

Why Earth?

2013-Jan-05

Jonathan Stahl



Are you special?

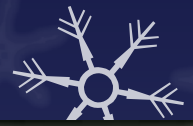
- Are we special?
- Is Earth special?



● Travel ... Video next...



Let's take a journey... (5min video)



Quick note on time

- Ex 4:67 - Again, the Lord said to him, "Put your hand inside your cloak." And he put his hand inside his cloak, and when he took it out, behold, his hand was leprous like snow. 7 Then God said, "Put your hand back inside your cloak." So he put his hand back inside his cloak, and when he took it out, behold, it was restored like the rest of his flesh.





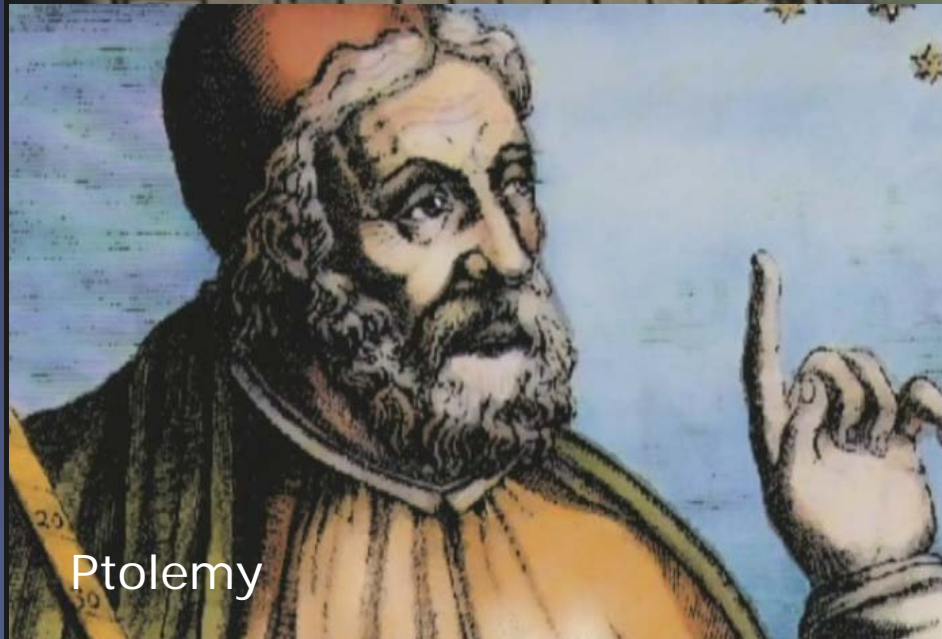
“In long, slow motion moments of immense majesty, there emerges a sparkling blue and white jewel. It takes more than a moment to fully realize this is Earth...home.”

EDGAR MITCHELL, ASTRONAUT

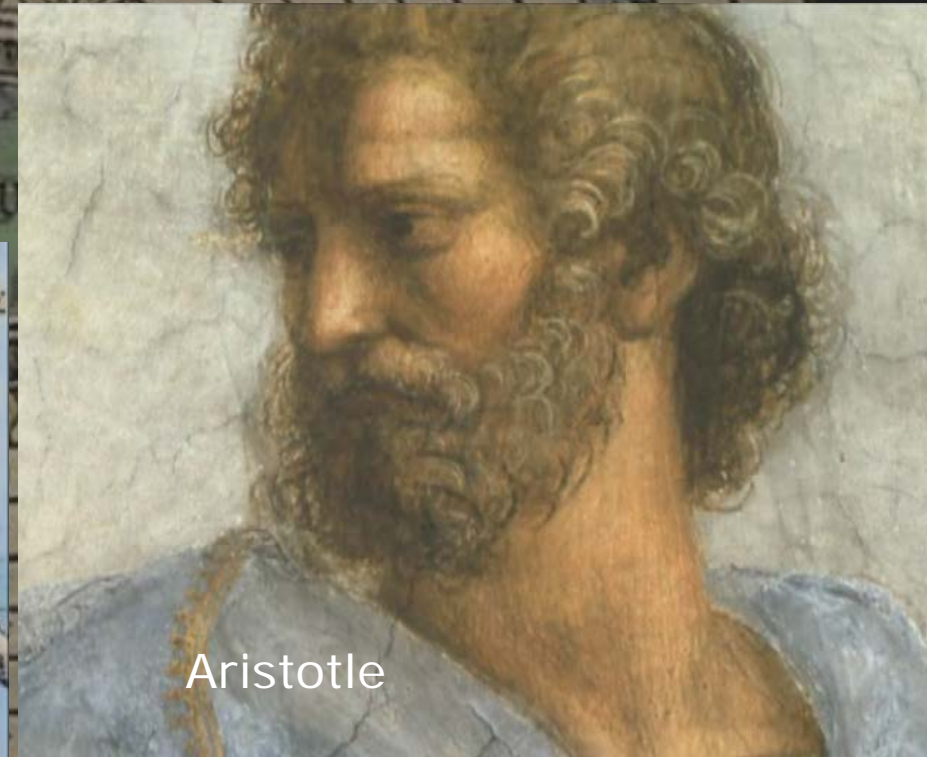


For 1800 years, the geo-centric model

- Aristotle and Ptolemy taught this
- Earth sat motionless
- Plane [flat] geometry actually works



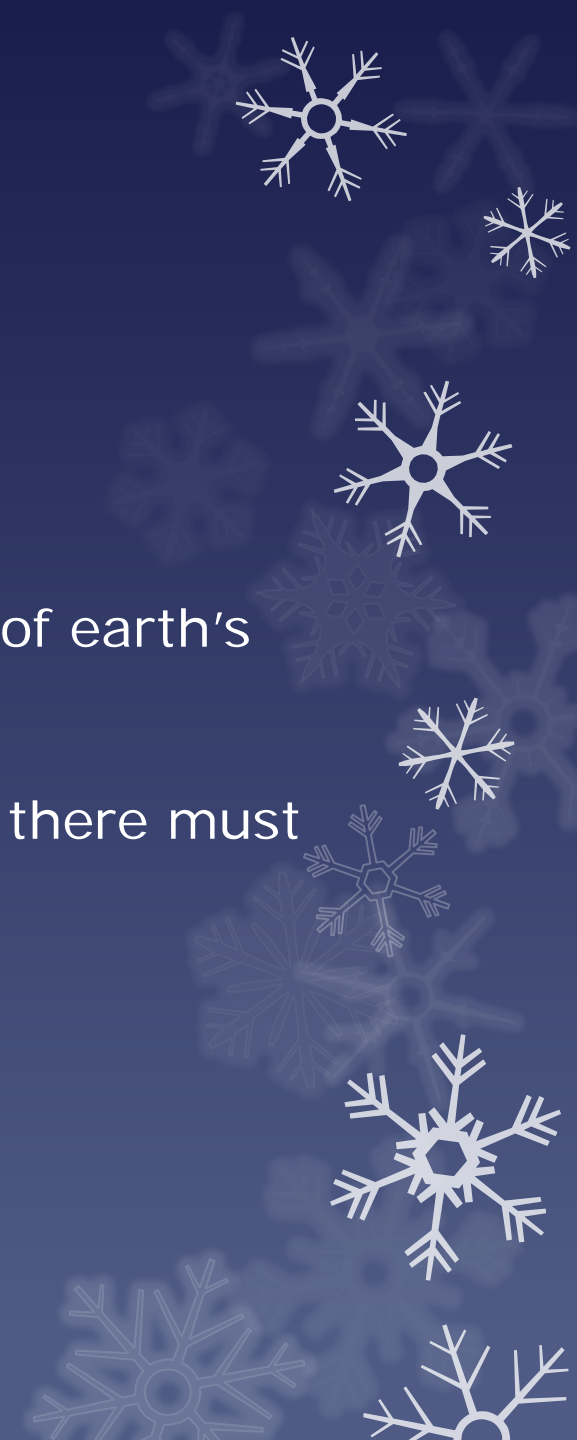
Ptolemy



Aristotle

We and Earth are just an accident???

- Carl Sagan believed there are millions of earth's out there just like our's
- Because accidents happen all the time there must be, right? [jws]



Let's take a journey... (5min video)

- Remember, a light-year is not a measurement of _____ but rather _____
- Remember, a light-year is not a measurement of **TIME** but rather **DISTANCE**

Are we on just a "Pale blue dot" ?



Copernican Principle

- 1543 – Polish astronomer Copernicus
- Earth was not in center, but rather the sun
- But 400 years later evolved into a situation where earth was in no special place...rather it was just hanging out in space
- Theory of the motion of planets in the sky
- But, it evolved into the Principle of Mediocrity:
 - We are not special
 - That the universe was NOT designed for us
 - 1970-80 – Carl Sagan: we are not special



1970-1980's – The Pale Blue Dot

Our planet is a lonely speck
in the great enveloping cosmic dark.

CARL SAGAN

Edwin Hubble

- From earth saw specks of light ... Hubble saw these as individual galaxies: extension of Copernicum Principle
- 100 billion stars in Milky way – see we are not special was the argument by others
- Before Hubble's discoveries, many thought we were on the edge of the universe and nothing else was really out there
- Are we special?



Hubble discovered that these little dots...

- We originally thought to be large pockets of gas
- Rather they are entire galaxies

We are NOT special



The universe is populated by
innumerable Earths and, perhaps,
innumerable forms of life.

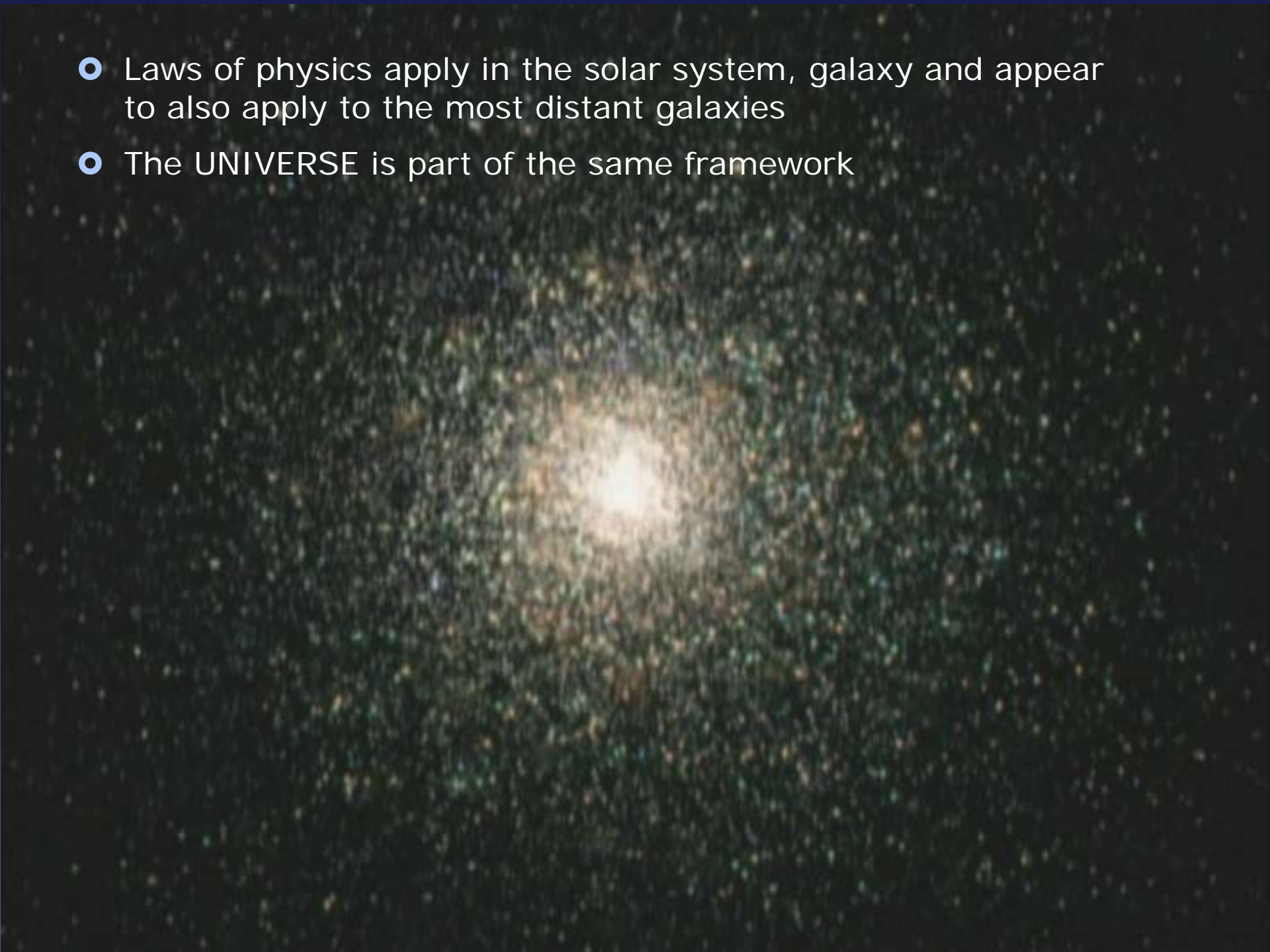
ROBERT JASTROW

More than 1 earth found?

- As many as 10,000 billion-billion star systems
- More than 100 planets found
- It takes a LOT of factors for a functional "earth"



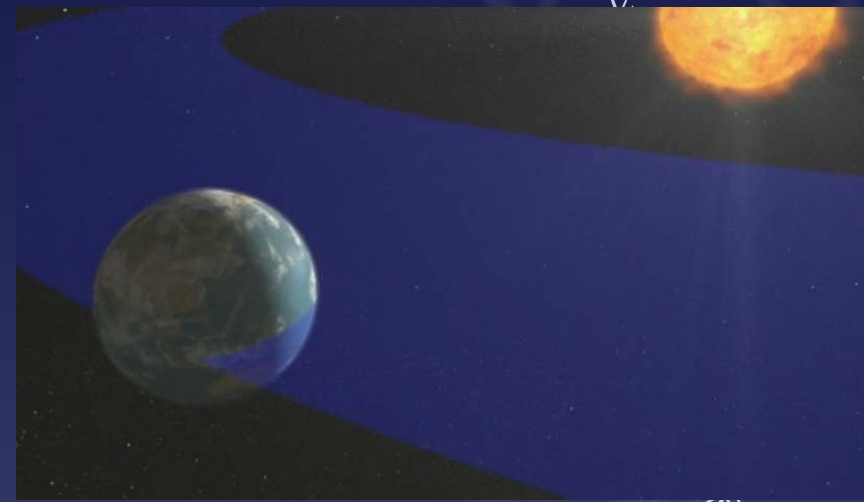
- Laws of physics apply in the solar system, galaxy and appear to also apply to the most distant galaxies
- The UNIVERSE is part of the same framework



Location, Location, Location!



Location is crucial

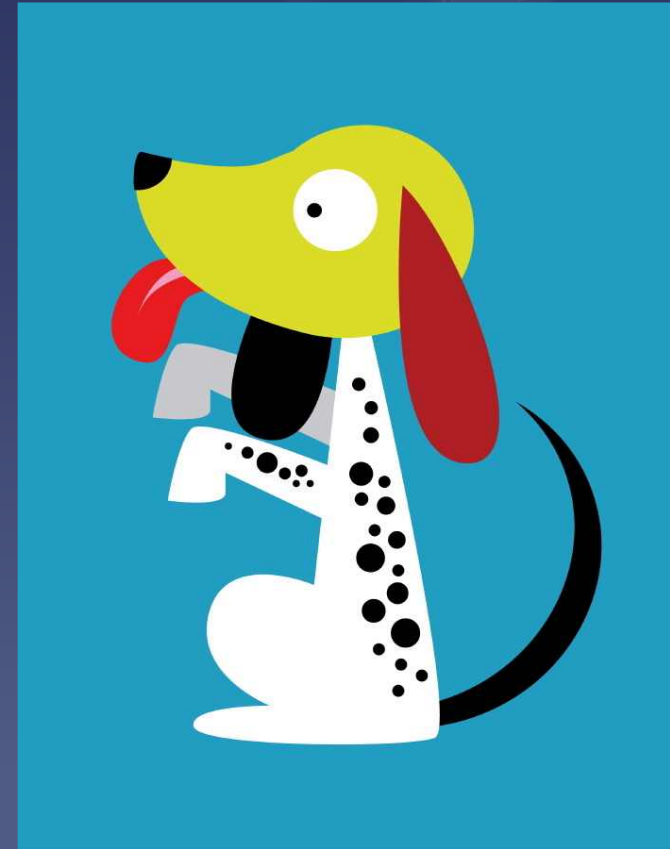


- (14:54) Must have LIQUID WATER FOR LIFE (but you need much more than just water)
- If 5% closer ... too hot (Venus) 900 degrees F
- 20% farther away... ice and cold (Mars)



Recipe for Life?

- Copernican principle: just need water (in a nutshell)
- For those who want to believe in this de-evolution of Copernican principle, then they have a really simply recipe:
 - Water
 - And an accident
 - LIFE??????????????????
 - That's not usually what we get, do we ???



Recipe: add Water

- Is the key to life for carbon-based life
- Universal solvent
- Transfer nutrients
- Hinged on distance from the sun
- Ice floats (not sinks)
- Ice is insulation
- Vapor for easy transport
- 3 phases with no loss of molecular structure: ice to water to vapor in any direction and it always remains the same
- Unmatched capacity to absorb heat from sun

78% NITROGEN
21% OXYGEN
1% CARBON DIOXIDE

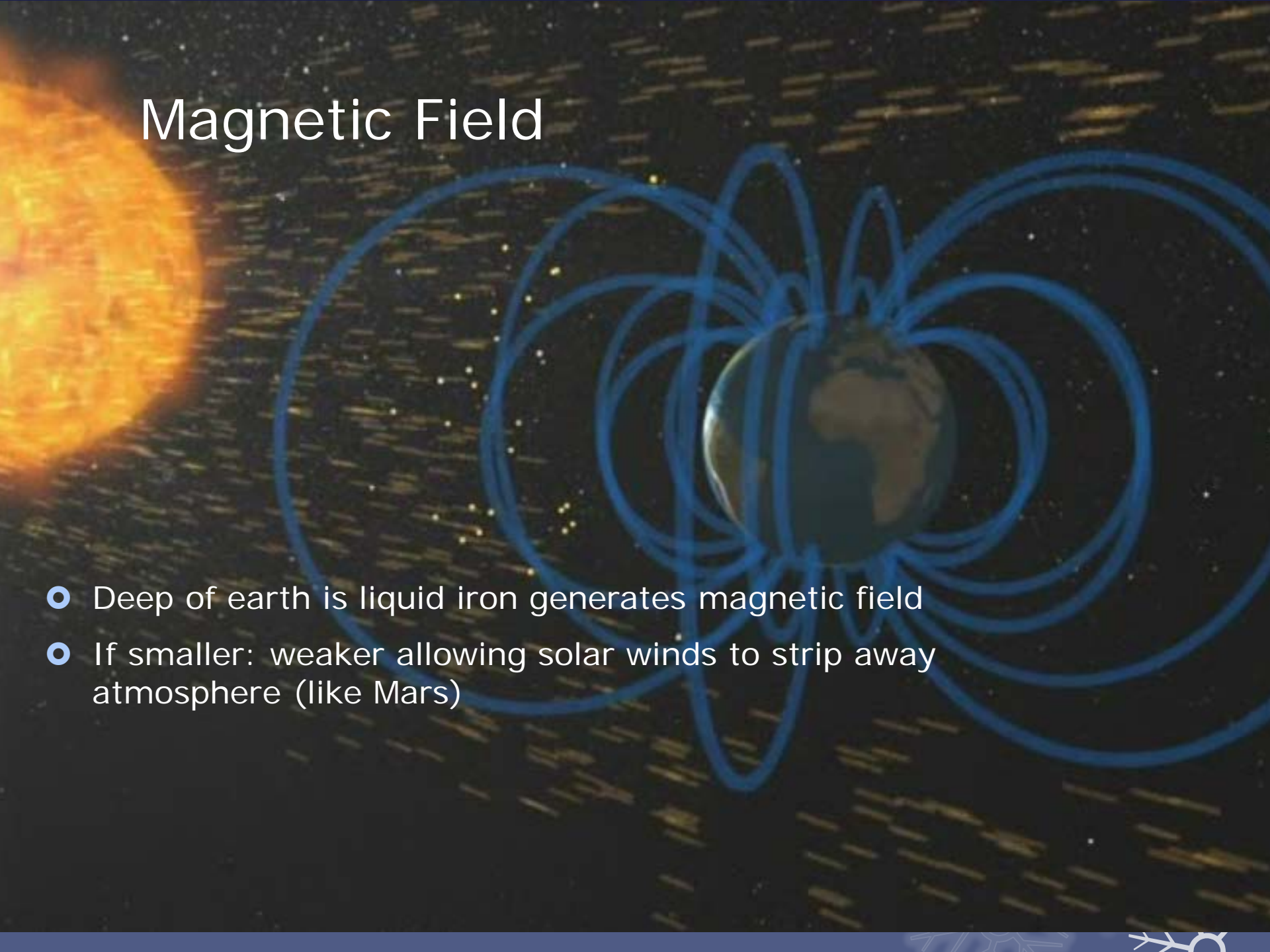
Preference: Stuffed, Thick or Thin Crust?

- 4 – 30 miles thick
- If much thicker, then tectonics would not work
- Constant motion
- Regulates internal core temperature
- Recycles carbon
- Mixing chemical elements

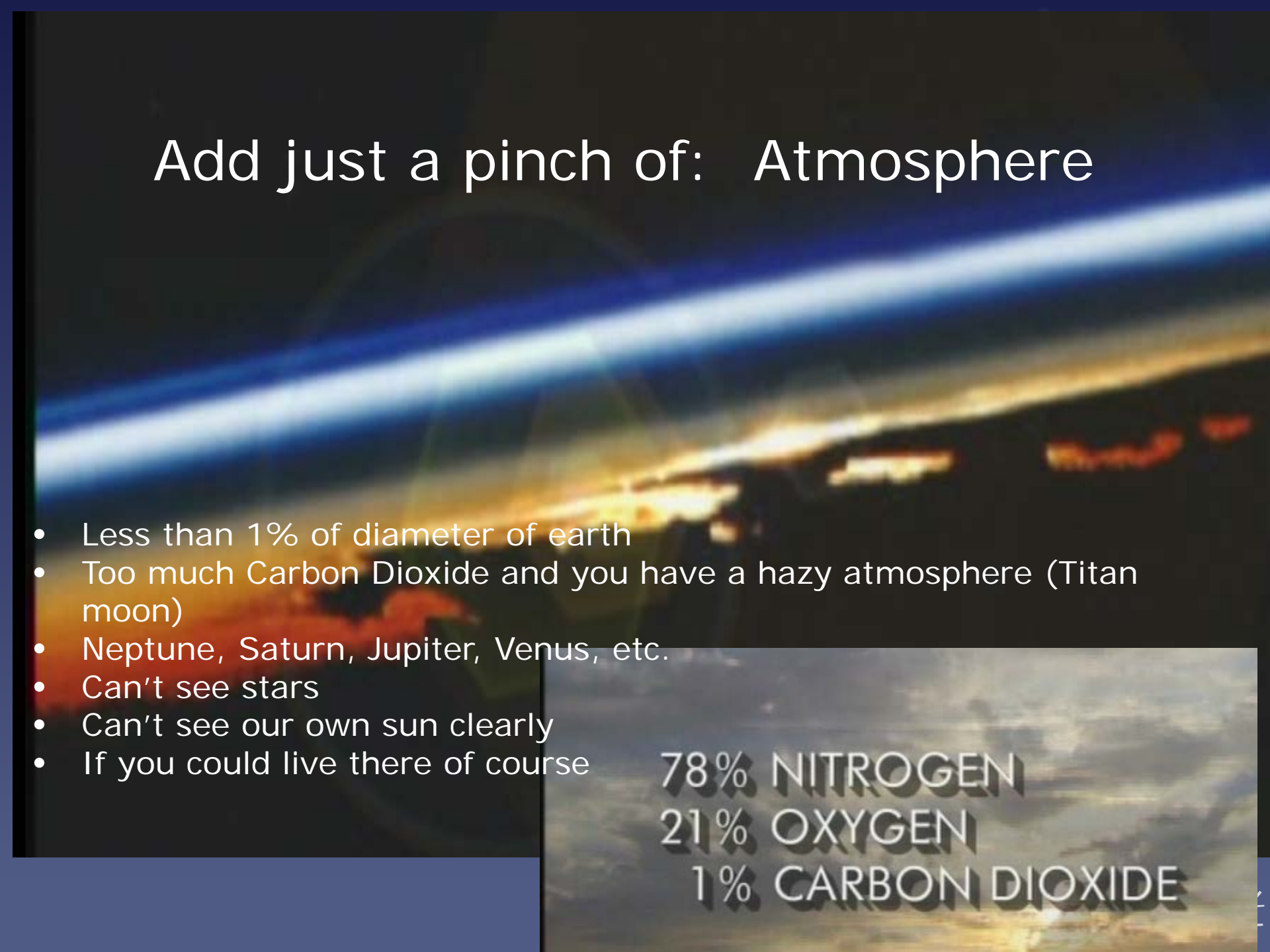


Magnetic Field

- Deep of earth is liquid iron generates magnetic field
- If smaller: weaker allowing solar winds to strip away atmosphere (like Mars)



Add just a pinch of: Atmosphere

The background of the slide is a composite image. The top half shows the Earth's atmosphere as seen from space, with a thin blue and white layer curving over a dark surface. The bottom half shows a close-up, hazy atmosphere with a strong orange and red glow, suggesting a thick, carbon dioxide-rich atmosphere like that of Venus or Titan.

- Less than 1% of diameter of earth
- Too much Carbon Dioxide and you have a hazy atmosphere (Titan moon)
- Neptune, Saturn, Jupiter, Venus, etc.
- Can't see stars
- Can't see our own sun clearly
- If you could live there of course

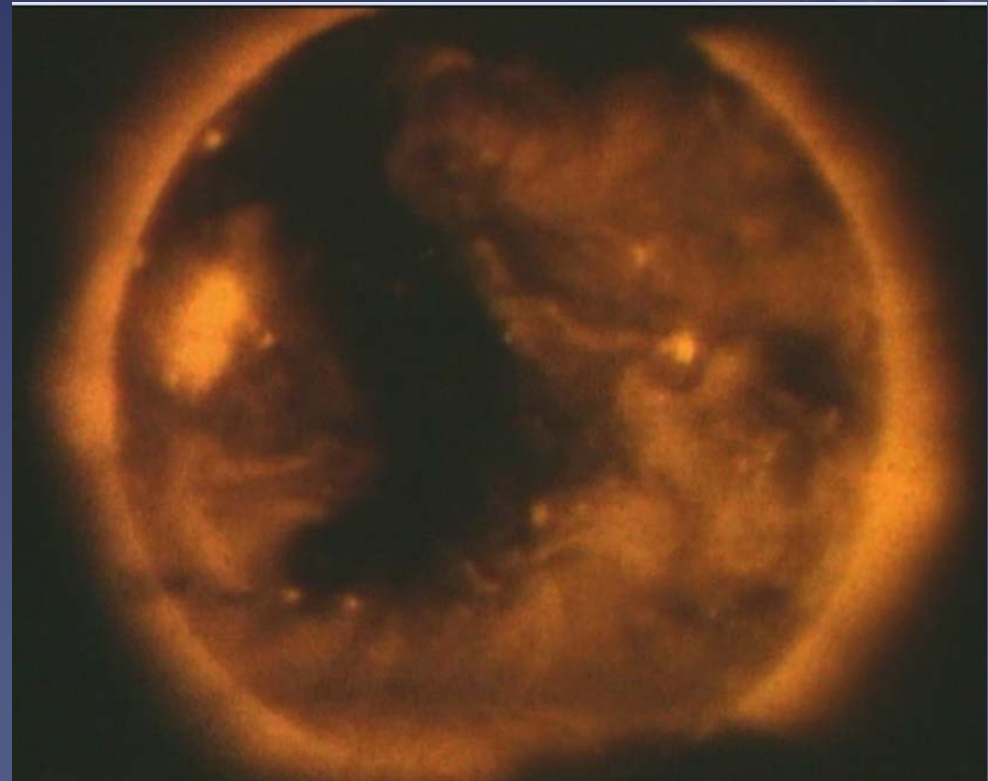
78% NITROGEN
21% OXYGEN
1% CARBON DIOXIDE

Add a dose of: Large Moon

- ¼ size of earth
- Stabilizes earth's angle at about 23.5 degrees
- Moves the waters

Add Heat: Spectral-style G2 dwarf star

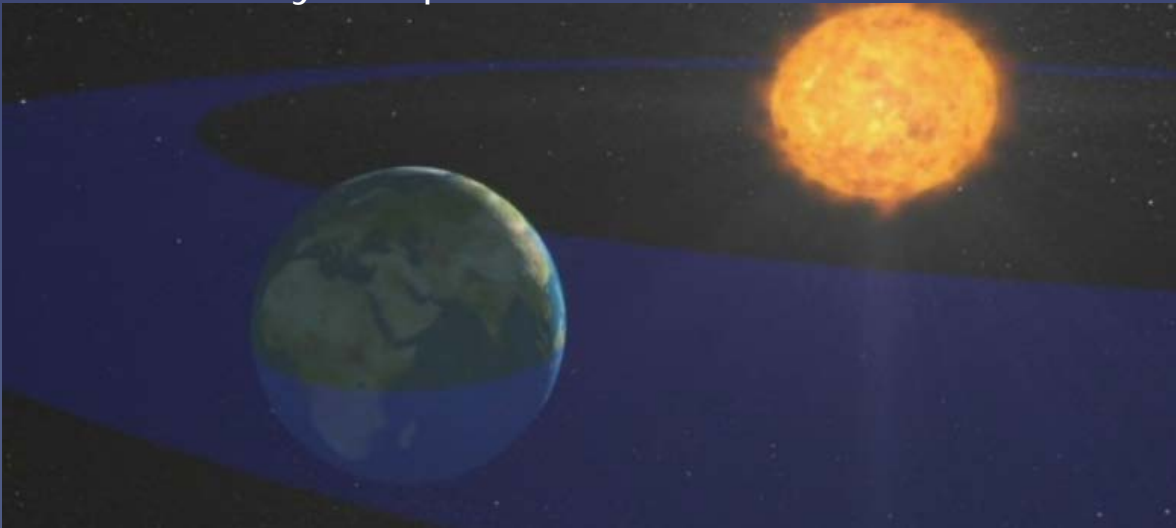
- 90% of most other stars are SMALLER than our own.
- If our sun was smaller, then we would be closer to the sun increasing the pull of gravity
- If bigger, ...



If closer due to smaller sun....



- Knock our rotation into synchronization with its orbiting
 - Thus one side of earth would continually be hit with radiation from solar flares
- The dark side would never face the sun and be
 - Forever freezing and ice
 - Unlikely complex life could thrive in that environment



Correct location in the galaxy



Actual known recipe for complex life?

- ✓ Within galactic habitable zone
- ✓ Orbiting main sequence G2 dwarf star (not too hot or too cold)
- ✓ Protected (shielded) by giant gas planets
- ✓ Within circum-stellar habitable zone
- ✓ Nearly circular orbit
- ✓ Oxygen-rich atmosphere
- ✓ Correct mass
- ✓ Orbited by large moon (help stabilize tilt of planet, circulate water)
- ✓ Correct strength of magnetic field
- ✓ Plate tectonics
- ✓ Correct ratio of liquid water and continents
- ✓ Terrestrial planet
- ✓ Moderate rate of rotation
- ✓ At one place and at one time
- ✓ Properly measured and mixed in just the right order



Imagine the formula for life

- What if you take all the currently known components needed for life ... what would that formula look like?



The equation for life?



$$\begin{array}{cccccccc} \mathbf{N} & \mathbf{x} & \mathbf{f_{sg}} & \mathbf{x} & \mathbf{f_{ghz}} & \mathbf{x} & \mathbf{f_{cr}} & \mathbf{x} \\ \mathbf{f_{sp}} & \mathbf{x} & \mathbf{f_{chz}} & \mathbf{x} & \mathbf{n_p} & \mathbf{x} & \mathbf{f_j} & \mathbf{x} \\ \mathbf{f_c} & \mathbf{x} & \mathbf{f_o} & \mathbf{x} & \mathbf{f_m} & \mathbf{x} & \mathbf{f_{cp}} & \mathbf{x} \\ \mathbf{f_{mn}} & \mathbf{x} & \mathbf{f_w} & \mathbf{x} & \mathbf{f_t} & \mathbf{x} & \mathbf{f_l} & \mathbf{x} \\ \mathbf{f_i} & \mathbf{x} & \mathbf{f_r} & \mathbf{x} & \mathbf{f_{lc}} & \mathbf{x} & \mathbf{f_{lt}} & \end{array}$$



The equation

- If you assign a conservative value of 1 in 10 per value

$$\begin{aligned} &10^{11} \times 1/10 \times 1/10 \times 1/10 \times \\ &1/10 \times 1/10 \times 1/10 \times 1/10 \times \\ &1/10 \times 1/10 \times 1/10 \times 1/10 \times \\ &1/10 \times 1/10 \times 1/10 \times 1/10 \times \\ &1/10 \times 1/10 \times 1/10 \times 1/10 \end{aligned}$$

The equation

- One thousandth trillion-ith of a trillion
- Can't happen statistically
- Evidence is pushing us to acknowledge this just is not going to happen



We might be RARE, but we are certainly SPECIAL



N	x	fsg	x	fghz	x	fcr	x
fsp	x	fchz	x	np	x	fj	x
fc	x	fo	x	fm	x	fcp	x
fmn	x	fw	x	ft	x	fl	x
fi	x	fr	x	flc	x	flt	

Solar eclipse: Important?

- From Northern India
- Predictable
- 51 seconds
- Rare event



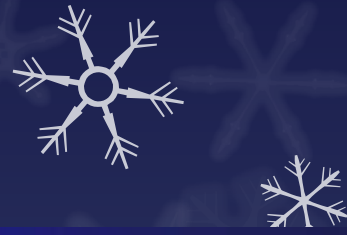
Recipe for an Eclipse

- Moon has to appear as a similar size of sun
- Sun is 400 larger than moon, but 400 times farther away
- In a straight line
- Giant natural experiment: to understand the sun!!!



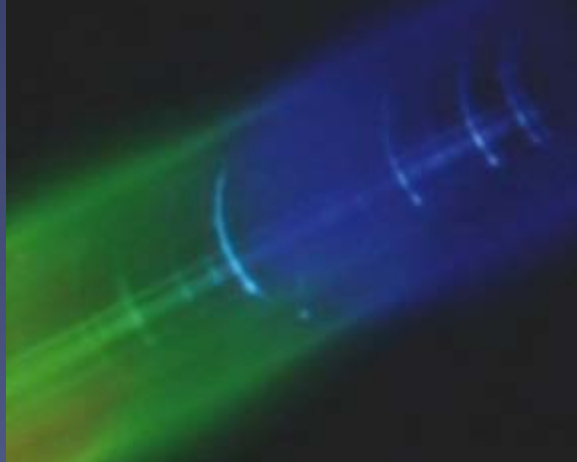
What can you do ONLY with a perfect eclipse...

- Measure sun's atmosphere!



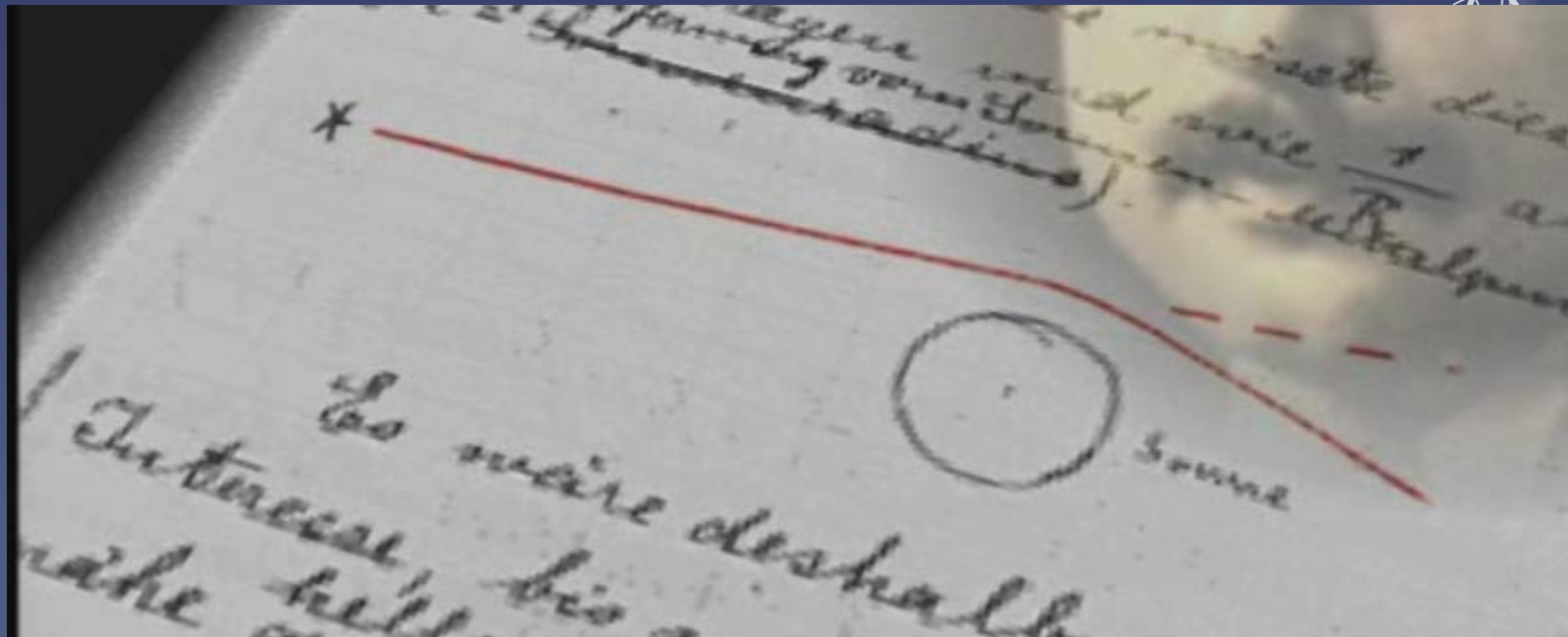
Only from an eclipse do we see: Flash Spectrum

- Discovery of Flash Spectrum was only discovered from our eclipse
- Provides single greatest information about a star
- If moon was too big or too small, no perfect eclipse
- If sun was too big or too small, no perfect eclipse



Our Eclipse PROVED something else crucial....

- 65 other eclipses on other planets, etc. only EARTH has observers to view the eclipse
- May 29, 1919 - Sun's gravity bent light from distant star as Einstein predicted but PROVEN from eclipse



Electro-magnetic spectrum

- Only a EXTREMELY NARROW part of it [all light frequencies] supports life (like photo-synthesis)
- But that narrow part also shows us the universe
- Light is a FREQUENCY !!!



Experimental Location

- Best place in galaxy for discoveries is EARTH



Our galaxy

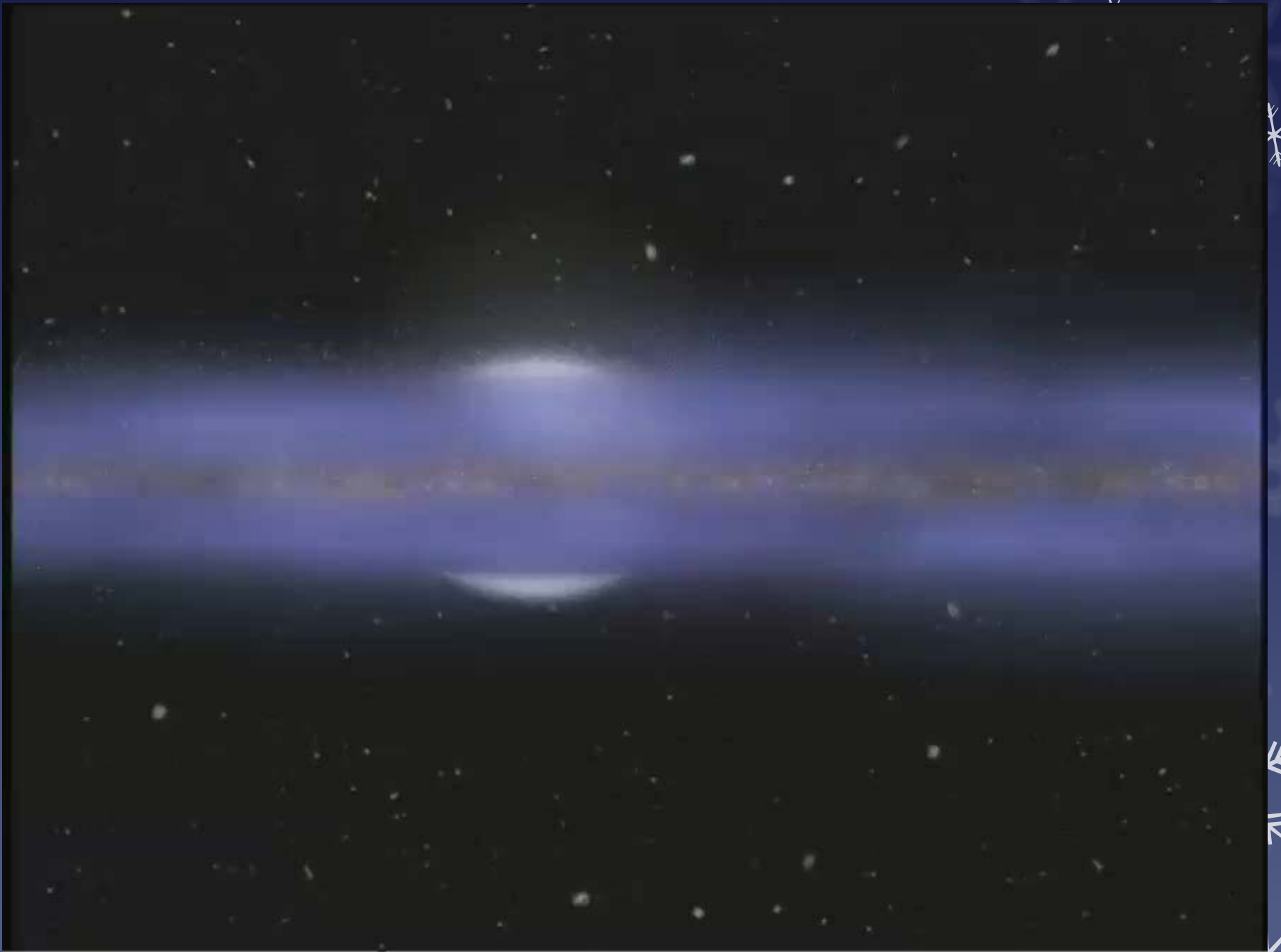
- Flat
- Spiral arms
- Spherical bulge in the center
- We live about half-way from the center to the edge



Play video clip (next slide)

- Location is everything!





Galaxies have a lot of dangers

- The Galactic CENTER is the most dangerous
 - Star concentration, super-novas, etc.
 - Black-hole in center
 - Radiation

The outer edge

A diagram of a spiral galaxy with a blue ring labeled "GALACTIC HABITABLE ZONE" around its core. The galaxy is shown in a perspective view, with the core at the center and spiral arms extending outwards. The blue ring is positioned between the core and the outer edges of the galaxy, indicating the region where life is most likely to exist. The text "GALACTIC HABITABLE ZONE" is written in blue capital letters along the inner edge of the ring.

GALACTIC HABITABLE ZONE

- Our area: Iron, magnesium, silicon, oxygen
- Outer edge these heavy elements are not as plentiful

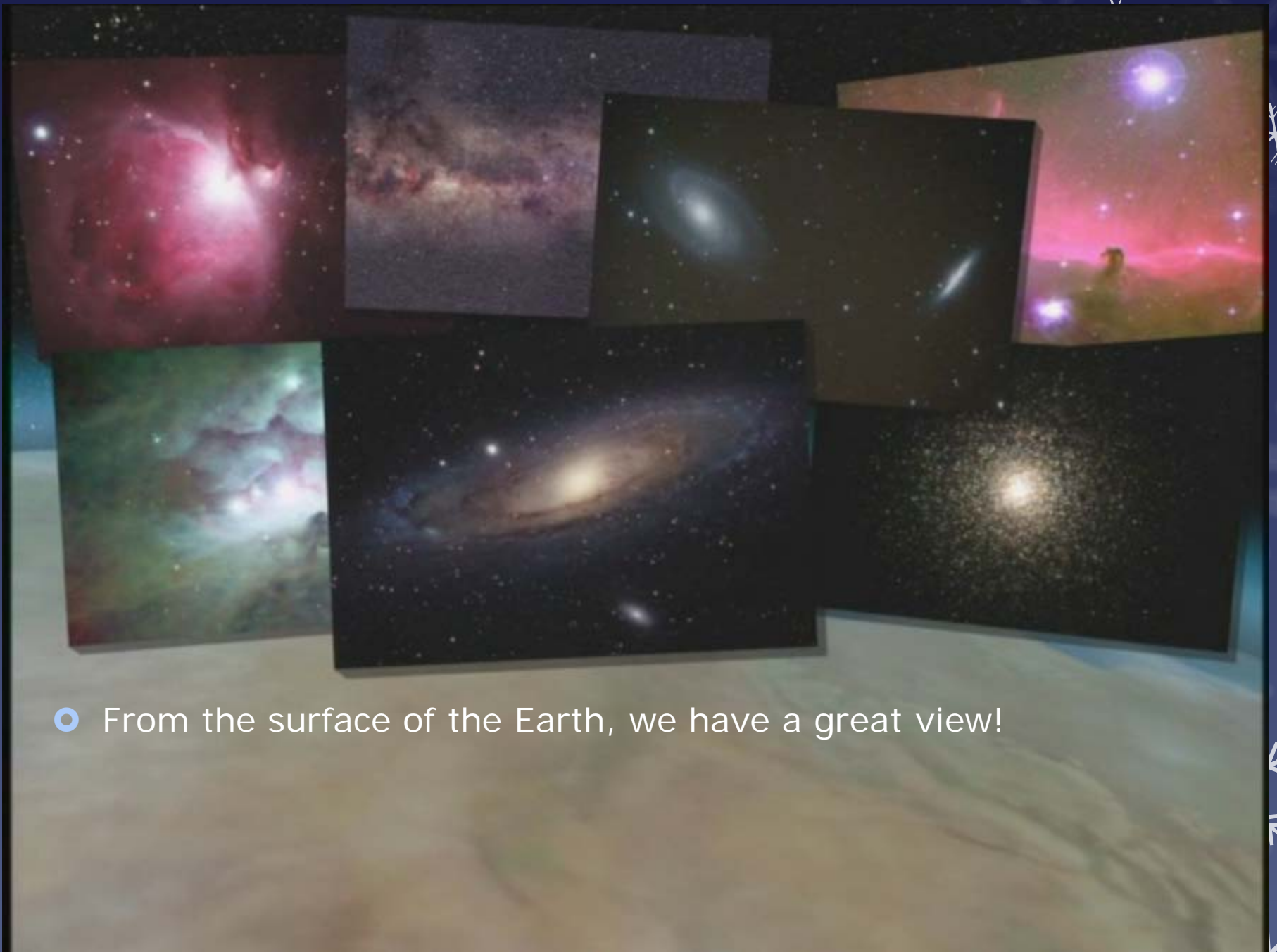
Even within habitable zone, dangers!

- You don't want to be too close to a spiral arm!
- We are right in the middle of a spiral arm
- Location is "perfect"



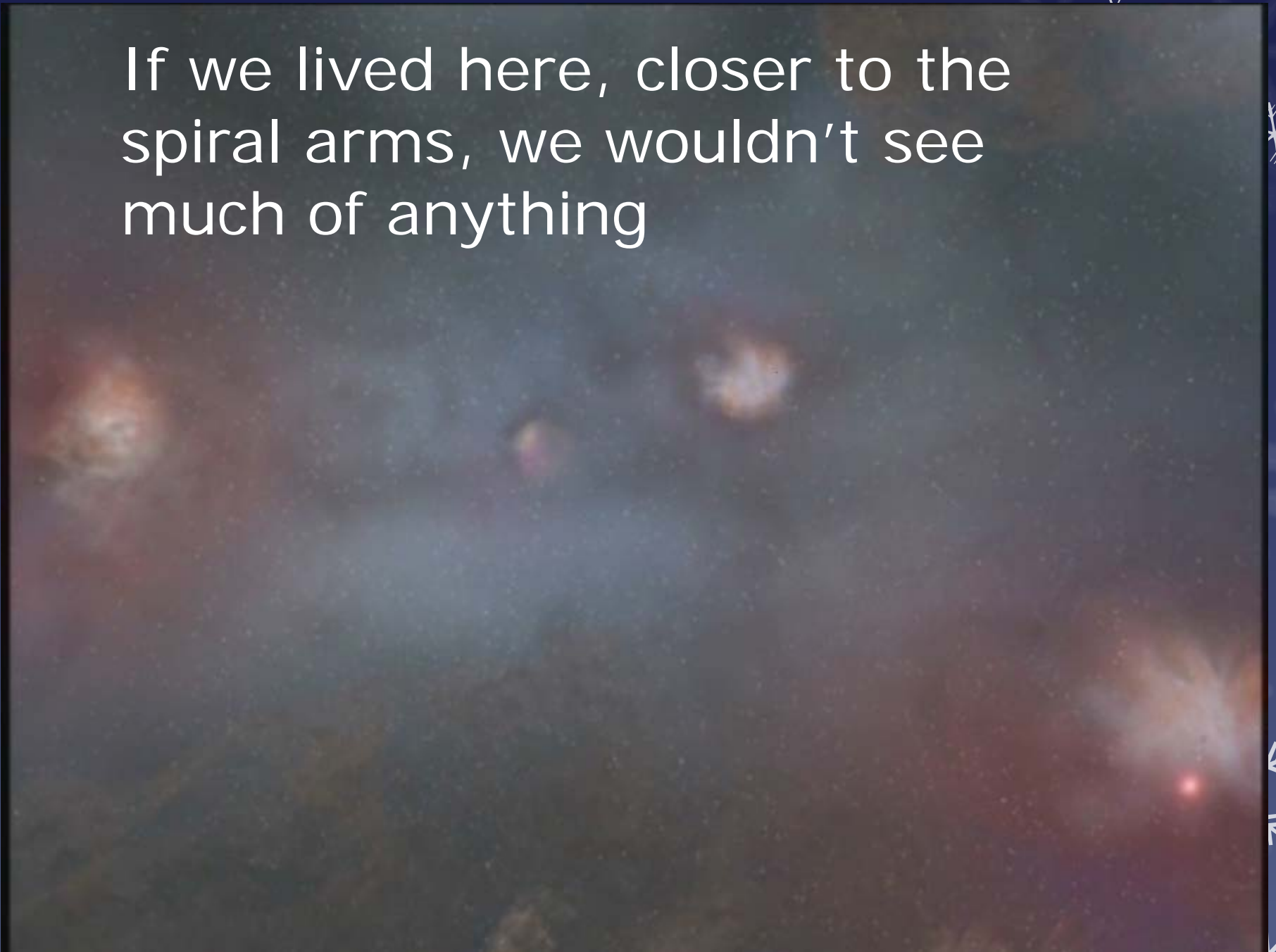
Earth in best setting for astronomical research


- Mid-plane of a flat galaxy
- Between spiral arms
- In a low-dust section of galaxy
- We can see both our own galaxy layout
- AND, distant galaxies from our own backyard
- And, we can understand and measure galactic scale



- From the surface of the Earth, we have a great view!

If we lived here, closer to the spiral arms, we wouldn't see much of anything



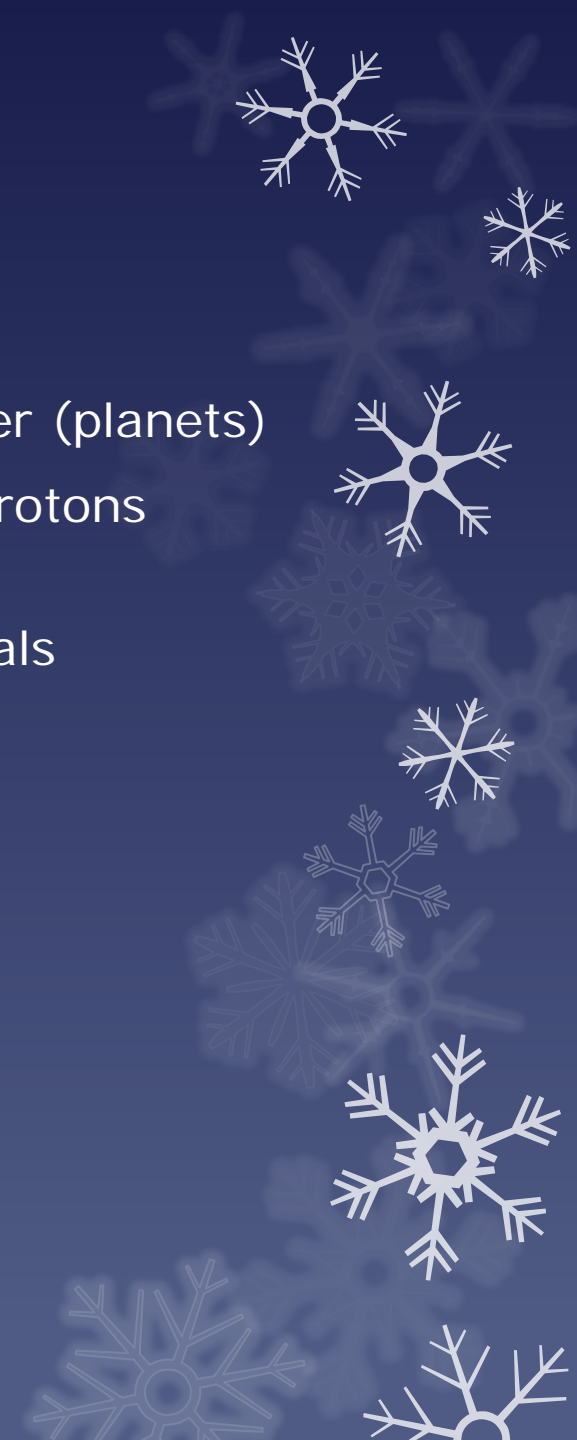


The most incomprehensible
thing about the universe
is that it is comprehensible.

ALBERT EINSTEIN

Fundamental principles

- If we didn't have gravity...pulled matter together (planets)
- Nuclear force – nothing to hold neutrons and protons together – no chemistry
- Electromagnetic – no bonding between chemicals
- And others...
- Remove just one LAW and nothing will work



Finely Tuned Constants of Nature

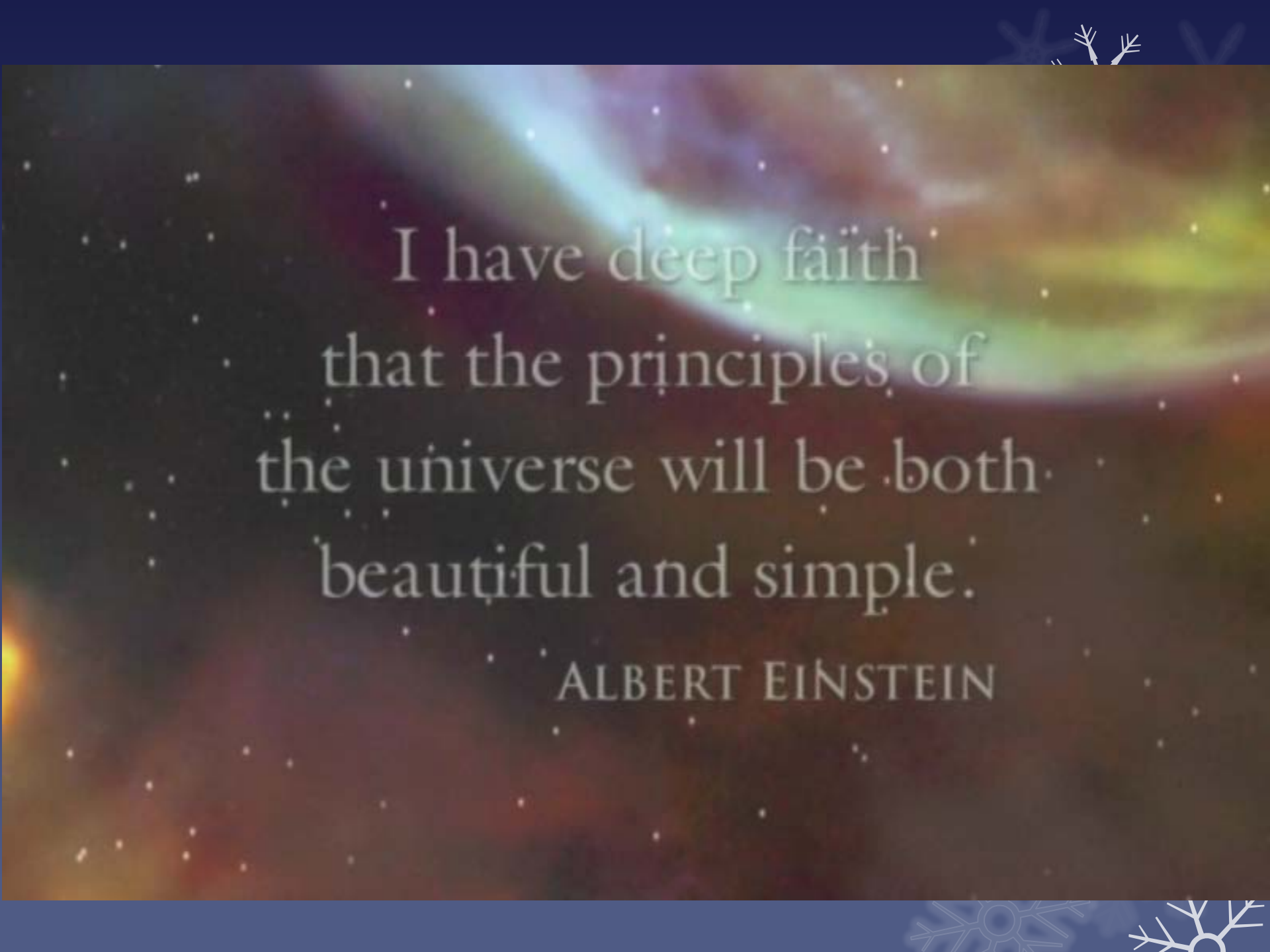
● Time: 50:15 -



Play video clip: machine

- D:\data\PROFILE\CS\Desktop\WhyEarth\70_Constants_Machine.mp4





I have deep faith
that the principles of
the universe will be both
beautiful and simple.

ALBERT EINSTEIN

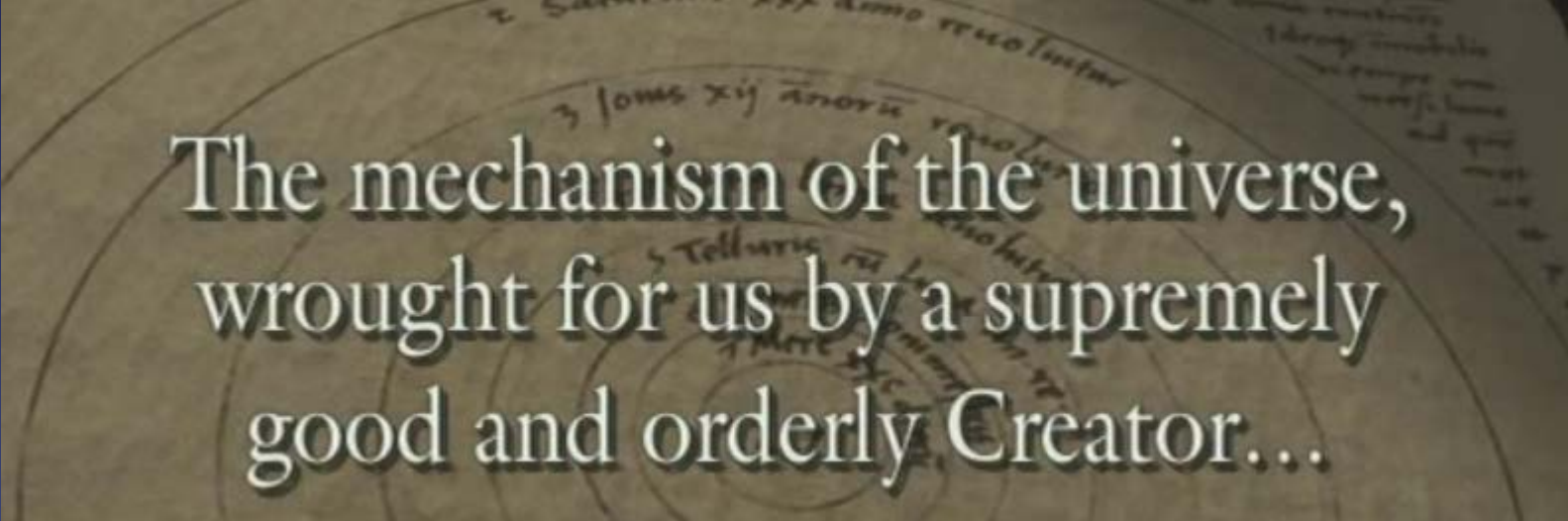
...Yet, we can understand

- Elegant simplicity to formulas
- Most important theories can be written on a single sheet of paper
- Finely tuned universe
- Structured
- We can discover and understand this structure
- What is the explanation of that?

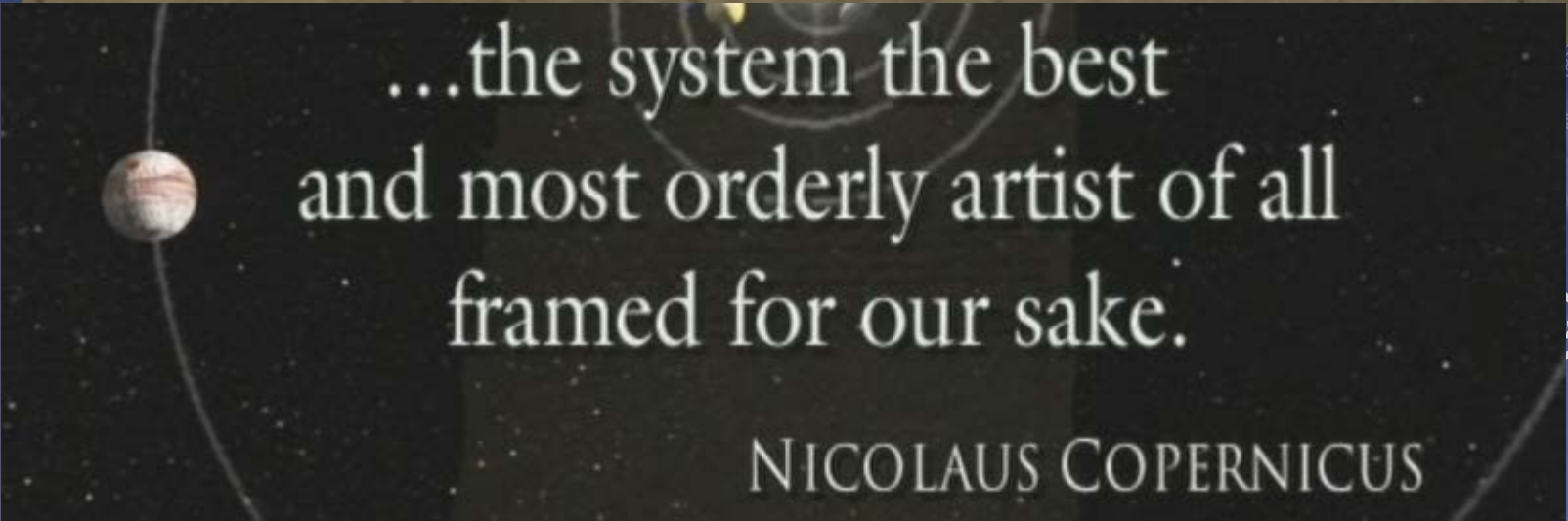


$$E = MC^2$$
$$F_G = \frac{GMm}{d^2}$$
$$F = \frac{kq_1q_2}{r^2}$$

Creator is an artist



The mechanism of the universe,
wrought for us by a supremely
good and orderly Creator...



...the system the best
and most orderly artist of all
framed for our sake.

NICOLAUS COPERNICUS

400 years ago...

- VIDEO CLIP next 55:27 –
- Copernicus, Kepler, Galileo, Newton
- Product of a mind
- Driven by the notion that this was a theological quest
- Universe is here for a purpose

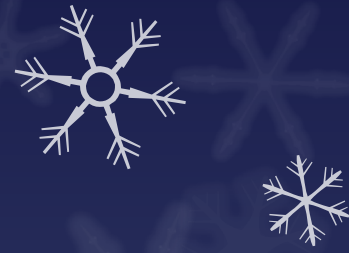




- Heavens created by God (Gen. 1:1, 14–19; Job 9:7–10; 26:7; Pss. 8:3; 136:7–9; Amos 5:8)
- Job 9:7–10 - who commands the sun, and it does not rise; who seals up the stars; who alone stretched out the heavens and trampled the waves of the sea; who made the Bear and Orion, the Pleiades and the chambers of the south; who does great things beyond searching out, and marvelous things beyond number.

Conclusion is next...

- Ge 1:1
- Job recognized that the earth “hangs on nothing” (Job 26:7)
- Movements of the constellations were known only to God (Job 38:31–33).



Conclusion

- See, we are special and privileged



Q&A

