

# THE DRAKE EQUATION

NUMBER OF  
COMMUNICATING  
CIVILIZATIONS  
IN OUR GALAXY

PROBABILITY THAT  
LIFE ON A PLANET  
BECOMES INTELLIGENT

$$N = R^* f_p n_e f_i f_c L B_s$$

NUMBER OF LIFE-  
SUPPORTING PLANETS  
PER SOLAR SYSTEM

AMOUNT OF BULLSHIT  
YOU'RE WILLING  
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## DRAKE EQUATION

$$N = R \times f_s \times f_p \times n_e \times f_l \times f_i \times f_c \times L$$

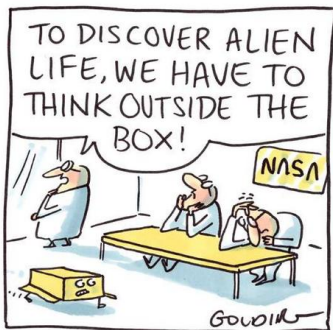
- R average rate of star formation
- $f_s$  fraction of good stars that have planetary systems
- $n_e$  number of planets around these stars within an "ecoshell"
- $f_l$  fraction of those planets where life develops
- $f_i$  fraction of living species that develop intelligence
- $f_c$  fraction of intelligent species with communications technology
- L lifetime of the "communicative phase"

## *Scientific Consensus*

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- We've discovered many worlds orbiting stars.
- We've discovered life that exists in places we never imagined (very hot/very cold/very acidic environments)
- Many scientists expect extraterrestrial life to exist



- The search leads to other useful breakthroughs

# THE FERMI PARADOX

There are 400 billion stars in our galaxy, astronomers estimate that each has 1.6 planets on average, bringing the total number of planets within the range of 660 billion. The number of potentially habitable worlds differs according to the source, but most say the Milky Way may have **over 60 billion habitable planets**. As such, based on those numbers alone, it seems rather improbable that we are alone.

Therein lies Fermi's paradox: if other forms of intelligent life exist, why haven't we found any evidence yet? Here are ten possible solutions to the Fermi Paradox:



## DOWN THE RABBIT HOLE

We haven't found evidence of extraterrestrials because our reality is an elaborate illusion. As in, we are living in a computer simulation created by our alien overlords, who make all the rules.



## THEY ARE ALREADY HERE

*(A perk of being a wallflower)*

It would be silly to presume that all life is similar to Earth's. Perhaps alien beings are so different, they would not register to us even if they were under our noses. Conversely, they may be so similar, they are indistinguishable from humans, and can easily avoid detection.



## OUR WIRES ARE CROSSED

It's very possible that other intelligent life forms are actively sending transmissions into space, we simply don't use the same range of frequencies (radio waves, for instance), or perhaps everyone is listening and no one's talking.



## THEY LIVE IN UNLIKELY PLACES

*(We don't know where to look)*

The search for life is largely conducted on other planets, but what if we are looking in the wrong place altogether? A truly advanced civilization may not need to be anchored to a rocky world. In fact, some astronomers suggest that, because of energy demands, aliens might lurk on the edge of the galaxy, maybe even in supermassive black holes themselves.



## EARTH IS A FISHBOWL

*(Which makes us the fish)*

In this scenario, alien civilizations know we exist, they simply watch our development from afar to let us evolve without influence, ultimately forging our own path.



## THEY USE TECH TO SPY

Regardless of how technologically advanced a civilization becomes, space exploration will always be long and fraught. Instead of sending manned ships to explore the galaxy, aliens might dispatch self-replicating nanobots, like von Neumann probes, to do the work for them.



## DESTROY OR BE DESTROYED

In Darwin's theory of evolution, a tenet says the strongest species survives. A similar tactic may be employed by alien beings: perhaps they stay silent, hoping that hostile species aren't alerted, or they strike before others destroy them first.



## WE ARE THE ALIENS

Perhaps aeons ago, some alien race visited Earth. After seeing all the earmarks of a habitable world, the creatures sowed the seeds of life with their own genetic material, before going along their merry way. We, in a sense, are their experiment.



## SPACE IS TOO VAST

*(& Signals take too long)*

Space, simply put, is incredibly large. So large, if we beamed a transmission to the closest star, it would take 4 years to reach the system. Say intelligent life did pick up one of our signals, it might take years, if not decades, to get a response.



## LIFE IS EXTREMELY RARE

Perhaps, in the search for extraterrestrial intelligence, the simplest solution is the correct one. We haven't encountered signs of life either because it doesn't exist, or it's exceedingly rare. The prerequisites for complex life are nearly impossible to replicate in their entirety elsewhere.