Is Solar System Expanding ?

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OUTLINE

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3. Number of days in the year
4. Increase of the Earth distance to Moon
5. Conclusions

Definition of the problem

Established theories advice that gravitationally bound systems don't expand when space is expanding.

Suntola's DU theory tells that they are expanding

Both cannot be true

Nature is the final court

Local phenomena are studied

Time span must be large, because
if it exists, expansion rate is slow

1. FAINT SUN PARADOX

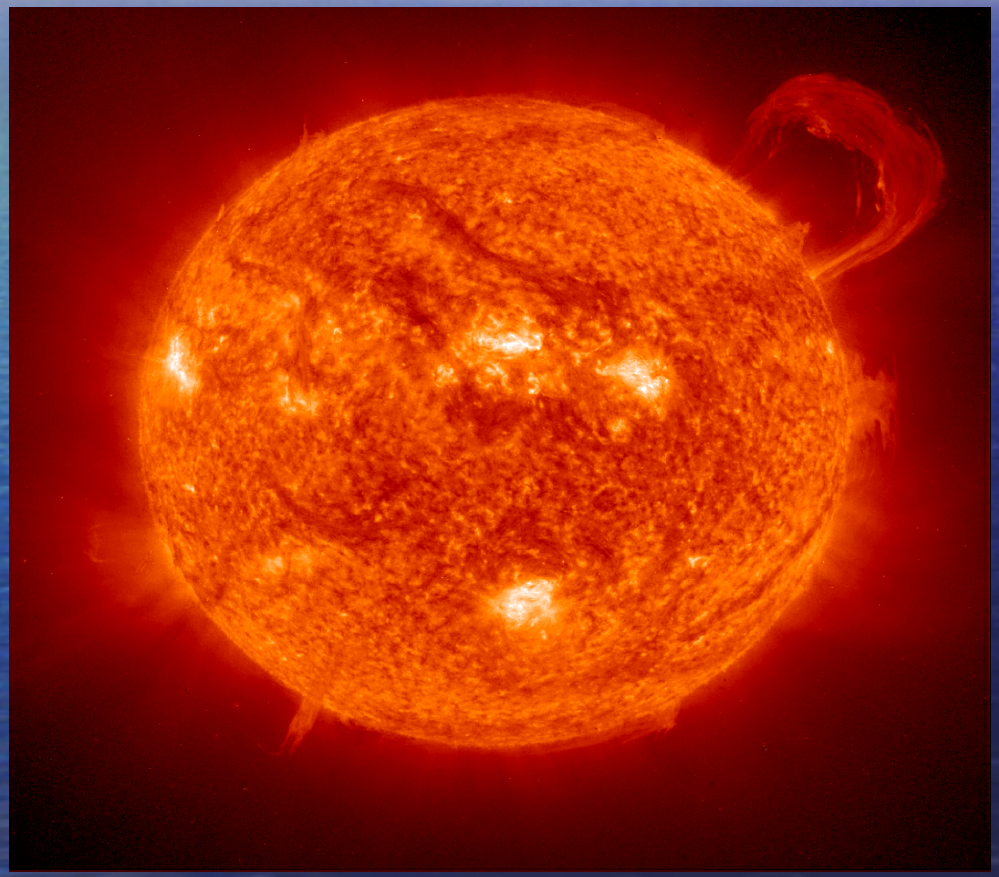
Oceans have been on Earth from 4000Ma

Also on Mars have been oceans from 4000Ma up to about 3000Ma

4000Ma ago luminocity of Sun was 30% lower than now

Why Earth was not frozen and Mars even colder than now

AURINKO



History of the Solar system

- Sun 4570 Ma
- Earth 4540 Ma
- Oldest minerals 4400 Ma
- Life 3850 Ma

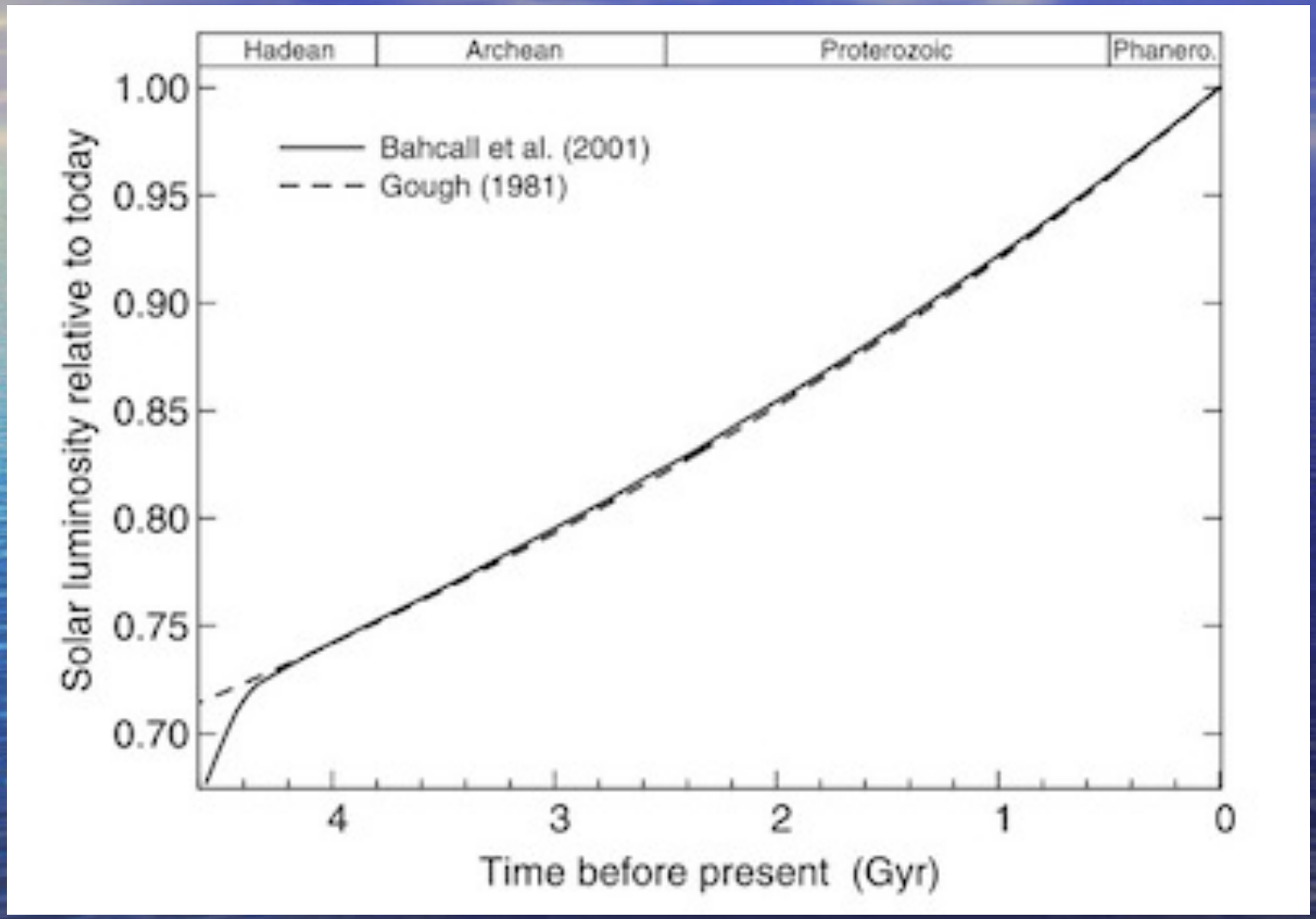
Planets from Sun

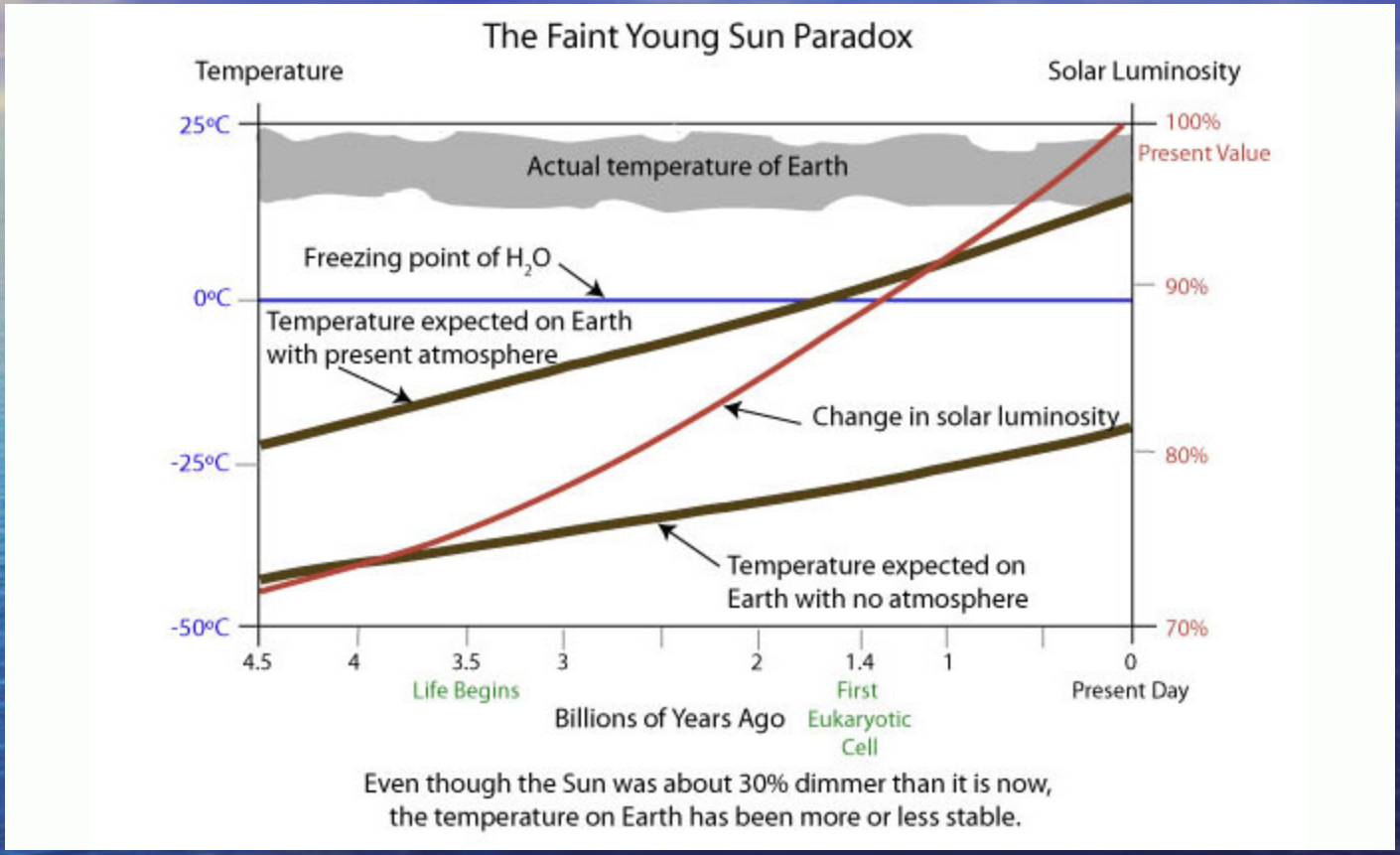
- Mercury 58 Mkm 0.37 AU
- Venus 108 0.72 AU
- Earth 150 1 AU
- Mars 230 1.53 AU

- Habitable zone 0.90AU-1.37AU

Luminocity of Sun will change in time

- Burning process will change so that radiation power will increase


Hadean
Archean
Proterozoic
Phanero.
1.00
0.95
0.90
0.85
0.80
0.75
0.70
Bahcall et al. (2001)
Gough (1981)
Solar luminosity relative to today
4
3
2
1
0
Time before present (Gyr)


The Faint Young Sun Paradox
Temperature
Solar Luminosity
25°C
0°C
-25°C
-50°C
100%
Present Value
90%
80%
70%
Actual temperature of Earth
Freezing point of H_2O
Temperature expected on Earth with present atmosphere
Change in solar luminosity
Temperature expected on Earth with no atmosphere
4.5
4
3.5
3
2
1.4
1
0
Life Begins
First Eukaryotic Cell
Present Day
Billions of Years Ago
Even though the Sun was about 30% dimmer than it is now, the temperature on Earth has been more or less stable.

Habitable zone

- It is estimated that habitable zone is between 0.90-1.37 AU , where AU is the distance of Earth from Sun. Closer than 0.90 AU is too hot and further than 1.37 AU is too cold. Liquid water is necessary for life.

Faint young Sun Paradox

- According geological observations has been concluded that 3850 Ma ago there were oceans on Earth and temperature was 30-40 C which is higher than now.
- Faint Sun could give only -20C temperature.
- Explanations have been rather syntetic green house effect caused by ”tailored” atmosphere

MARS currently

Dimensions of Mars

- Diameter 6752 km
- Acceleration on the surface 3.69m/sxs
- Tilting of the rotation axil 25.19 astetta
- Rotation time 24.6h
- Year 687 d

Temperature on Mars

- Average -63 C
- lowest -140 C
- highest +20 C

Atmosphere of Mars

- Carbon dioxide 95,3%
- Nitrogen 2,7%
- Argon 1,6%

- Total pressure 0.7-0.9% of the Earth atmosphere pressure

Faint Sun Paradox

- Distance of Mars from Sun is 1,53.
- Now Mars is frozen. Carbon dioxide partly and water are mainly on condensated on the poles.
- From Mars geology has been concluded that there have oceans 3000-4000Ma ago.How this is possible when luminocity of Sun has been 25% lower.

Standard cosmology

- Space is expanding
- Expansion rate will increase
- Gravitationally bound systems don't expand

CASE WHEN SOLAR SYSTEM IS EXPANDING

- What where distances 3850 Ma ago sitten, if solar system is expanding (Mkm and AU units)
- | | Now | | -3850 Ma | |
- | Mercury | 58 | 0.39 AU | 45 | 0.30AU |
- | Venus | 108 | 0.72 AU | 83 | 0.55AU |
- | Earth | 150 | 1.0 AU | 116 | 0.77AU |
- | Mars | 230 | 1.53 AU | 178 | 1.19AU |

Habitable zone -3850 Ma ago 0.78AU-1.19AU. Earth and Mars in this zone

Conclusions

- Earth has been 3850 Ma ago in habitale zone,but conditions have been warm. Ocean temperature has been +30-40 °C. (according geologists)

  This supports expanding orbits .
- Mars has been very close to the habiable zone. CO2 has stayed in the atmosphere . Temperature has been high enough for the water to stay in liquid form.

Final comments

- Expansion of solar system does not contradict with geological observation made from the Earth and Mars
- Expansion of solar system is good explanation for the faint sun paradox.
- According the current theory, Earth can't be habitable anymore than 300-500Ma because of the increased luminocity of Sun. However because of expansion of solar system Earth will stay habitable several billions of years

2.NUMBER OF DAYS IN A YEAR

It has been known long time that there has been more days in a year millions of years ago

Effect of tide on Earth rotation

P.M.Matthews and S.B. Lambert calculated effect of mantle and ocean tides on the Erth's rotation rate Earth rotation to be 2.5ms/ 100a

Astronomy and Astrophyics 493, 325-330 (2009)

Method to count days millions of years ago

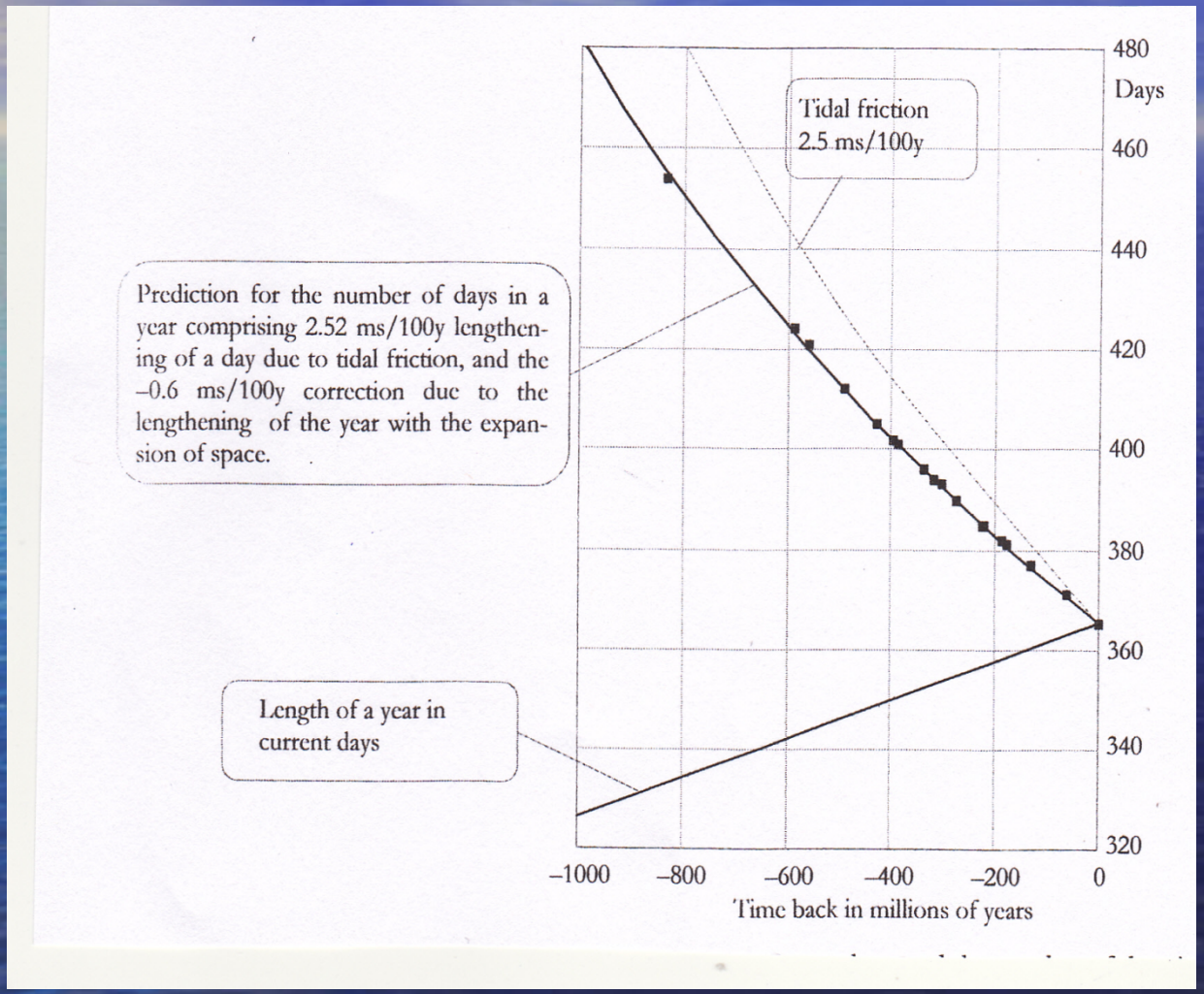
- Corals grow so that they develop dayly layer like in trees we can see yearly rings.
- Cutting coral fossils and lapping the surface it is possible to count layers.
- According the season layer thickness varies so that number days in a year can be counted.
- Radioactive dating will tell the age of the fossil

Results from corals counting

- Accurate data is collected down to 800Ma ago
- Number of days at 800Ma is about 435 day in a year
- What is the length of the year measured by clock at 800 Ma, nobody knows. We know exactly the number of days. We only assume that the year lenght in seconds is same than now

Number of days in a year according Suntola

$$N_D = \frac{Y_t}{D_t} = \frac{Y_0}{D_0}\frac{Y_t/Y_0}{D_t/D_0} = N_0\left(1-\frac{\Delta t}{t_0}\right)^{2/3} \Big/ \left(1-2.9\cdot 10^{-10}\,\Delta t\right)$$


Prediction for the number of days in a year comprising 2.52 ms/100y lengthening of a day due to tidal friction, and the –0.6 ms/100y correction due to the lengthening of the year with the expansion of space.
Tidal friction 2.5 ms/100y
Length of a year in current days
480
Days
460
440
420
400
380
360
340
320
–1000
–800
–600
–400
–200
0
Time back in millions of years

Suntola made fit by using his model to the number of days in a year and the experimental number found from corals and decrease rate of the rotation rate of the Earth

Lengthening of the year with expansionsion of space is taken account

Fit of the calculation to the experimental values is very good.

Different interpretation of the result

Suntola's theoretical fit containa a term, which have direct connection to the Hubble constant.

Starting from experimental values from the decreased number of days in a year from corals and calculated value of the decreased rotation rate of the Earth, one can calculate Hubble constant from his formula.

Result is 70km/s/Mparsec

Hubble constant is derived from observation of the

local phenomena. Earth-Moon system is expanding at same rate than whole space !

3. Increase of the Earth distance to Moon

It has been long known that distance to Moon will increase because of tidal friction.

Mirrors were set on Moon almost 50 years ago and distance to Moon has been measured. It is found that distance to Moon will increase 3.82 cm/a

Generally it is explained caused by tidal friction

However Suntola made controversial calculations that 2,75 cm/a comes from expansion of space and 1,07cm/a from tidal friction

Mirrors on Moon is not only way to measure the retreat rate of Moon from Earth

Tidelities have been deposited in several formation.

Lunar–solar cycles are preserved in those deposits.

Elatina Formation(-635Ma)of Southern Australia is perhaps best of the founded deposits.

There is continuos 60 years layered deposit

Rotation number of Moon in a year can be calculated directly from sediment layers from tides

Distance of Moon from Earth is then calculated from Kepler's law knowing the orbiting time.

In all studies is assumed that the lenght of the year has been constant

Two results from the literature

1. Best results in the literature, G.E. Williams
Journal of the Geological Society Vo.146,1989 pp.97-111
0-635Ma average rate 2.0 cm/a
2. Christopher L.Coughnour et.all. , Sedimentary Geology 295 (2013) 67-76
0-315Ma average rate 1.46cm/a (this result has rather wide error estimates)

Results from the sediments give roughly 50 % lower values than the current directly measured value

Weakness in the calculations is that the lenght of the year is assumed to be constant

Calculation according the Suntola model, where orbit is expanding and clock rate change when space is expanding is following

The increase of clock rate in the year observable with clocks on the Earth is 2.3x10E-3 s/year

New results for the retreat of Moon knowing the number of rotation and time of the year from Suntola's theory

Williams: 635Ma 3.98cm/a

Coughenour: 315Ma 3.57cm/a

Conclusion: retreat rate has been close the modern value 3.82 cm/a

Conclusion

Results from 3 phenomena 3-0 that gravitationally bound systems will expand when space is expanding

How it is energetically possible that gravitationally bound systems can expand when space is expanding

According the current theories it is not possible

Energy calculations

In Suntola's model in the expansion of space kinetic energy will change to potential energy. This happens so that the kinetic energy mc2 will change to the gravitational energy when velocity of light will slow down.

Comparing classical energy to the rise of Moon on the higher orbit to the energy what is released from the decreased velocity of light,

there is 11 orders of magnitude difference

Potential of the whole space is huge, expansion of space is huge phenomenon.

Potential of the local gravitation is very small

It can seen eg. in inertia of mass

It is practically independent of local masses like Sun and Milky Way

Is solar system expanding ?

3-0 is