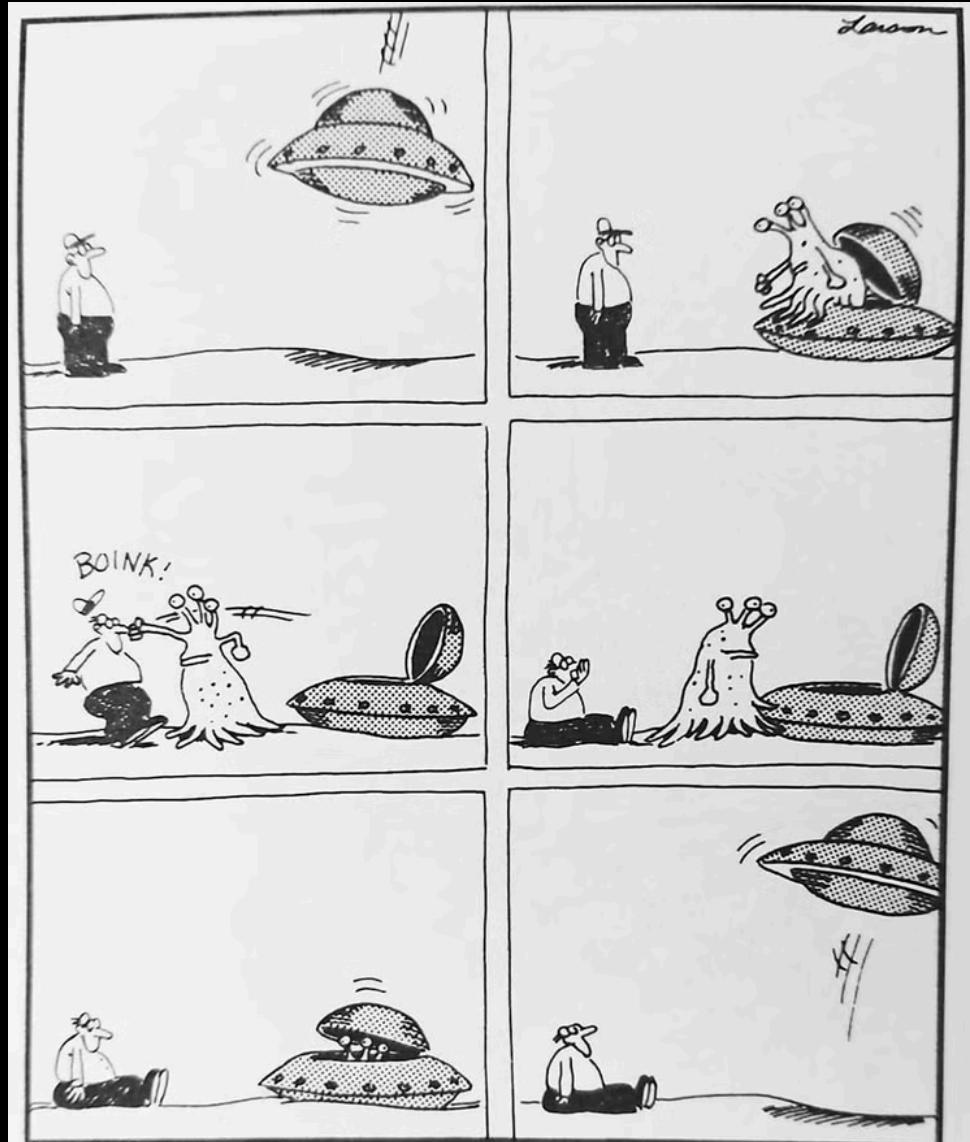


"Pretty cool, Dewey... Hey! Shake the jar  
and see if they'll fight!"

<http://go.to/funpic>

## Technosignatures

- Technospheres
- pollution
- CFCs

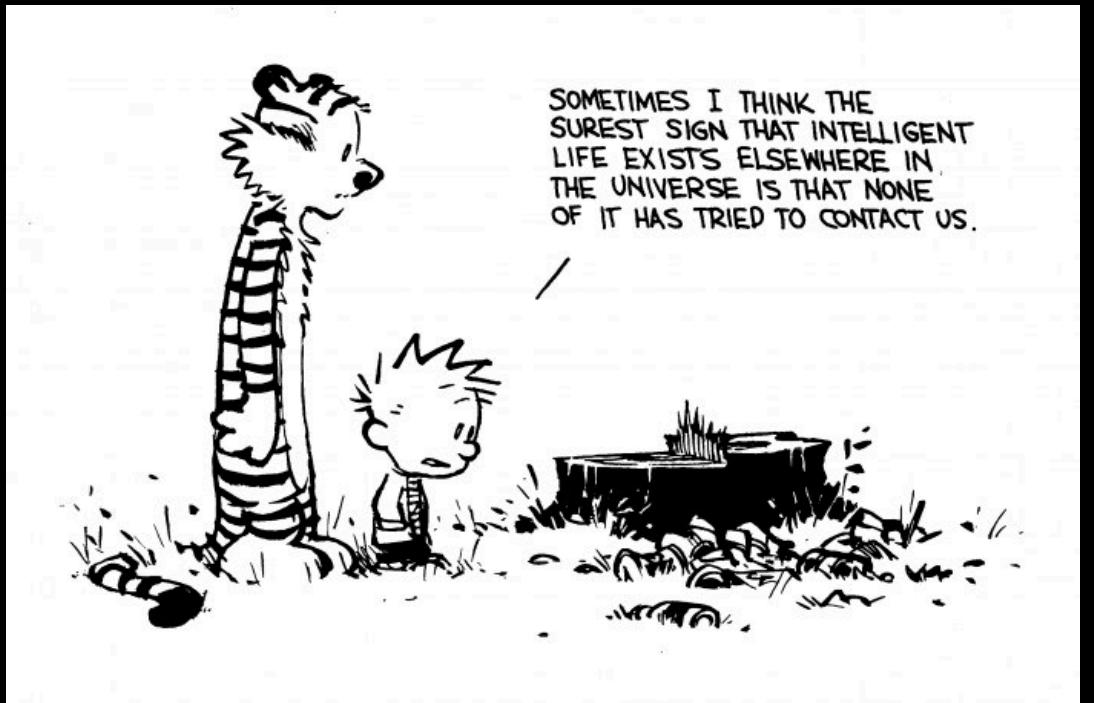


Henry never knew what hit him.

If life is easy we will find it soon.

If it is rare, it will take a long time.

If we do not find evidence for life elsewhere, that does not mean that it does not exist.





Novice Astronomy Class  
March 6, 2026  
Solar System Series: The Asteroid Belt