If the distance between the earth and sun changes, Could there still be any kind of life?

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Introduction

There is no life in the solar system except the earth planet. Even though, life search in the universe is still in progress, scientists have not found any location in space where the life could exist.
Hence, the long observation of the solar system over time has shown that the earth should be the only place where life can exist, so far.
In fact, there are several reasons for that, and one principal reason is the temperature range on the earth surface.
On earth, the temperature varies in a well-known range providing the conditions of life.
For instance, one of the hottest temperature on earth was recorded in Lut Desert of Iran [NASA, 2012] with a temperature of 70.7°C (159°F) [Williams, 2015].
On the other hand, by trying to measure the lowest air temperature ever measured by a weather station, the researchers found a temperature of minus 98 degrees Celsius (minus 144 degrees Fahrenheit) during the southern polar night, mostly during July and August [Scambos, 2018] [AGU, 2018].
Anyway, the temperature varies continuously over time and across the geographical location, but the average temperature on earth can be evaluated to represent a medium value for the researches on this field. The GISS organization (Geographic Information Science and Systems Specialty group) measures the change in global surface temperatures relative to average temperatures from 1951 to 1980. According to GISS, the global mean surface air temperature for that period was estimated to be 14 C (57 F) [Sharp, 2018] [Williams, 2015].

Hence, according to the cited data, it appears that a mean temperature of 14° C (57 F) should represent an optimal temperature for life, and consequently the life could exist within the range of (14° C - ΔT) and (14° C + ΔT), where ΔT represents a small variation of temperature that could be determined experimentally.

Earth's temperature variation versus the solar distance

In the present section, we will simulate the expected temperature on the earth surface according to its distance to the sun, by neglecting the other geographical and physical aspects for a purpose of simplification.
First, we do know that the intensity (or illuminance) of light radiating from a source is inversely proportional to the square of the distance from the source. Hence, an object distant from the source by a distance d, will receive an energy proportional to $1/d^2$.

Moreover, we also know that the temperature T on earth is proportional to the fourth root of the solar flux F (T proportional to $F^{0.25}$), and the flux F is proportional to the Sun's luminosity. There are other factors involved, like cloud changes, earth rotation and tilt, other greenhouse effect changes, etc. , but for a purpose of simplification, we can limit our approximation to the previous hypothesis.
That is, we can summarize these physical facts, as follows.

The luminosity L is inversely proportional to the square of the distance R between the sun and earth:

$L = K/R^2$ (1)
where K is a constant.

Again, the temperature is proportional to the fourth root of luminosity:

$T = (L)^{0.25} = (K/R^2)^{0.25} = K'/R^{1/2}$ (2)
where K' is a constant.

If one consider the average temperature on earth in Kelvin (i.e. 14+273.15 °Kelvin) = 287.15 Kelvin and knowing the average distance between the sun and earth (i.e. 149,600,000 **kilometers** ≈ 150 10^6 km), then the value of K' would be:

$K' = T.\ R^{1/2} = 287.15 \times (150\ 10^6\ km)^{1/2}$
$= 3516855\ Kelvin.km^{1/2} \approx \mathbf{3.517\ 10^6}\ Kelvin.km^{1/2}$ (3)

Consequently, the equation 2 becomes:

$T = \mathbf{3.517\ 10^6}\ R^{-1/2}$ Kelvin (4)
where R represents the distance between the sun and earth, in km.

To get the temperature in Celsius, we can subtract 273.15 from the previous formula:

$T = \mathbf{3.517\ 10^6}\ R^{-1/2} - 273.15$ ° C (5)

For instance, let us simulate the average temperature on Mars.
Since its average distance from the sun is 228 10^6 km, then the approximate temperature on Mars (i.e. simulated) should be: $T = \mathbf{3.517\ 10^6}\ (228\ 10^6)^{-1/2} - 273.15$ ° C = -40.23 ° C.

Note that this is only an approximation, while the actual average temperature on Mars is about -60° C (-81° F), as reported by NASA [NASA 2021].

Limits of Temperature for Life

The boundaries of survival are better established for long-term comfort. According to a 1958 NASA report**,** people can live indefinitely in environments that range between roughly 40 degrees F and 95 degrees F (4 and 35 degrees C), if the latter temperature occurs at no more than 50 percent relative humidity. The maximum temperature pushes upward when it's less humid, because lower water content in the air makes it easier to sweat, and thus, keep cool. [Tate 2012]

Now, by pushing things to the an unbearable temperature already existing on earth, the extreme limit for life is expected to be between -20°C and +70°C -A-
So, by replacing those temperature limits in equation 5, one can determine the boundaries of the distance R ensuring a possible existence of life on earth (see figure 1).

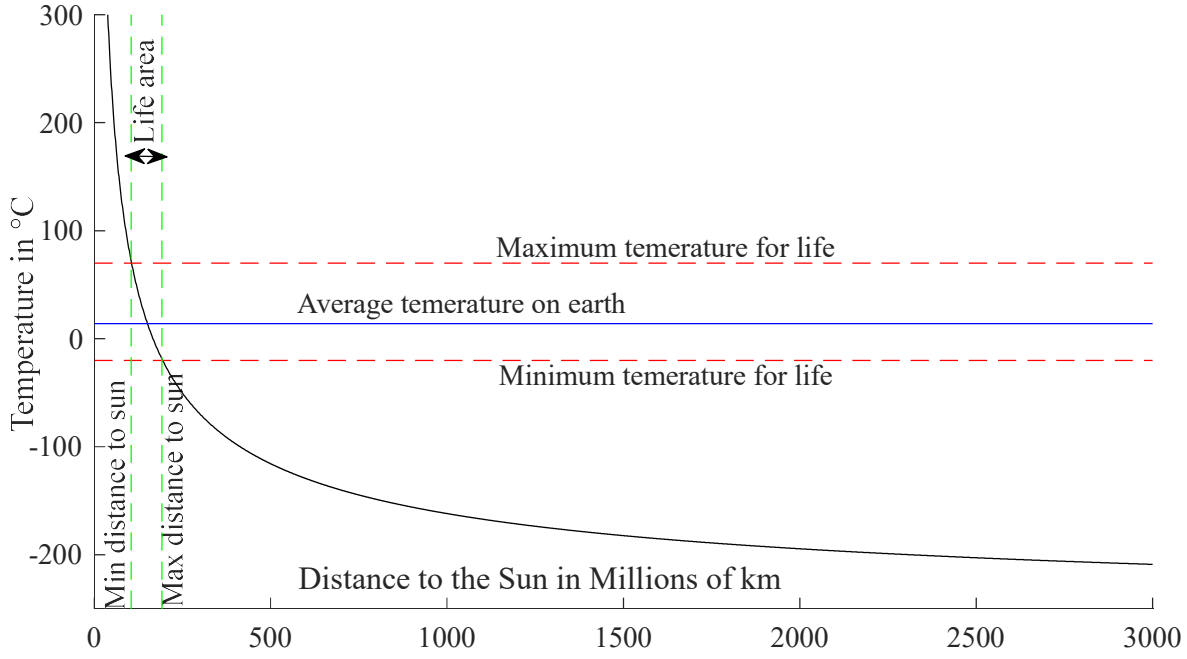

Figure 1: Average temperature on earth versus the distance to sun

In figure 1, one can see that a safe distance to sun presents a small margin (between the two vertical green lines). That is, outside this small margin, life could not exist.

Discussion: What could have designed all this accurate architecture?

It seems that the distance between the earth and the sun is calculated and adjusted with precision inside the solar system, in order to ensure life on the planet Earth (see figure 2).

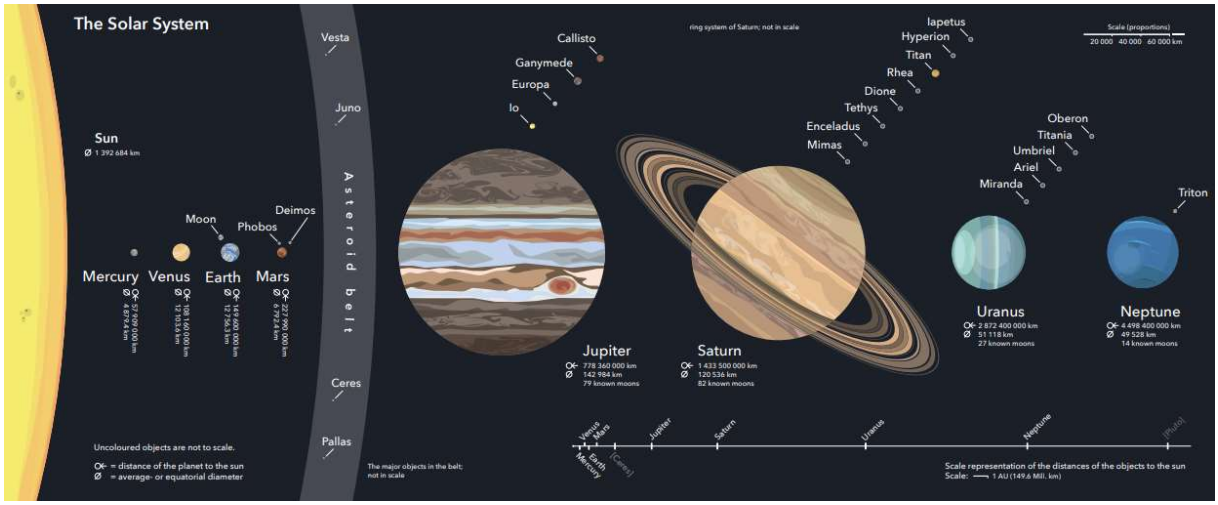

Figure 2: position of the different planets of the solar system -courtesy of Beinahegut-wikimedia [Solar System - Wikimedia Commons].

What should happen if the distance between the earth and sun decreases? and what if it increases? Obviously, there will be no life for us to talk about this, in both cases, but let us explore both cases.

-First case: If the distance is reduced, its results will increase the earth's temperature and consequently the occurrence of changes in the earth's climate and temperature may become unbearable and maybe a cause of death. Moreover, the sun could cause a rain of flames that can reach the earth and consequently burn its vegetation too [Khalq 2017].

-Second case: If this distance were to grow, its results would cause severe coldness in the Earth's climate, and thus the extinction of many species that could not adapt to this cold, the occurrence of freezing of seas and oceans, and probably an imminent death of any type of living organism [Khalq 2017].

That is, we conclude that the distance between us and the sun was calculated with great precision from the Most Gracious Creator, the Almighty, in order to ensure life on planet Earth. Maybe, our Lord, Allah, wants to show us that everything in the universe is calculated and weighed with high precision, and the earth globe was not put in that optimal location randomly. This accurate calculation is one of the signs of God, indicating his greatness and vast knowledge. This particular aspect could be clearly noticed in the verse [27:88]:

" وَتَرَى الْجِبَالَ تَحْسَبُهَا جَامِدَةً وَهِيَ تَمُرُّ مَرَّ السَّحَابِ ۚ صُنْعَ اللَّهِ الَّذِي أَتْقَنَ كُلَّ شَيْءٍ ۚ إِنَّهُ خَبِيرٌ بِمَا تَفْعَلُونَ"

Translation: "And you will see the mountains presuming them fixed whereas they will be moving like the clouds; a work of God, who has ordered all things to perfection! Verily, He is fully aware of all that you do."

Indeed, everything on earth or in the universe was conceived and adjusted with a so great precision that one cannot deny the existence of a superpower intelligence (Allah / God) that created all this wonderful architecture.

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