

ALIENS



ON BILLION

- If you were left one Billion dollars but could only draw \$10,000 per day, how long would it last?

274 YEARS!

DNA

- Deoxyribonucleic acid
- Self-replicating material which is
- Present in all living organisms
- The software program that defines living things







WHAT DO ALIENS LOOK LIKE?

- Movie aliens mostly look like men in rubber suits
- They almost all have two eyes, one nose, one mouth two arms and two legs.
- Faces are usually human enough to be frightening
- Motives are either all good or all bad
 - Benign welcoming us into the universe
 - Hostile wanting our land, water, women or bodies for food

WHAT DO ALIENS REALLY LOOK LIKE?

- We won't know until we see one
- Probably not much like us
- Probably not much like any Earth creature

ALIEN VISITORS

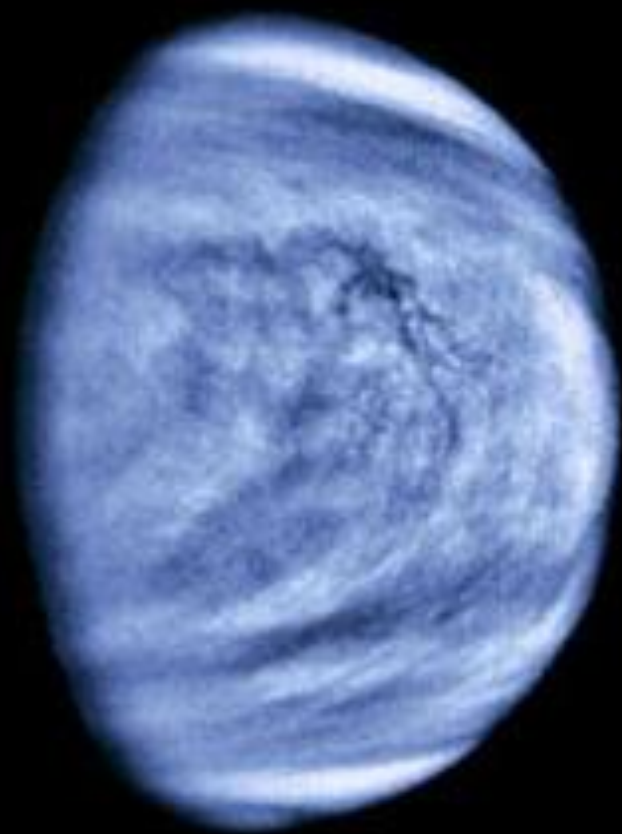
- Are they here?
 - Probably Not
 - Difficulty in keeping secret
 - Not seen by astronomers
- Why do people see UFO's



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ALIENS

- What do we know for sure about Alien life?

NOTHING!

- How many examples of Alien life do we have?

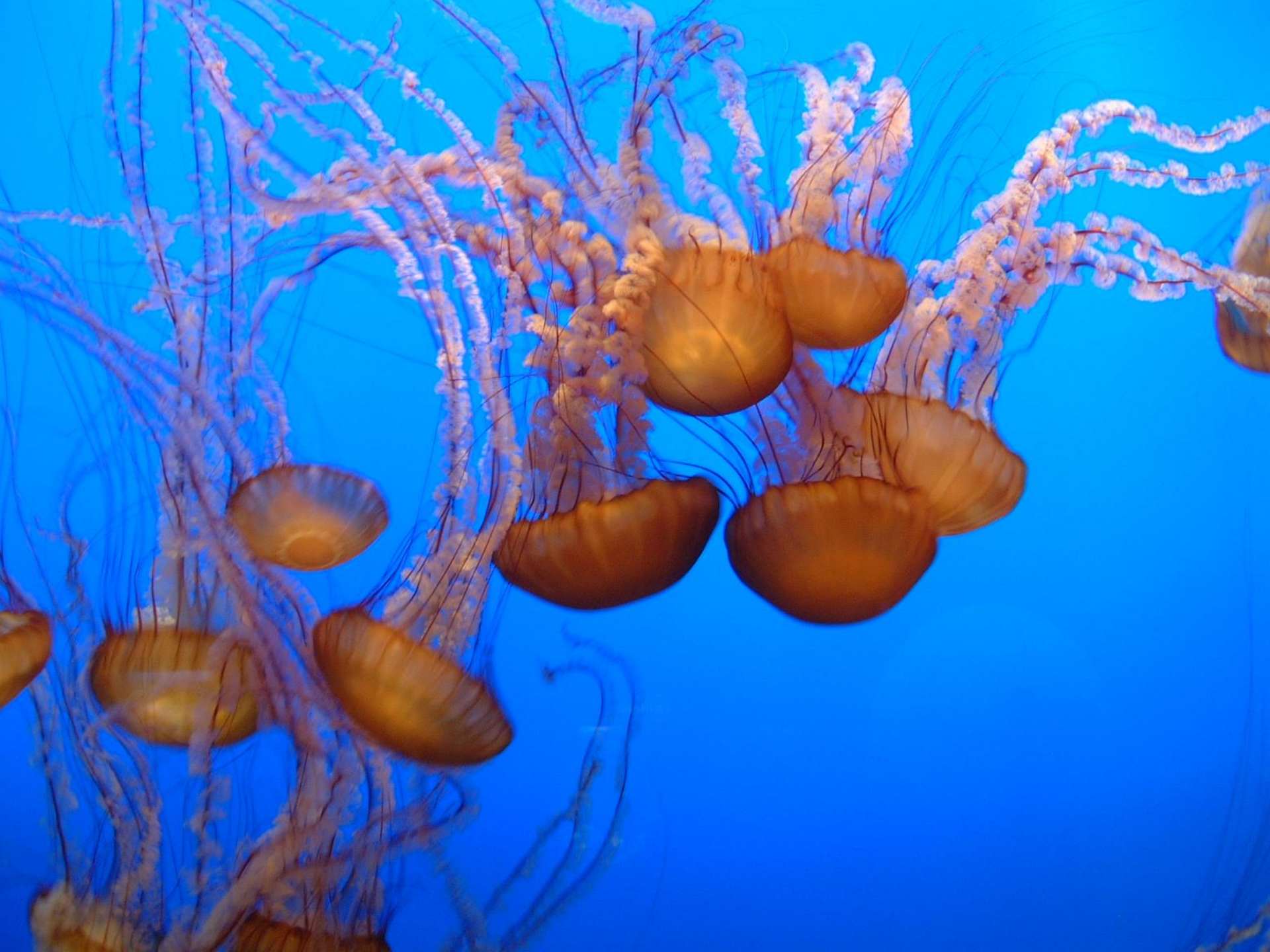
ZERO!

DO ALIENS EXIST?

- Very likely
- Size of the universe.
 - 1,000,000 Stars for every grain of sand on Earth.
- We don't know if any aliens life is close enough for us to learn about it.
- We need to understand the parameters of life on Earth to know where to look.

WHAT DO WE KNOW ABOUT LIFE

- We have only one example of life to draw upon – life on Earth.
- By studying the history of life on earth we can begin to understand how life might develop on other planets.





TARDIGRADE



BANANA



HISTORY OF LIFE ON EARTH

INTELLIGENT LIFE

- Human ancestors have been around about 1 Million years - .02%
- Modern Humans have been around about 200,000 years - .004%
- Civilization has been around for about 10,000 years - .0002%

IF THE ASTEROID DIDN'T HIT



IF THE ASTEROID DIDN'T HIT



WHAT DO WE KNOW ABOUT LIFE

- It arose soon after Earth cooled
- It only arose once
- For $\frac{3}{4}$ of the time life was on Earth it was single celled.
- Intelligent civilized life has only existed on Earth for a very short time.
- Life on Earth requires liquid water.
- Wherever there is liquid water on Earth, there is life.









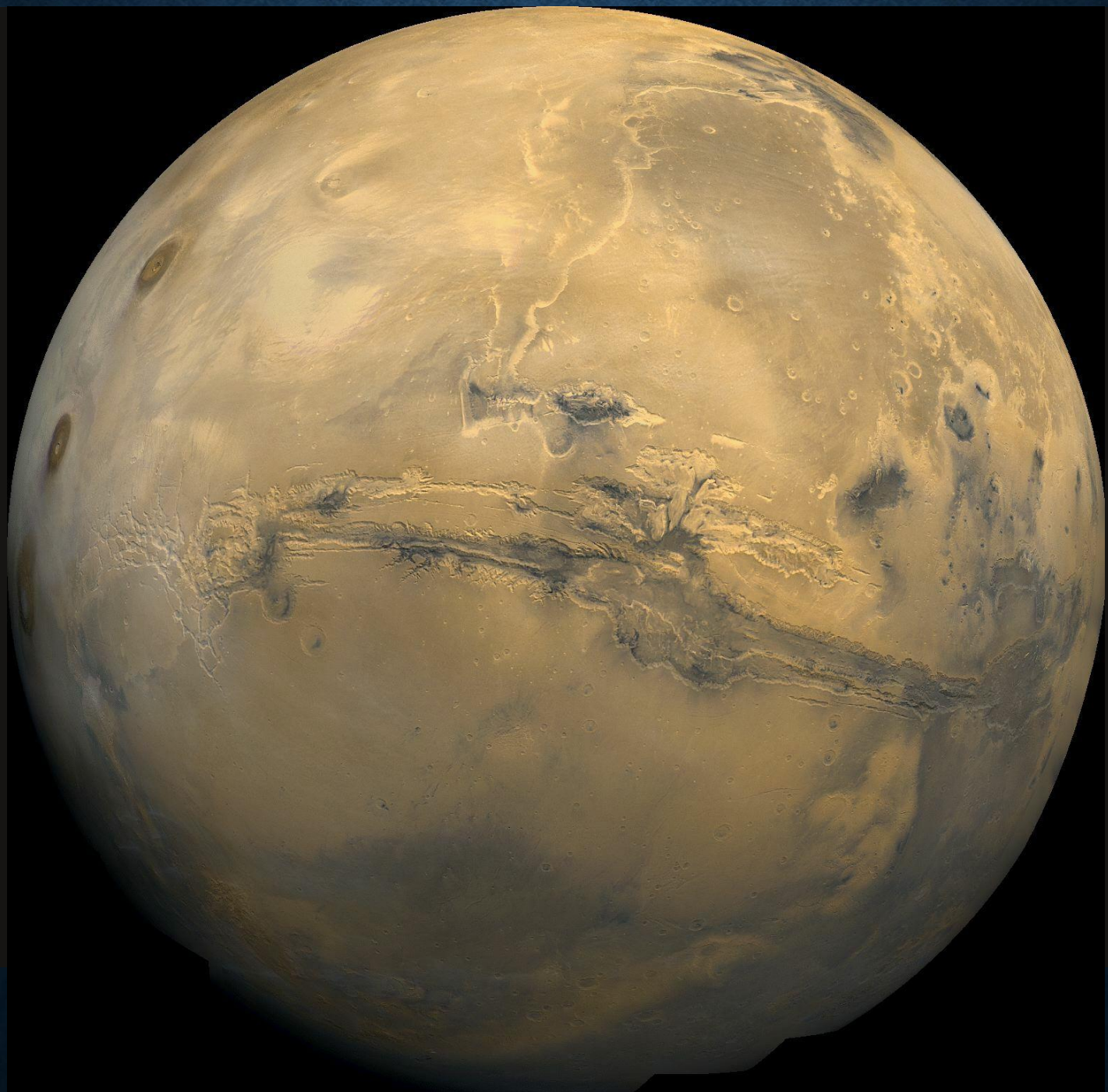


ALIEN LIFE IN OUR SOLAR SYSTEM

- If not in our solar system, it may be a long time before we can study it.
 - 70,000 Years for our fastest spaceship to reach the nearest star
- Where are we looking
 - Mars
 - Some moons

WHAT DO WE KNOW ABOUT MARS?

- Mars once had oceans
- There is a lot of water ice in the ice caps
- There is a mysterious source of Methane
- There may still be liquid water underground

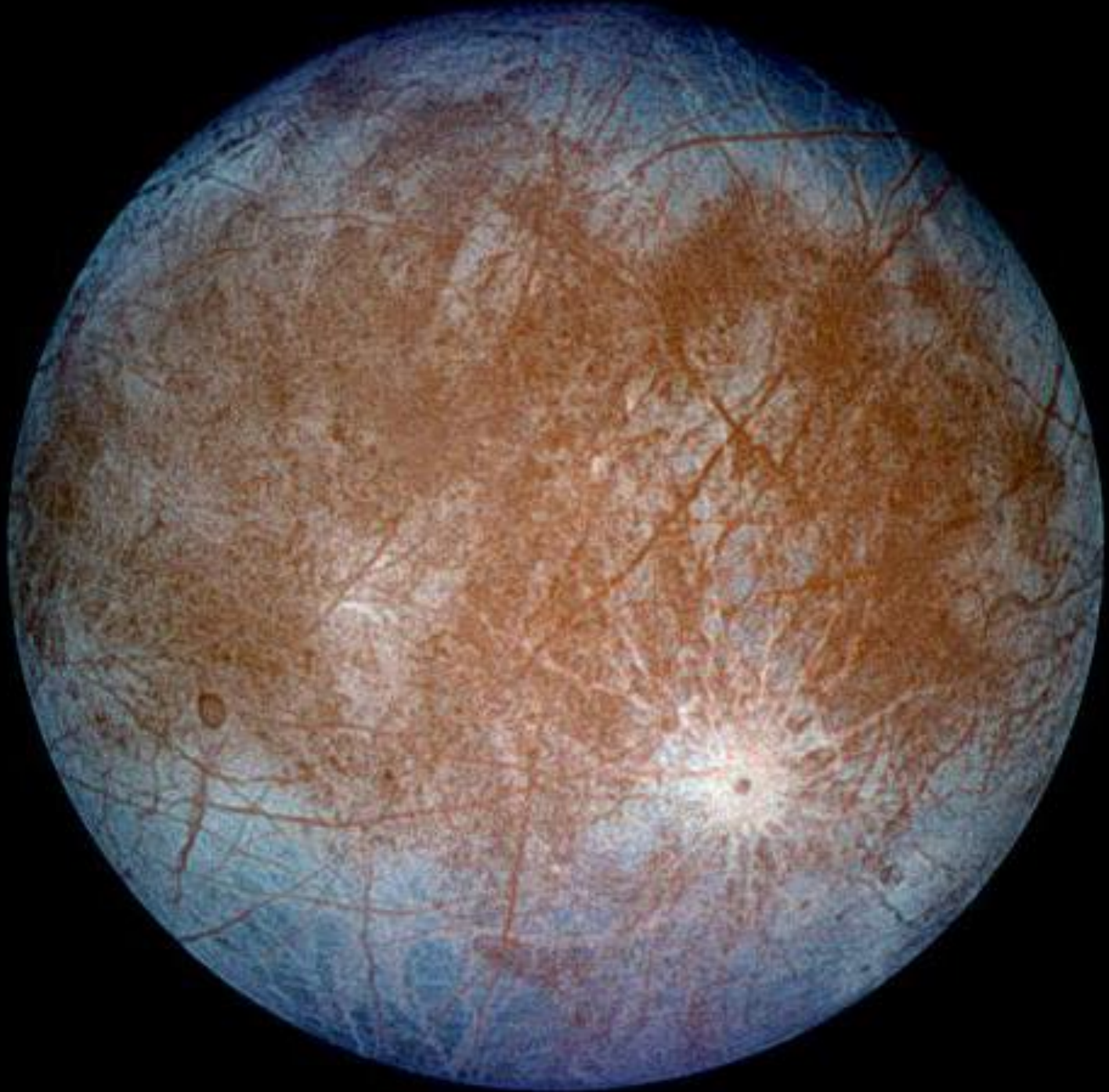




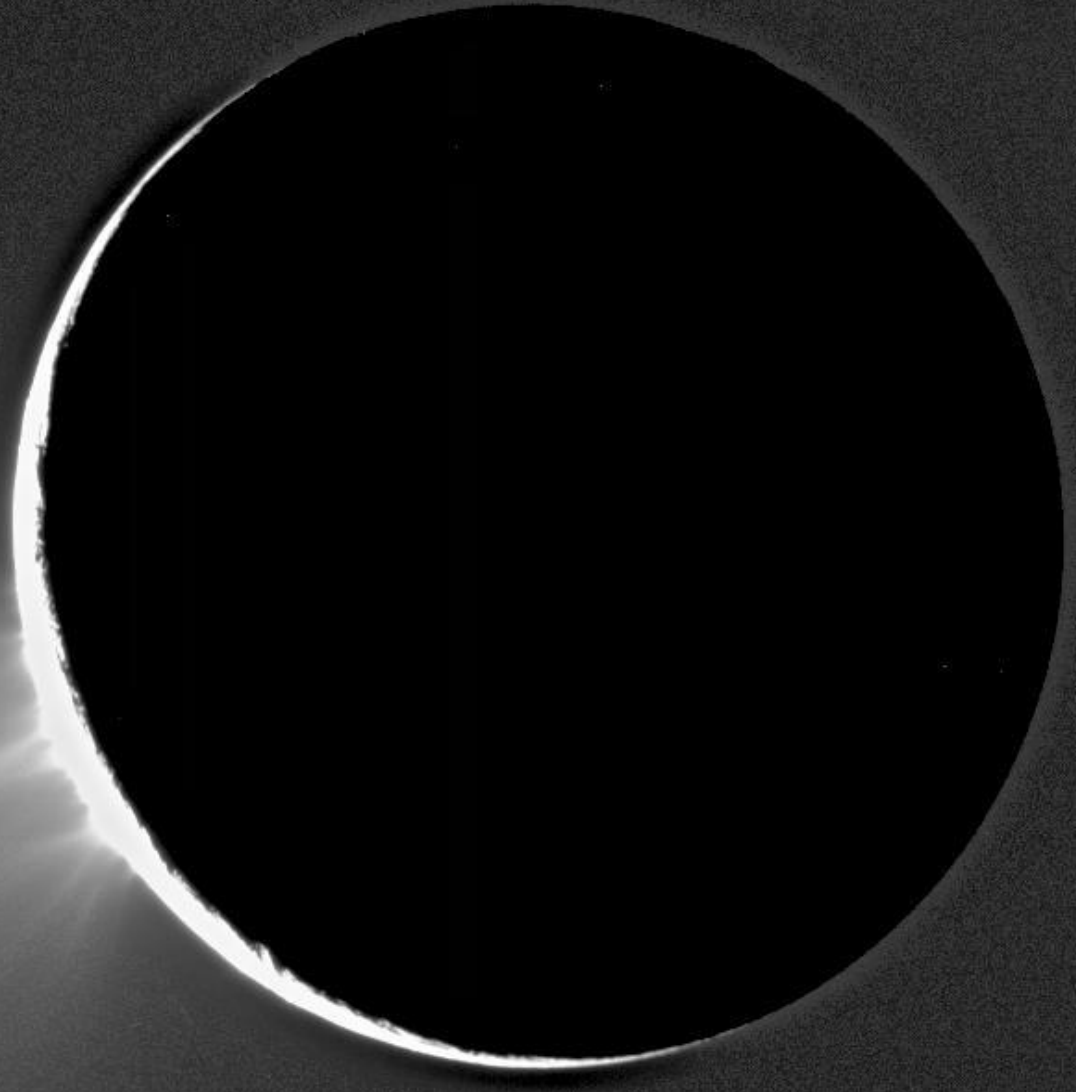
OTHER POSSIBLE WORLDS WITH LIFE IN OUR SOLAR SYATEM

- Europa
- Enceladus
- Titan (not water based)

Europa



Enceladus

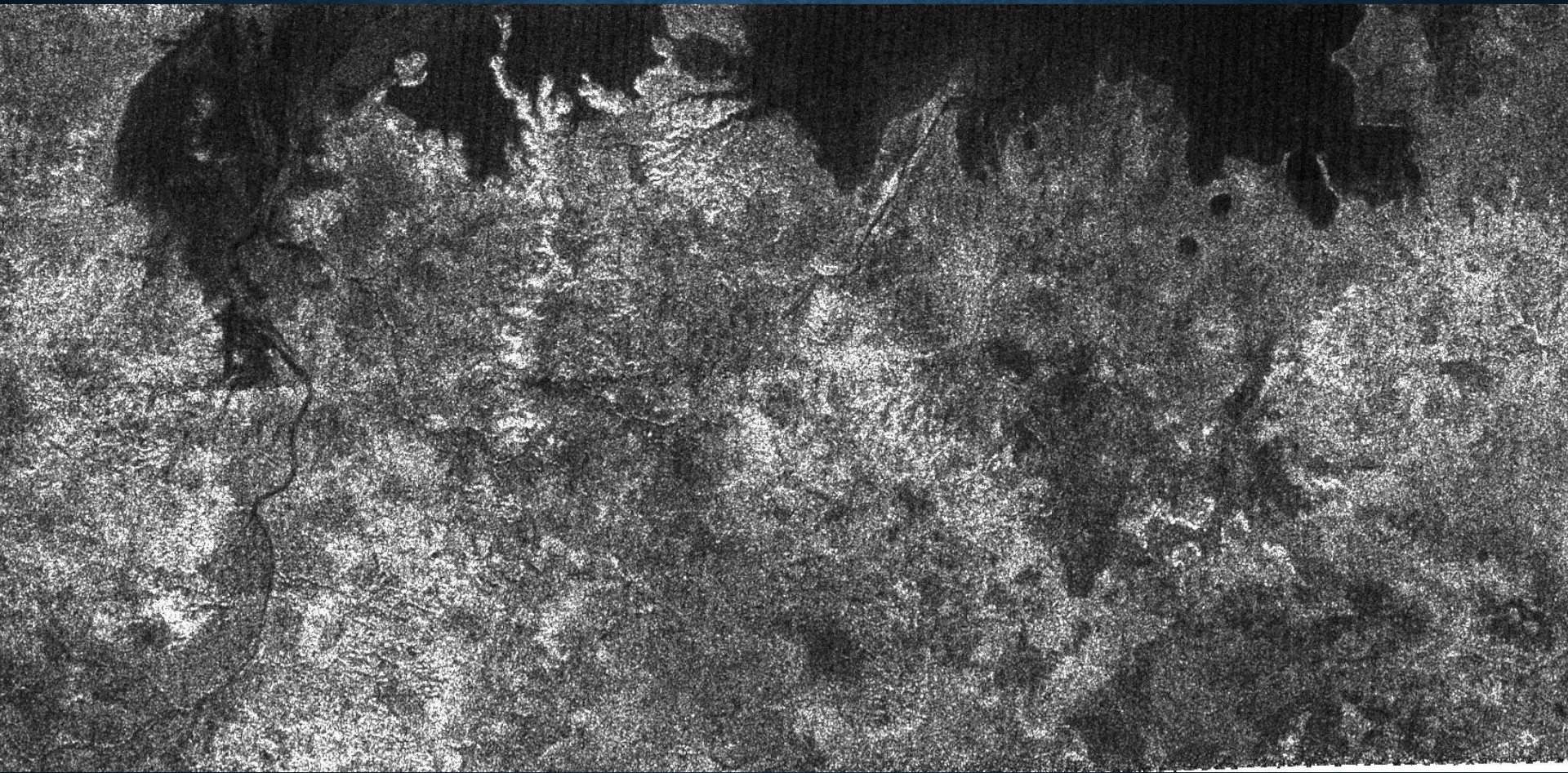


Titan



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Titan



WHAT IF WE FIND ALIEN LIFE IN OUR SOLAR SYSTEM?

- The life we find will not be intelligent nor will it have civilizations or technology.
- Most likely we would find only single cell creatures.

-BUT-

- It will either be the same or not the same as Earth life.

WHAT ABOUT ALIEN LIFE BEYOND OUR SOLAR SYSTEM

- First we need to find habitable worlds.
 - What is a habitable world
 - We assume liquid water is a requirement.
 - We assume that life would not arise on a giant planet or a gas planet.
 - The habitable zone.
 - Part of the Galaxy where life can arise
 - Part of a solar system where liquid water can exist.

SEARCHING FOR PLANETS

- We have found 3924 planets and 657 solar systems.
- We estimate that most of the stars in the galaxy have planets, making about 200,000,000,000 solar systems.

SETI (SEARCH FOR EXTRATERRESTRIAL INTELLIGENCE).

- An effort to find other intelligent beings
- Searches for radio signals which might be used for communications
- Odds of success are low but..
 - If found it would be the most profound discovery in history.
 - How can we not look?



WE'VE SEARCHED DOZENS OF THESE FLOOR TILES FOR SEVERAL COMMON TYPES OF PHEROMONE TRAILS.

IF THERE WERE INTELLIGENT LIFE UP THERE, WE WOULD HAVE SEEN ITS MESSAGES BY NOW.

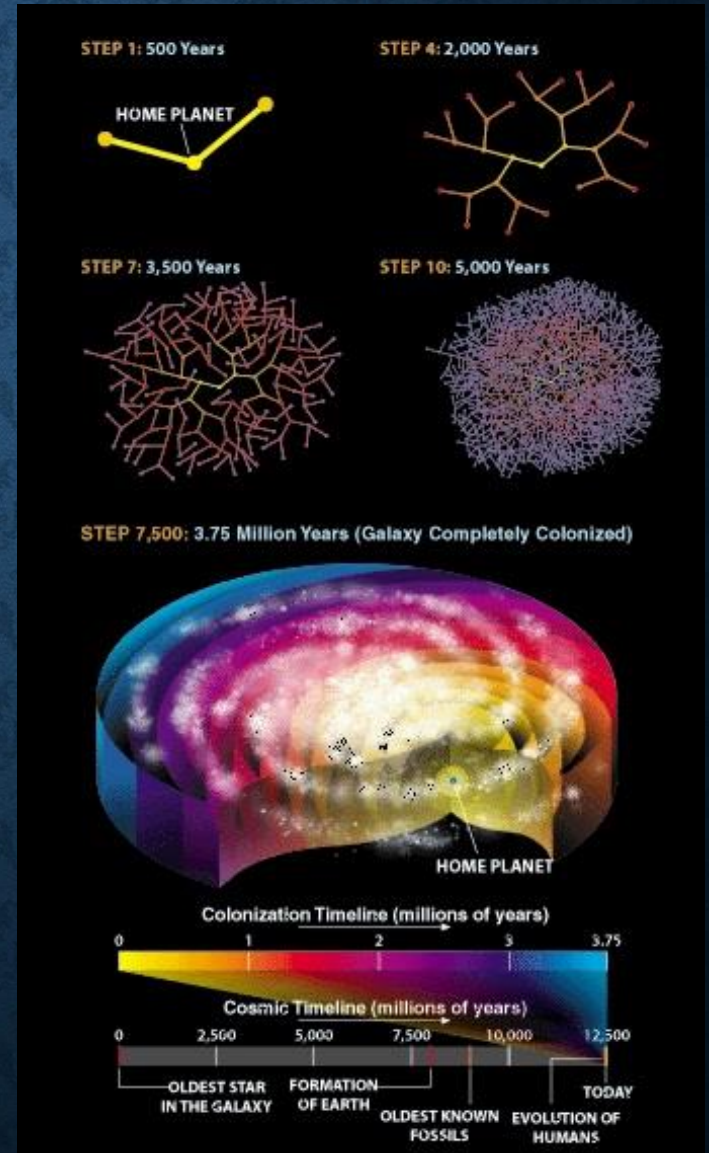


THE WORLD'S FIRST ANT COLONY TO ACHIEVE SENTIENCE CALLS OFF THE SEARCH FOR US.

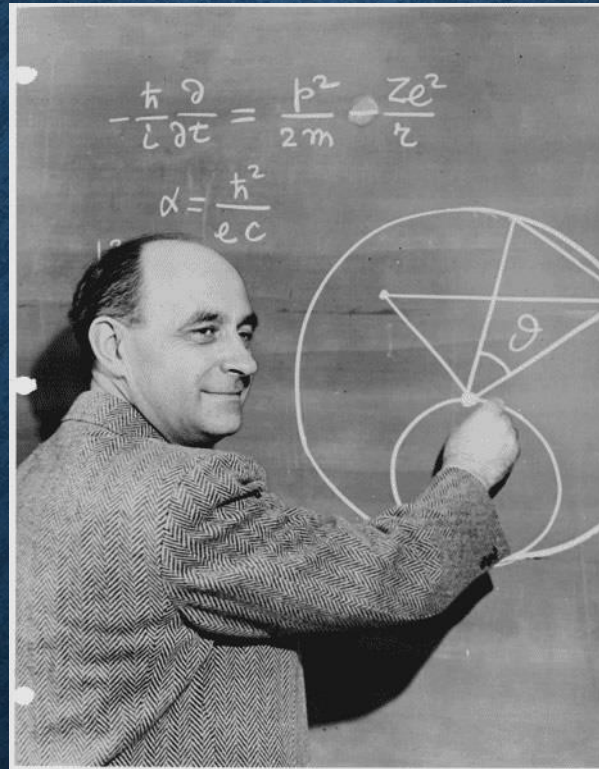
INTERSTELLAR COLONIZATION IS A RAPID, EXPONENTIAL PROCESS.

Mankind's March to the Stars

- Ships that travel at $0.01c$ and take 500 years between stars.
- 5,000 year wait time before dispatching the next ships.
- Inhabited region grows at 0.1% speed of light.
- Fills the Galaxy in 10 to 100 Million Years.



THE FERMI PARADOX



Where is everybody?

THE FERMI PARADOX

- If any civilizations have been around in our Galaxy for at least $\sim 10\text{--}100$ Myr they should have colonized the entire Galaxy by now.
- We should have been visited many times over.
- But, we have no evidence of extraterrestrial visitation, nor have we found any alien artifacts on Earth.

Where is everybody?

THE FERMI PARADOX

A number of solutions have been proposed to explain the Fermi Paradox:

- We are alone... and always have been (Rare Earth Hypothesis)
 - because civilizations blow themselves up (Doomsday Hypothesis)
 - because Nature eradicates us (Inhospitable Universe Hypothesis)
- Civilizations have not colonized the Galaxy...
 - because it's hard
 - because they don't want to
- Civilizations *have colonized the Galaxy but we don't know it*
 - *because they aren't telling us (Zoo or Prime Directive Hypothesis)*
 - *because we can't tell they are there*
- We do have evidence of their existence - but the government won't tell us (UFOs Are Real Hypothesis)

**“ANY SUFFICIENTLY ADVANCED
TECHNOLOGY IS
INDISTINGUISHABLE FROM MAGIC.”**

ARTHUR C. CLARK
APR 28, 2013

END