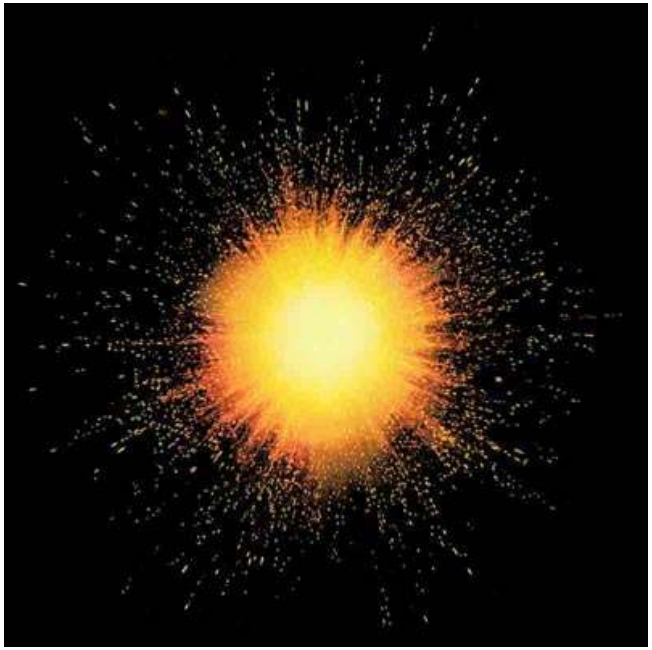
God of the gaps

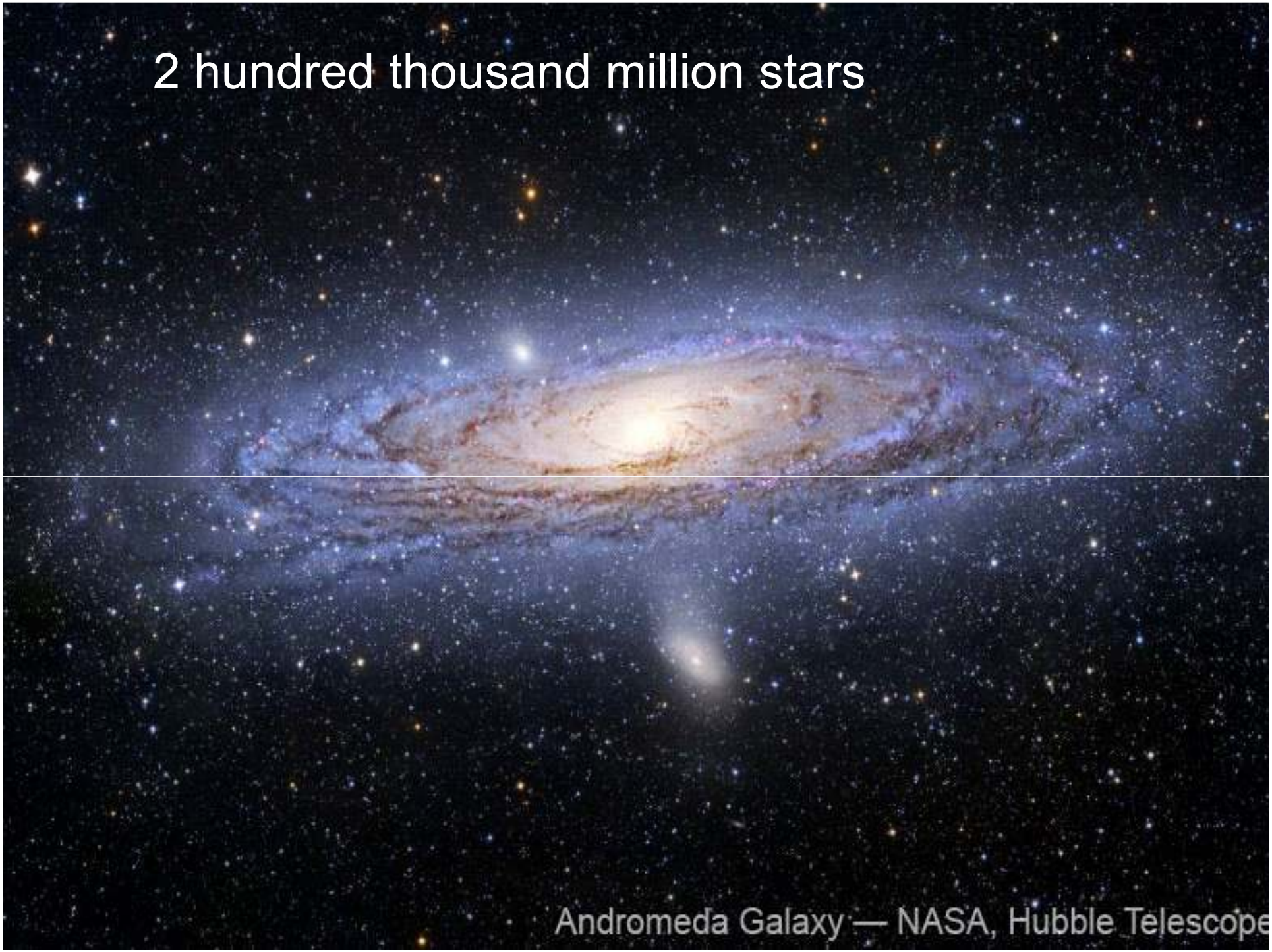
- It’s the bits of science we do understand that give most evidence for His existence and activity.

- For since the creation of the world God’s invisible qualities—his eternal power and divine nature—have been clearly seen, being understood from what has been made, so that people are without excuse.

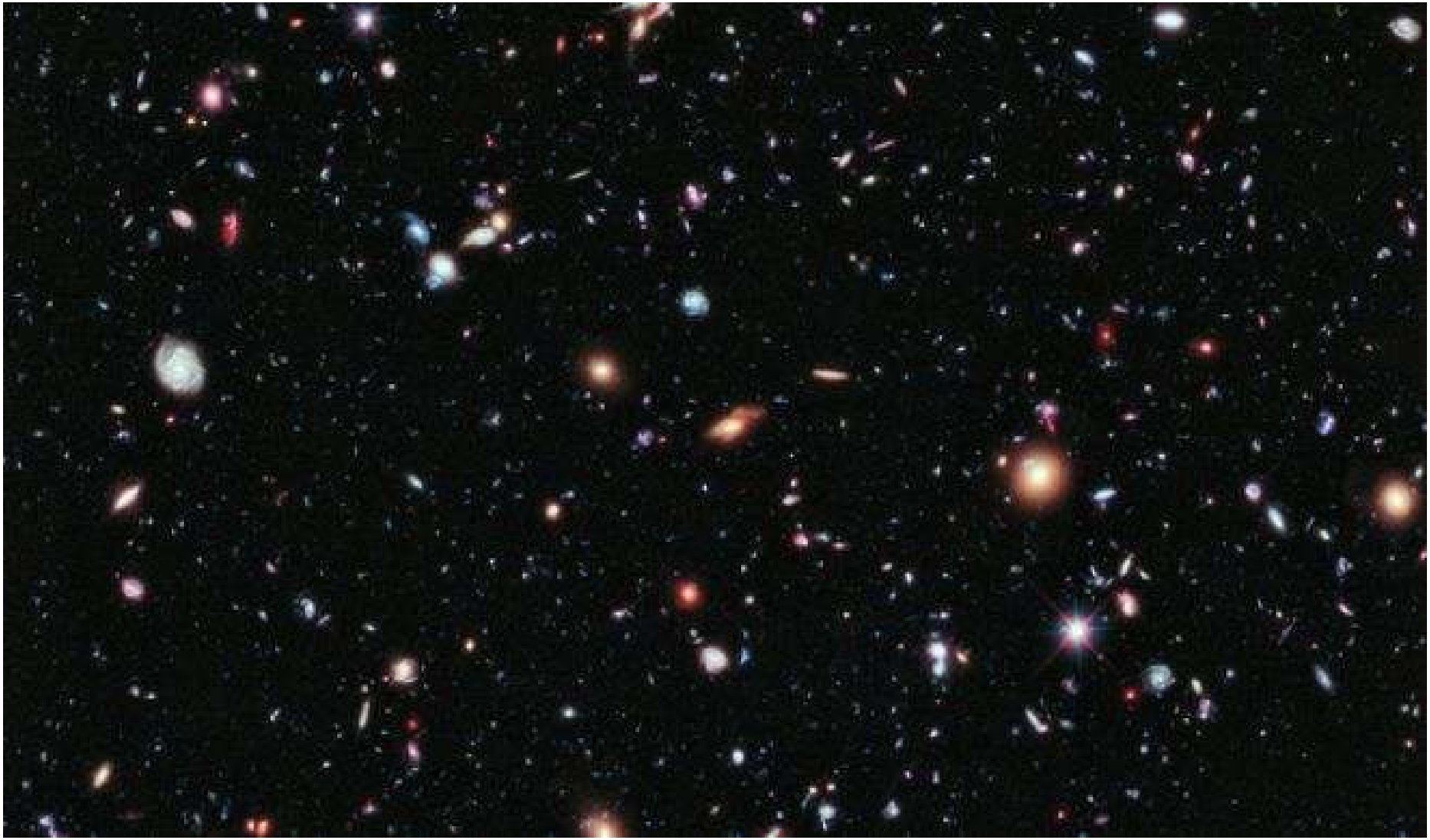
In the beginning God created the heavens and the earth.



Before this there was not, now there is; matter, energy, space and time.


2 hundred thousand million stars
Andromeda Galaxy — NASA, Hubble Telescope

2 hundred thousand million galaxies



The heavens

(Hubble deep field image)

and the earth

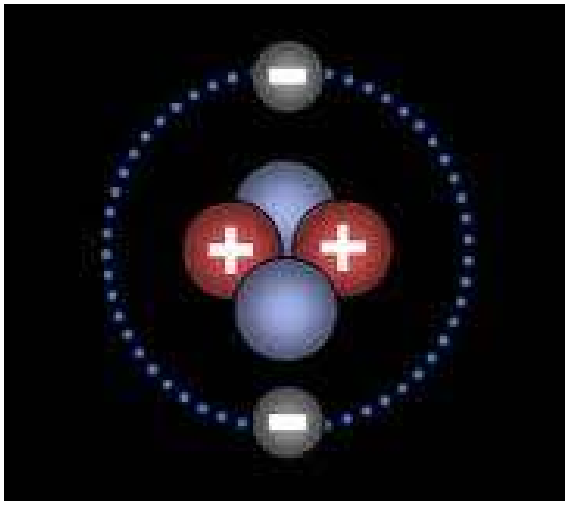
rom Apollo

Will any universe do?

- The right physics
- The right cosmos
- The right galaxy
- The right sun
- The right solar system
- The right Earth
- The right you
- All at the right time

Just right physics

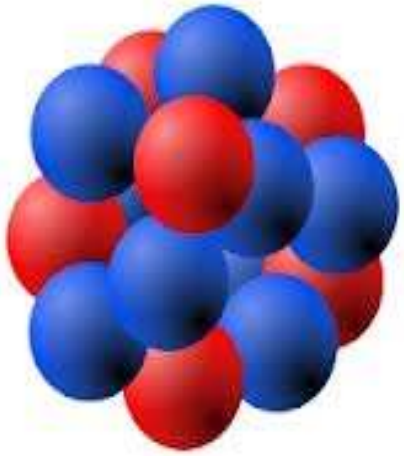
Electron to proton ratio



Positive or negative ions repel each other.

More of any one means electromagnetic repulsive forces would overcome gravity, so no galaxies, stars or planets.

Just right atoms

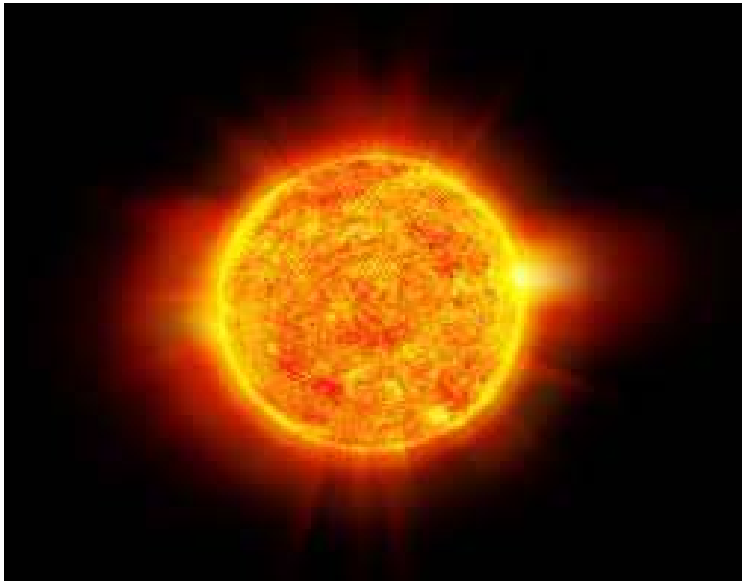


Strong nuclear force holds protons and neutrons together in atomic nuclei.

- Strong nuclear force, 2% weaker or 0.3% stronger.
- Weaker means no heavy elements, only hydrogen would exist.
- Stronger means only heavier elements would exist, no hydrogen.

Just right force of gravity

- Stronger – stars would burn up to quickly.
- Weaker – stars would not become hot enough to ignite nuclear fusion, therefore no elements beyond helium.

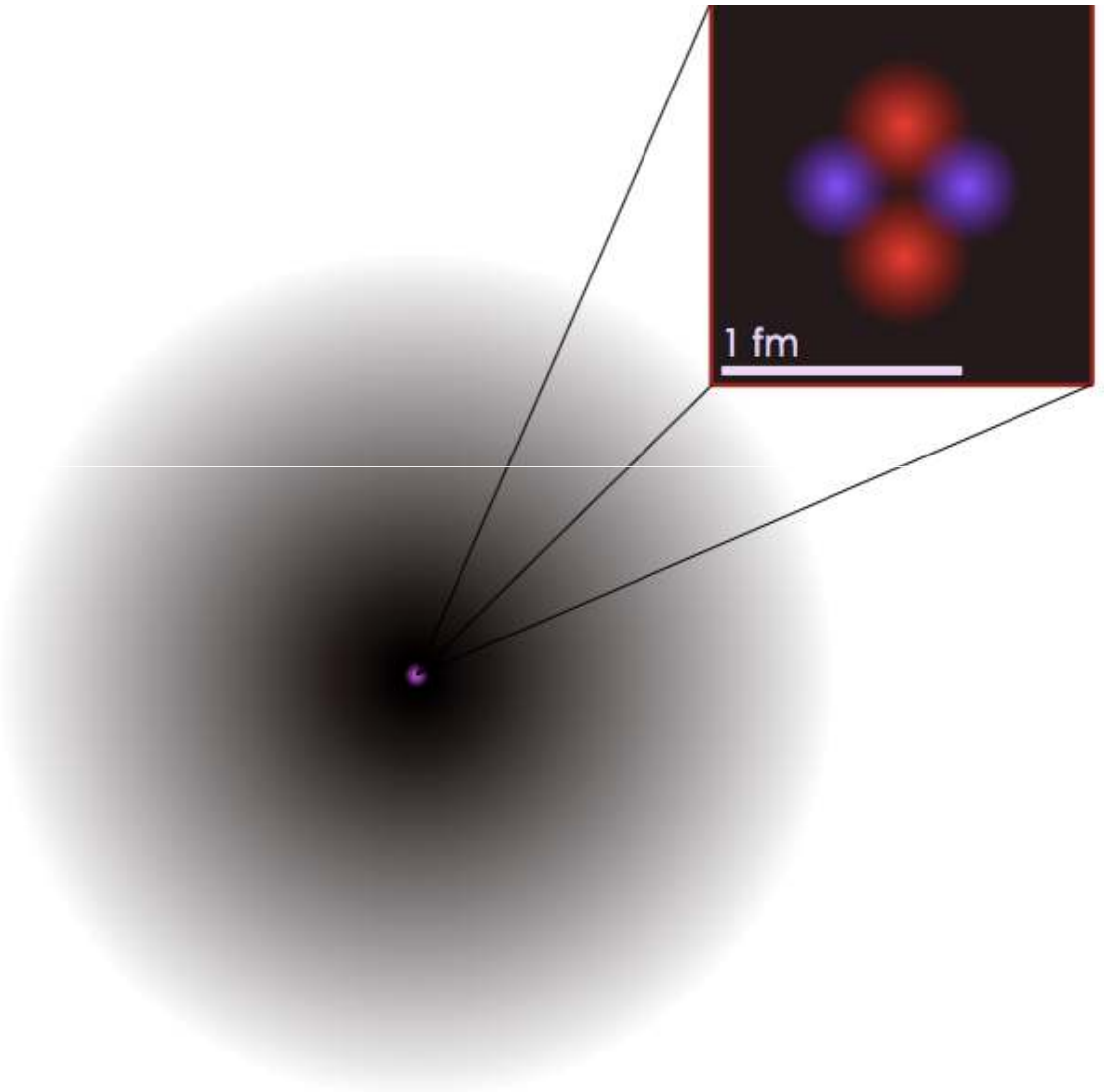


Stable stars are needed for stable, life supporting, planets.

All elements beyond helium come from nuclear fusion is stars.

Fine tuning

Nuclear strong force to electromagnetic force ratio, 1 part in $10^{16,}$ or no stars (Paul Davies)



Just right sized stars

- Big stars needed to produce elements.
- Only small stars burn for a long time to have stable planets.
- Star size depends on the ratio of electromagnetic force relative to gravity.
- Electromagnetic force constant to gravitational force constant, 1 in 10^{40}
- Increase by 1 in 10^{40} means only small stars, decrease means only large stars.

10^{40} 10 000 000 000 000 000 000 000 000 000 000 000 000

- Cover the US in coins
- A column 236,000,000 miles high.
- Do the same on a billion other continents.
- Paint one coin red.

Cosmic expansion rate

- Faster – matter disperses before it can form galaxies.
- Slower – matter would clump, all the universe would form one super-dense lump, so no stars.

1 part in 10^{55} change in initial conditions of cosmos

The time for life is now

- Younger universe – not enough heavy elements.
- Older universe – stars no longer in a stable burning phase.

More, just right physics

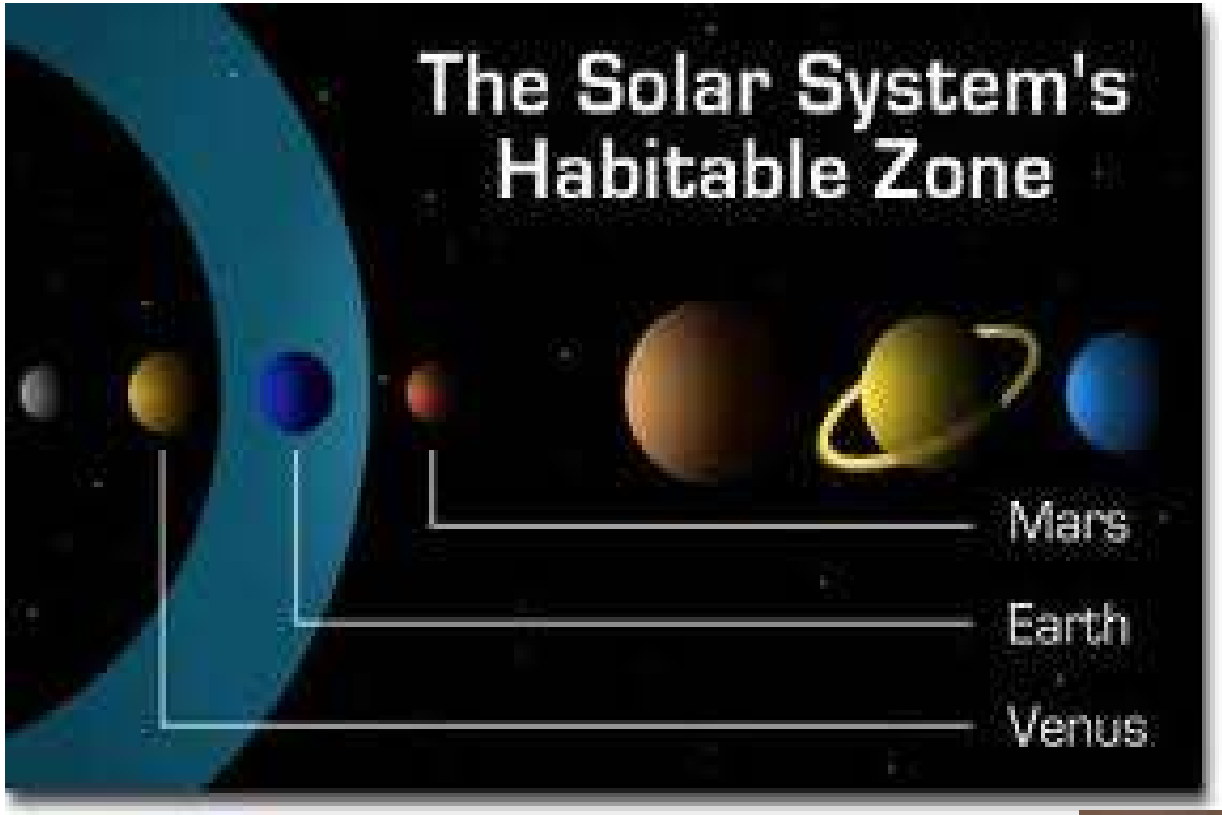
- Ratio of electron to proton mass.
- Polarity of water molecule.
- Frequency and distance of supernovae explosions.
- Mass energy density term.
- Ratio of exotic to ordinary matter.
- Most physical properties of matter.

Fred Hoyle (British astrophysicist):

‘ A common sense interpretation of the facts suggests that a superintellect has monkeyed with physics, as well as with chemistry and biology, and that there are no blind forces worth speaking about in nature. The numbers one calculates from the facts seem to me so overwhelming as to put this conclusion almost beyond question.’

Just right

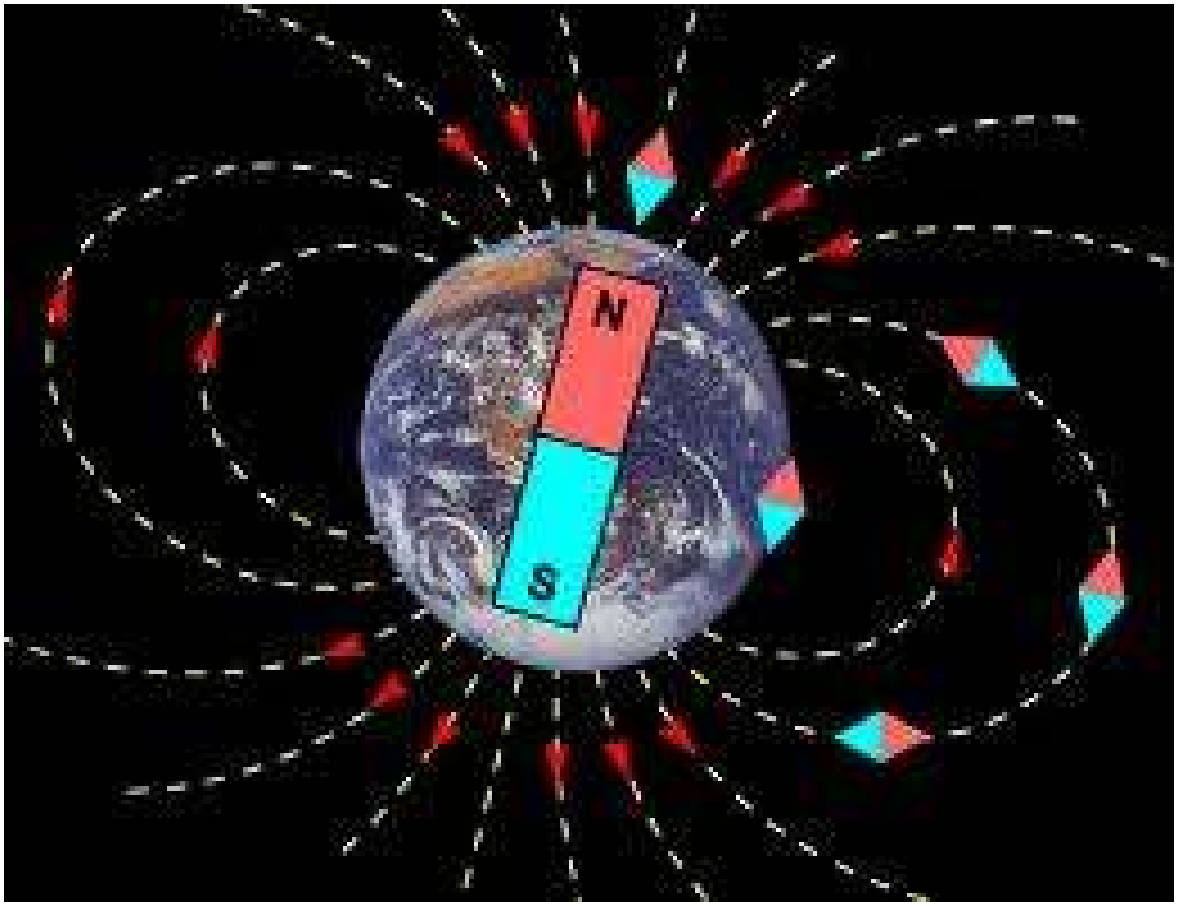
Earth



Not too hot, not too cold, just right

Earth, distance from sun, 2% tolerance

Just right magnetic field

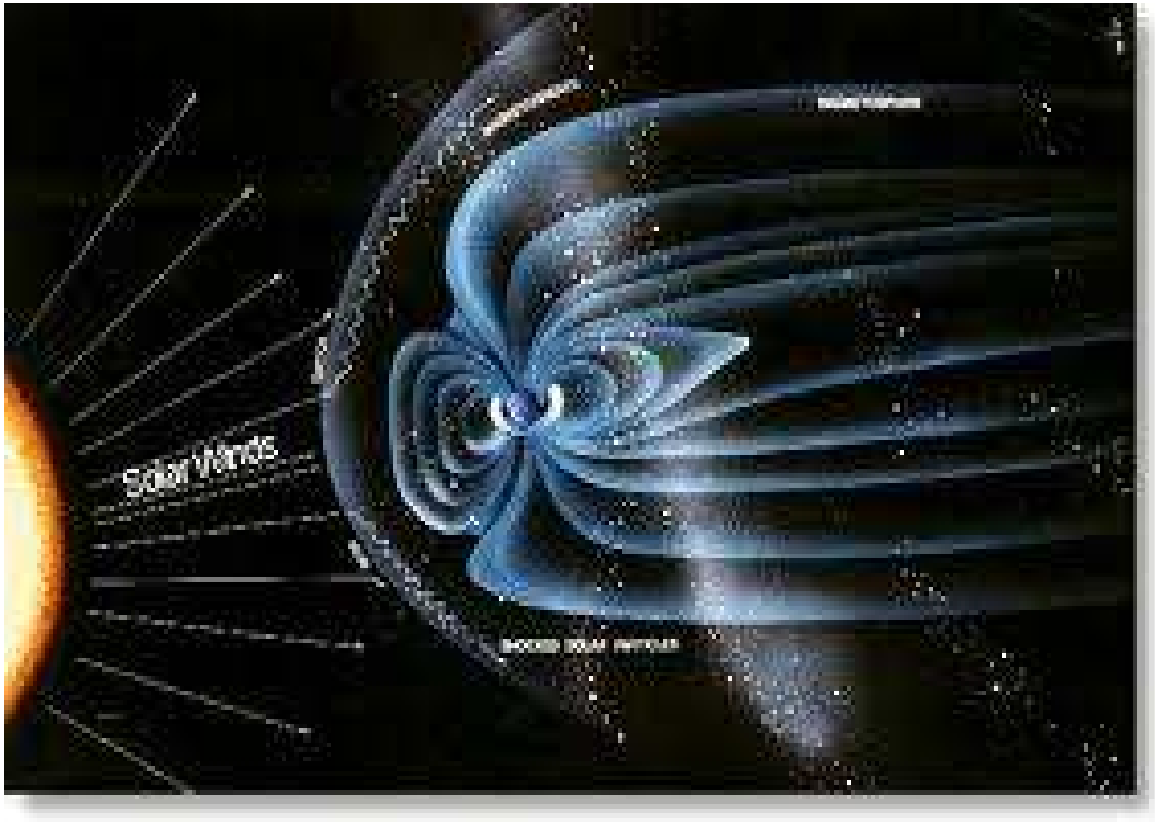


Currents in the Earth's iron core generate the magnetic field.

Just right magnetic field

- Right amount of iron
- Right position of iron in the centre of the Earth
- Right amount of currents in the white hot core
- Right magnetic field generated, extending out into space
- Magnetosphere surrounds the earth

Deflection of Solar winds and cosmic rays



400 – 700 Km/s

Energetic, charged protons and electrons

Charged particles cause cancer

Solar winds would also deplete Earth’s water

Just right moon

Right mass

Right distance from earth

Tides

Light at night

Stabilises Earth's axial tilt

Moon distance

- Closer, massive tidal bulges, miles of tides inland.
- Further, less tides, less stability of rotational axis.
- Earth is spinning therefore not half frozen, half boiling.

Moon mass

- More massive moon – Earth's axis would wobble, longer hot days, long cold nights.
- Less massive moon – Earth's rotation would be faster, shorter windy days.
- Rotation is necessary to develop magnetic field.
- Collider just right mass and angel, less impact and gravity would reform a massive earth, too much gravity with no moon.

23.5 degrees

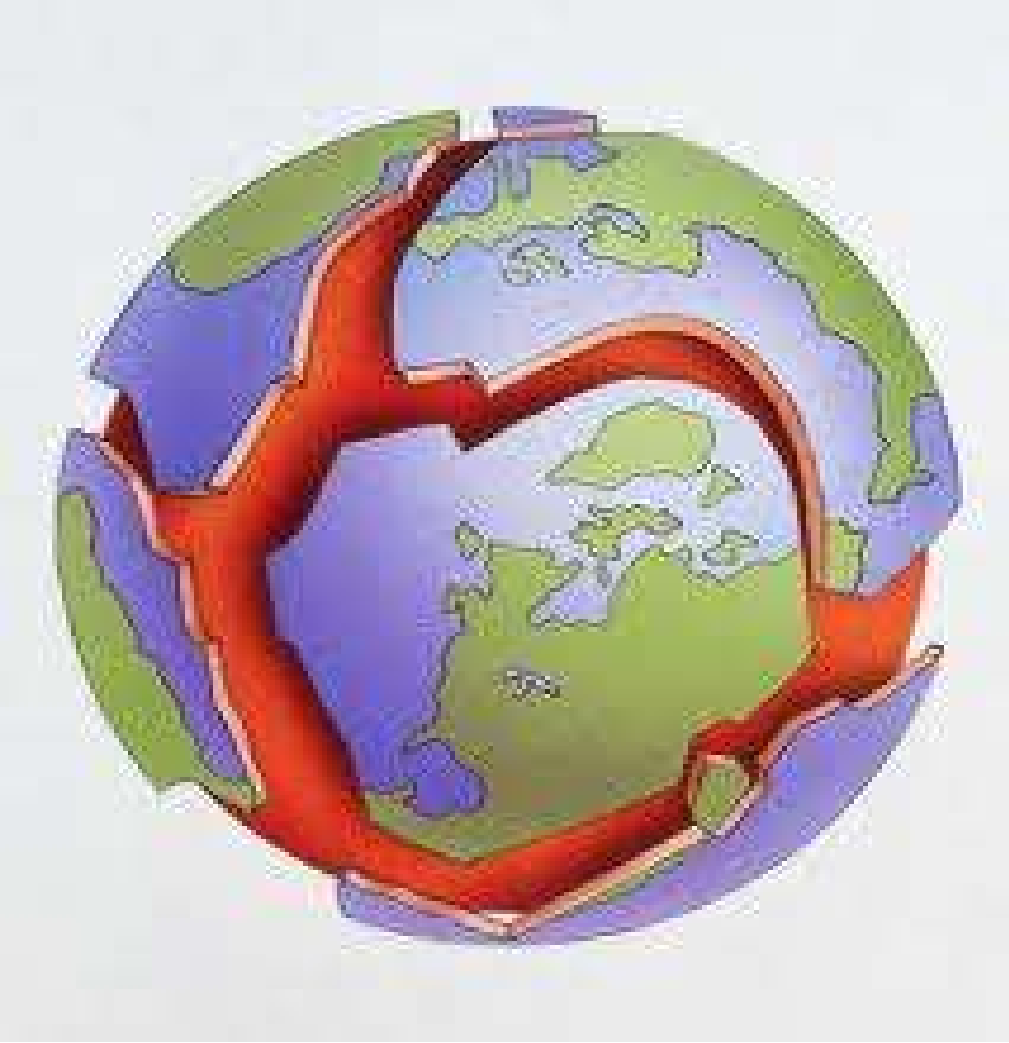
Stability, prevents wobbles and inversions

Seasons

Agriculture

Now the earth was formless and empty,
darkness was over the surface of the deep,
and the Spirit of God was hovering over the
waters.

Just right tectonics



Half life - 700 million years for uranium-235

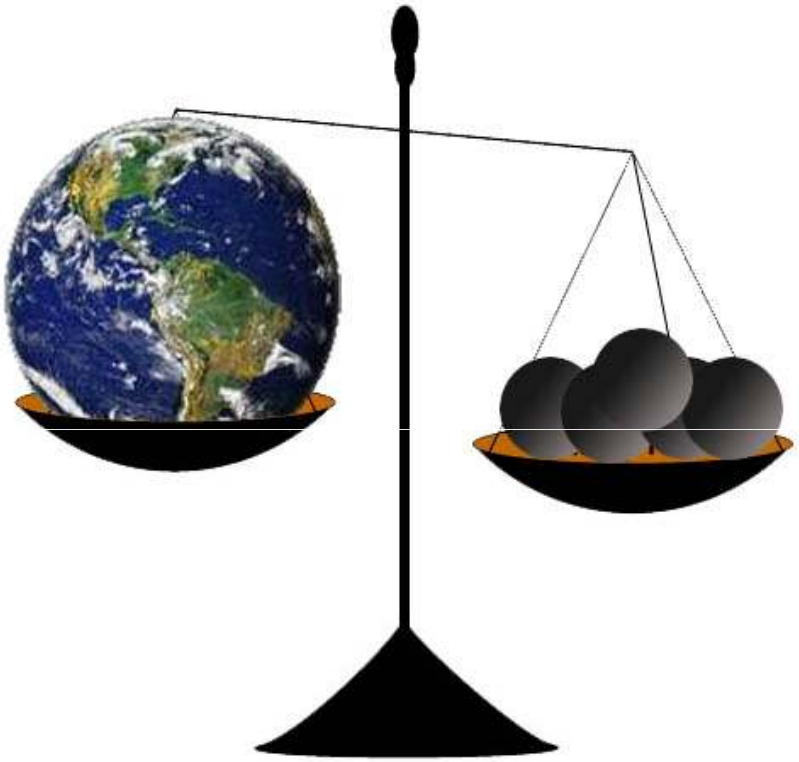
4,500 million for uranium-238

Decay produces the right amount of heat to generate currents in the mantle and lower crust.

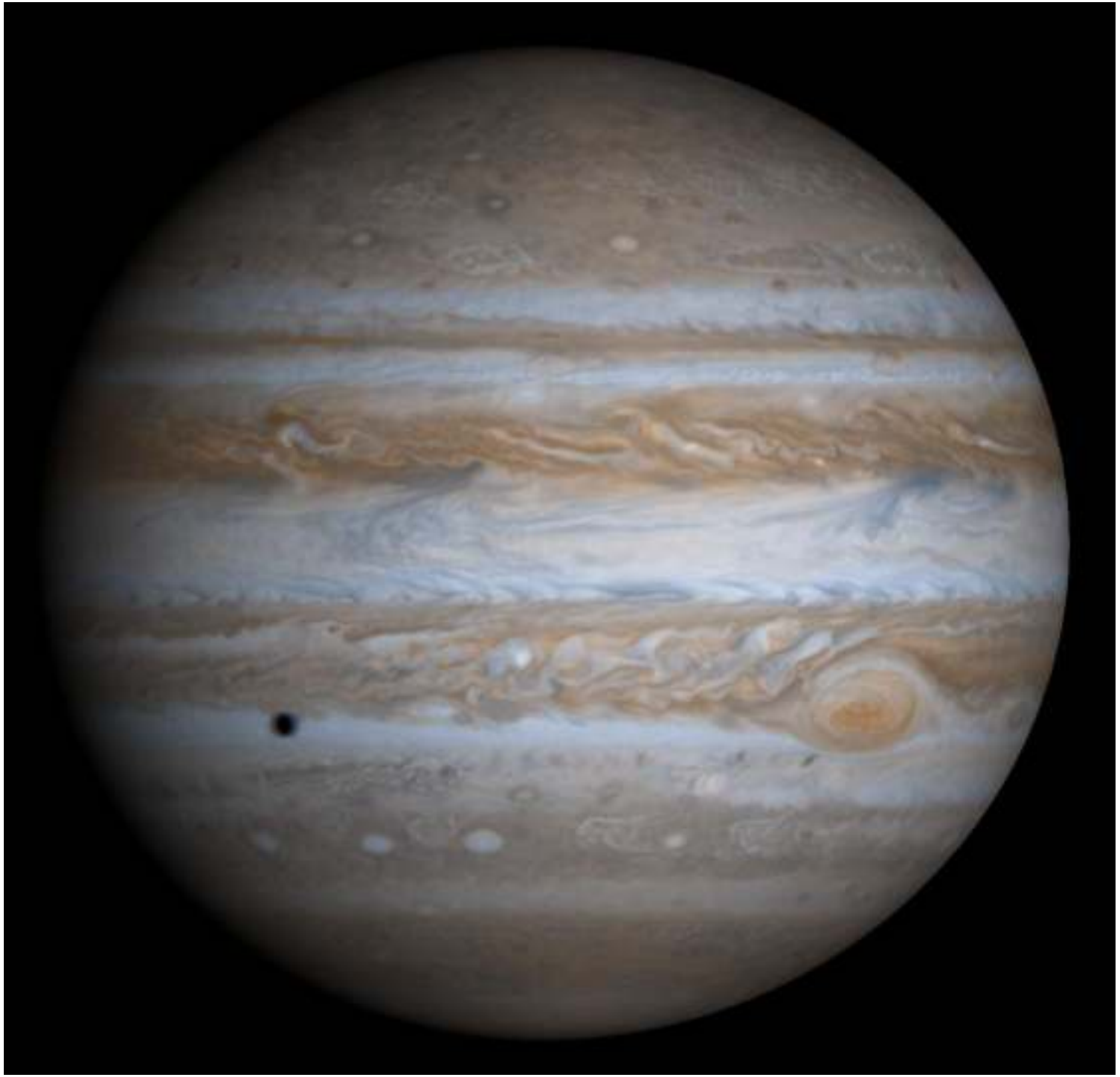
Earth's surface temperature

- Sun's luminosity has increased by 35% since first life on earth.
- This was exactly counter-balanced by the reduction in greenhouse carbon dioxide, used by the right volumes of photosynthetic life, at the right times.
- Earth's surface temperature has mostly remained stable.

Just right Earth



- Gives just right gravity
- The chances of one such planet existing are 1 in 10^{30} (Hugh Ross)
- Just right viewing platform



We need the right sort of galaxy

The right galaxy

Elliptical galaxies – mostly old small stars with sparse interstellar medium, so low in heavy elements

Irregular galaxies

Dense active core with a super massive black hole, high radiation levels, low metallicity.

Milky way galaxy

Fluorine can only come form white dwarf binaries

Barred spiral galaxy

Spiral arms are peaceful places with the correct stellar density

High in heavy elements from old supernovae

Few current supernovae

The star has to be right

Our sun

The sun is in middle age, in a with stable burning phase

Must be a single system and isolated

To massive – will burn quickly and erratically

Less massive – habitable zone is to close and the planet suffers tidal forces, slowed rotation rates with possible tidal locking

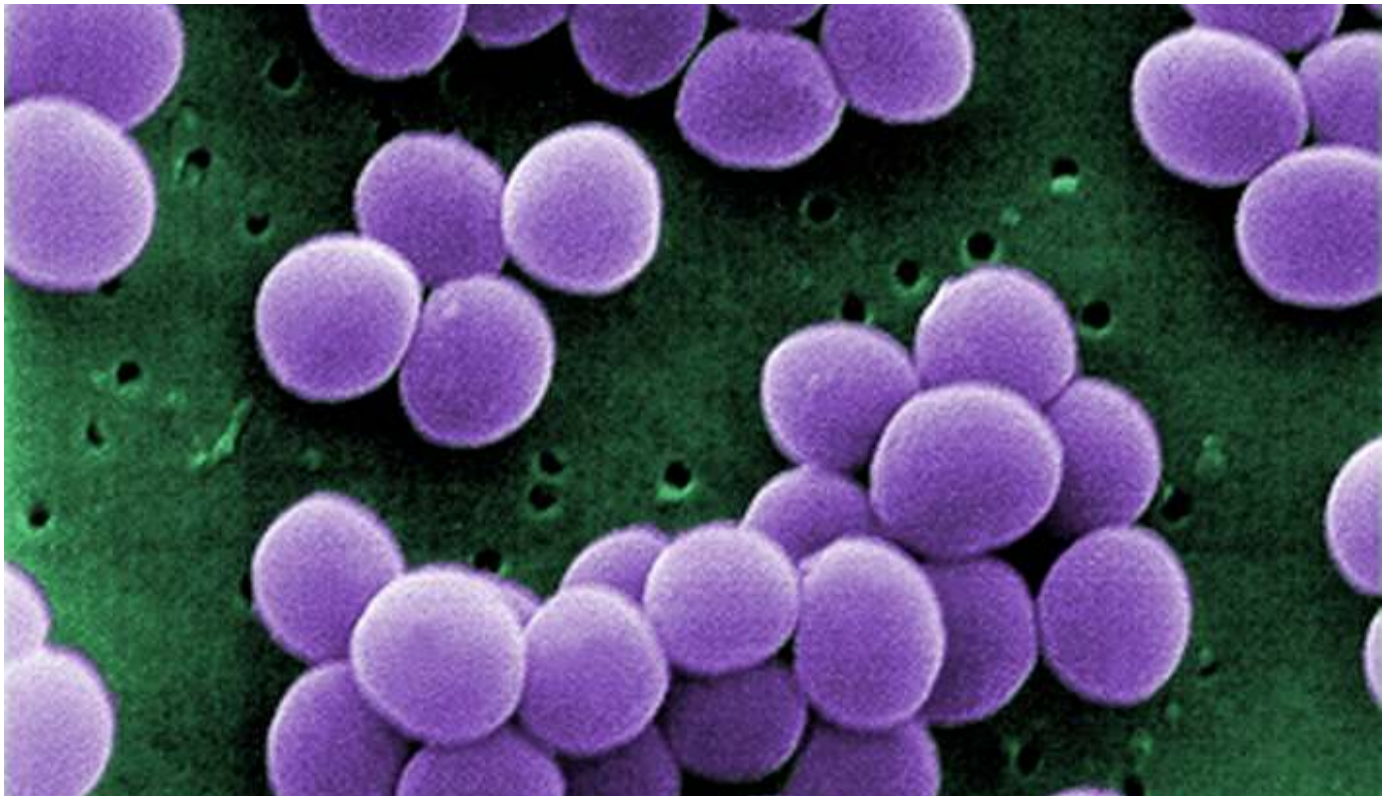
Just right life on Earth

Building blocks for life are simple molecules

And God said, “Let the water teem with living creatures, and let birds fly above the earth across the vault of the sky.

- Protein, usually hundreds of amino acids
- All L form amino acids
- DNA, hundred of bases
- RNA, hundreds of bases

Prokaryotic cells, minimum gene set is about 400

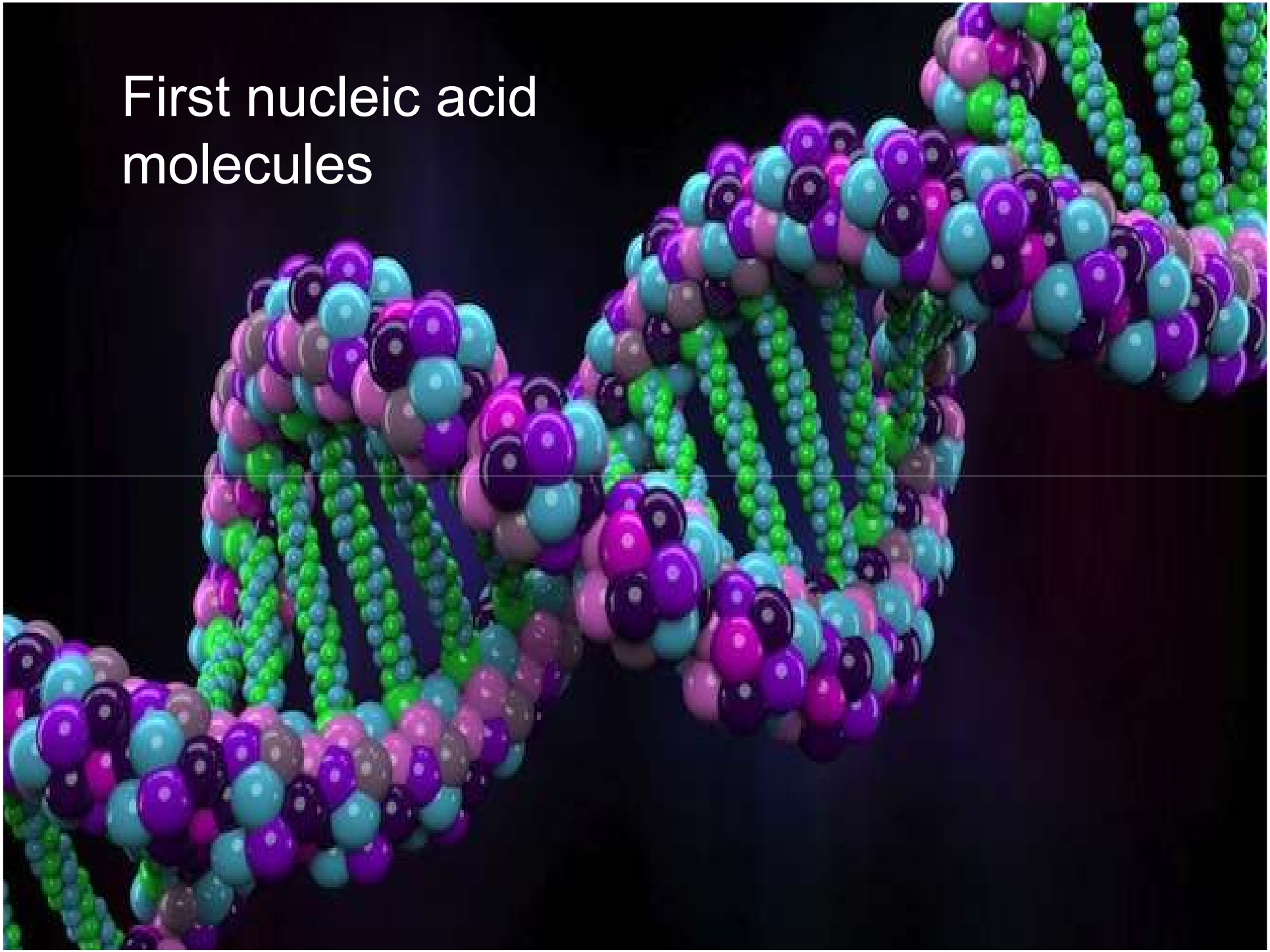


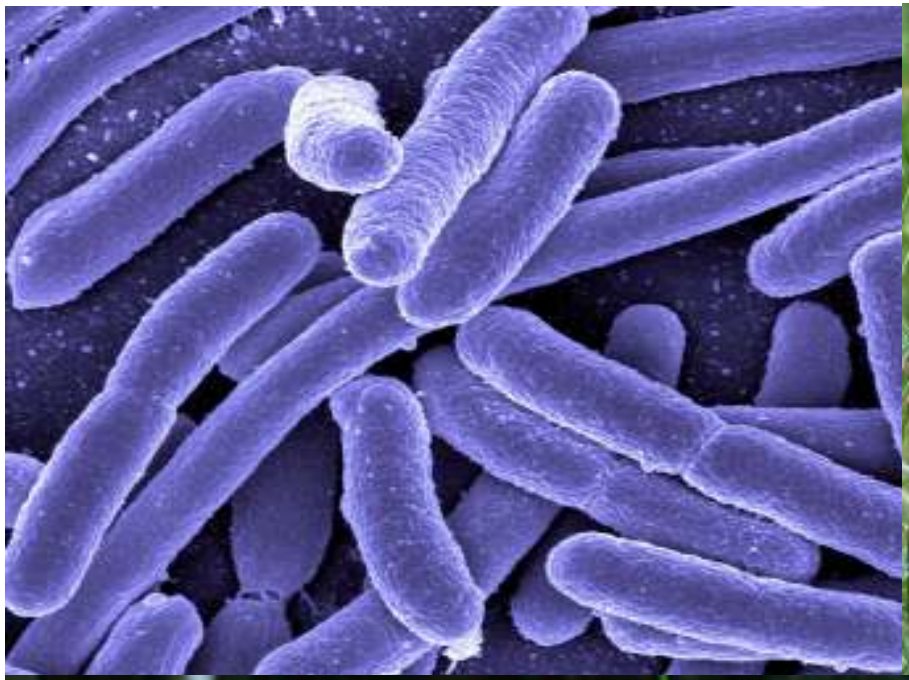
One gene is at least 1,000 base pairs, A, T, C and G
Each protein has hundreds of amino acids in sequence

The first protein

- Probability of getting 100 amino acids in L form are 1 in 10^{30}
- All amino acids need peptide bonds, probability of getting this is about 1 in 10^{30}
- That's a chance of 1 in 10^{60}
- Also, each letter needs to be in the correct order to make the protein chain functional. The chance of this is 1 in 10^{130}
- Then we would need a cell

First nucleic acid molecules





Just right you

Then the Lord God formed a man from the dust of the ground and breathed into his nostrils the breath of life, and the man became a living being.

You as an individual

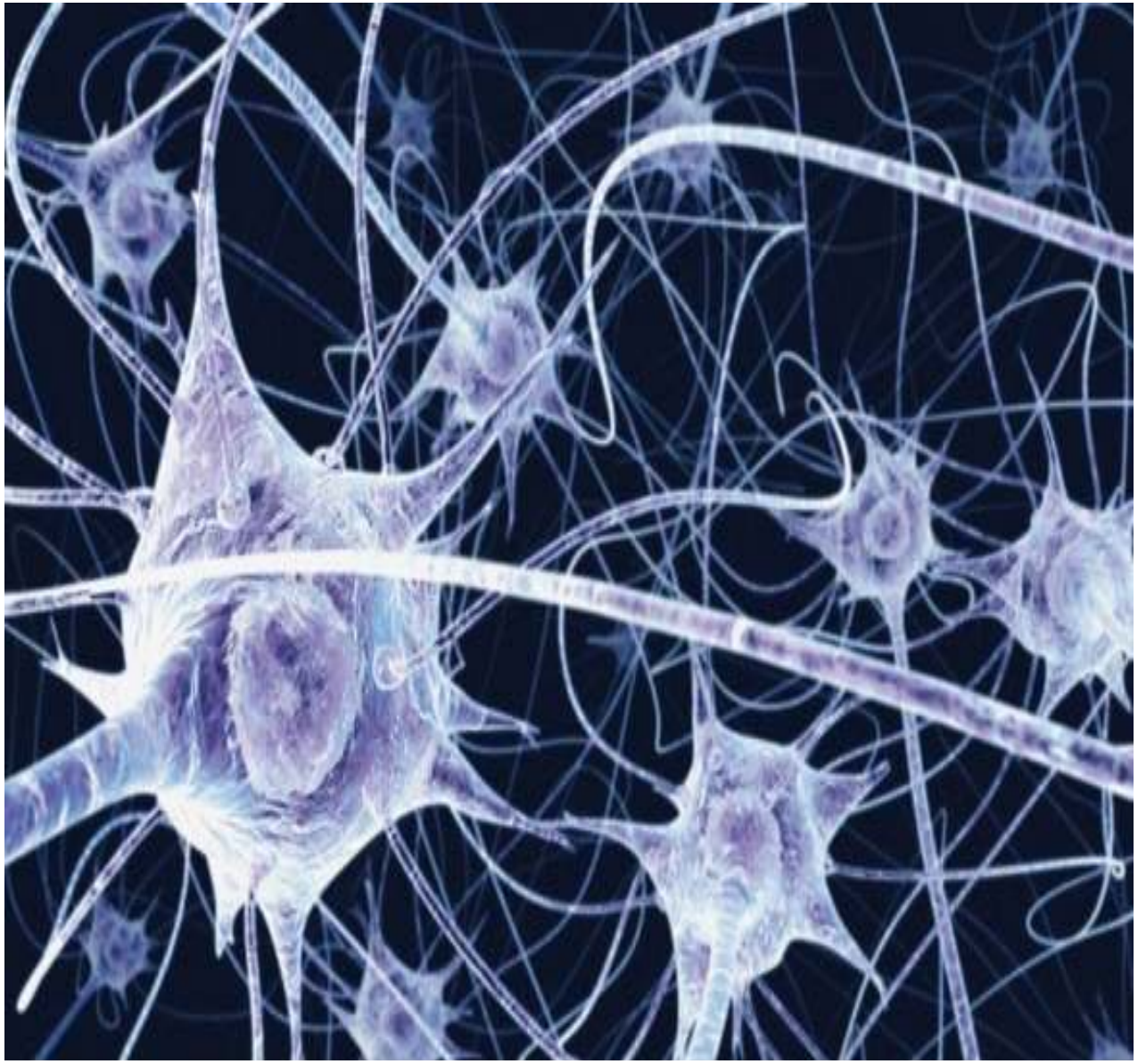
- 200, 000, 000 x 365 x 30 x 40,000

1 chance in 8.76 x 10_{19}

8,760,000,000,000,000,000,000

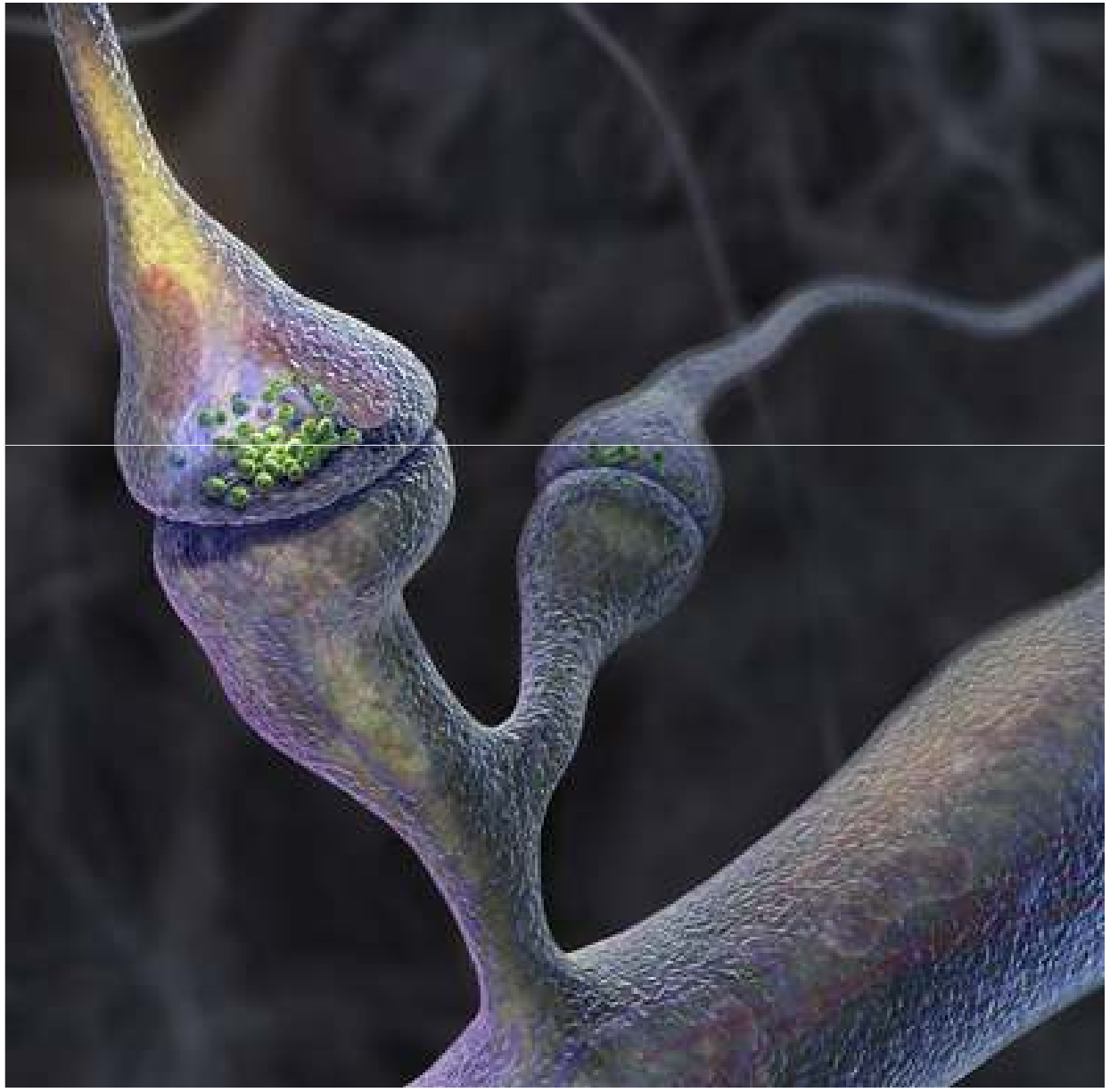
Euromillions jackpot 1 in 116,531,800

Neurones



One hundred thousand million

Synapses



1,000 to 10,000 per neurone

If it was not like this we would never know

- A man goes out to a firing squad of 100 marksman. They fire. The man realises he is unhurt. He thinks it is good luck they all missed. After all if they had not all missed, he would not be thinking.

How do we know anything?

- The only incomprehensible thing about the universe is that it is comprehensible (Albert Einstein)
- But then has horrid doubt whether convictions of man's mind, which has been developed from lower animals, are at all trustworthy (Charles Darwin. letter to William Graham, 3rd July 1881)
- So God created mankind in his own image, in the image of God he created them; male and female he created them.

The nature of faith

- "Faith is not a leap in the dark; it’s the exact opposite. It’s a commitment based on evidence… It is irrational to reduce all faith to blind faith and then subject it to ridicule. (John Lennox)

For in him all things were created: things in heaven and on earth, visible and invisible, whether thrones or powers or rulers or authorities; all things have been created through him and for him. He is before all things, and in him all things hold together.