The Expansion of the Universe into four Dimensions

English version 2011/01/07 G.Rowski

1-6 (without 2.1+2.3) translation from German by Rita Volgger

last reworked .2018/01/05

1. Preliminary considerations - philosophy of knowledge [1]

There is an objective reality, i.e. reality exists independently from consciousness. Our consciousness reflects reality correctly, i.e. the world is visible. There is no movement without matter and no matter without movement. Movement is matter's way of existence.

2. Why do natural constants match?

Why are our natural constants compatible? The changing of one single natural constant would mean that our universe couldn't exist in its actual form or a universe could not come into being.

Assuming that there has been a big bang and our universe has come into being, we can postulate that it had been a whole before, disaggregated into its components (here: the natural constants) which make up our universe, by the big bang. If, - in whatever way, a whole disaggregates into its components, the parts thereof show a joint characteristic: compatibility.

This is why it makes little sense in this context to contemplate a single component or to make any statements on what would happen if things were different.

2.1. Speed of light - a theory of relation

Acceptance: The speed of light is the maximum speed with which all known interactions can take place, the constant that determines everything in the universe.
If we were to change the speed of light and we look at how the other constants must change in order to keep the same relation to the speed of light.

Since the speed of light is a relation between space and time, it can be changed in several ways–only the spatial component, both components or only the temporal component.

Three cases correspondingly are compared:

Case 1: only the spatial component changes –less distance in the same time
Case 2: the spatial and temporal component changes –less distance in more time
(in this consideration, spatial and temporal components change in the same relationship)
Case 3: only the temporal component changes –same distance in more time

The comparison for better clarity will be with normed constants. All constants are put for the initial situation with unchanged speed of light 1.
The change of the speed of light shall amount to 81% of the initial situation – it changes from 1 m/s of exit system to 0. 81 m/s (normed).
this results in a new distance r and a new time t
Case 1 : $r=0.810\text{m}$ $t=1.000\text{s}$
Case 2: $r=0.900\text{m}$ $t=1.111\text{s}$
Case 3 : $r=1.000\text{m}$ $t=1.235\text{s}$
all results on 3 places after the comma rounded

In all 3 Cases we have only considered which of the physical constants depends of the spatial and witch depends of the temporal component (and in which way).

We start with the electric constant ϵ_0 and the magnetic constant μ_0
The equation $c=\frac{1}{\sqrt{\epsilon_0\mu_0}}$ is remodel to $1=\frac{1}{\epsilon_0\mu_0 c^2}$ arise, considering that ϵ_0 only depends of spatial and μ_0 only depends of the temporal components.

Case 1 : $\epsilon_0 = 1.524\,As/Vm \quad \mu_0 = 1.000\,N/A^2$

Case 2 : $\epsilon_0 = 1.235\,As/Vm \quad \mu_0 = 1.235\,N/A^2$

Case 1 : $\epsilon_0 = 1.000\,As/Vm \quad \mu_0 = 1.524\,N/A^2$

The elementary charge remains unchanged by the change of the light velocity and so remains the same for all systems 1.
If one checks the electrostatic force of two cargo loads in the space to each other now, and room component changed the accompanying arises the following values with the new ϵ_0,

with $4*\pi*F = (Q_1*Q_2)/(\epsilon_0*r^2)$

initial situation c=1m/s : $\epsilon_0 = 1.000\,As/Vm \quad r = 1.000\,m \quad 4*\pi*F = 1.000\,N$
Case 1 : $\epsilon_0 = 1.524\,As/Vm \quad r = 0.810\,m \quad 4*\pi*F = 1.000\,N$
Case 2 : $\epsilon_0 = 1.235\,As/Vm \quad r = 0.900\,m \quad 4*\pi*F = 1.000\,N$
Case 3 : $\epsilon_0 = 1.000\,As/Vm \quad r = 1.000\,m \quad 4*\pi*F = 1.000\,N$

Result for the electrostatic force gets cases for all three and one this exactly is like the initial situation–the force remains unchanged by a change of the speed of light.

If the force remains constant in all cases looked at, this also should apply to all other considerations. If we consider the formula $F = m*a$, in order to keep the force constant, the mass must change as the acceleration, as a relation of $a = r/t^2$ with a changed spatial or temporal component, has in the new systems other values.

Case 1 : $a = 0.810\,m/s^2 \quad m = 1.235\,kg \quad F = 1.000\,N$
Case 2 : $a = 0.729\,m/s^2 \quad m = 1.372\,kg \quad F = 1.000\,N$
Case 3 : $a = 0.656\,m/s^2 \quad m = 1.524\,kg \quad F = 1.000\,N$

The table of values show how individual components change with the change in the end system

change of constants if speed of light is changed
constants normed

		initial normed Value	unit	Case 1 only Spatial	Case 2 spatial and temporal	Case 3 only Temporal
speed of light (speed)	$c=\frac{1}{\sqrt{\varepsilon_0 \mu_0}}$	1,000	m/s	0,810	0,810	0,810
electric constant	ϵ_0	1,000	As/Vm	1,524	1,235	1,000
magnetic constant	μ_0	1,000	N/A²	1,000	1,235	1,524
length	r	1,000	m	0,810	0,900	1,000
time	t	1,000	s	1,000	1,111	1,235
force between two charges with Q1 and Q2 =1	$4*\pi*F=(Q_1*Q_2)/(\epsilon_0*r^2)$	1,000	N	1,000	1,000	1,000
either the mass is changed or the elementary charge is changed or both – else conflict						
for the next calculation the elementary charge is not change						
acceleration	a	1,000	m/s²	0,810	0,729	0,656
if the force in all systems the same then the mass must be change						
change the mass m with force is constant		1,000	kg	1,235	1,372	1,524
Check force and acceleration		1,000	N	1,000	1,000	1,000
constant of gravitation normed	G	1,000	N*m²/kg²	0,430	0,430	0,430
force between two mass		1,000	N	1,000	1,000	1,000
change of the electric Field strength	$4*\pi*E=Q/(\epsilon_0*r^2)$	1,000	Vm	1,000	1,000	1,000
change of voltage		1,000	V	0,810	0,900	1,000
energy in different ways		1,000	J	0,810	0,900	1,000
power	$P=E/t$	1,000	J/s	0,810	0,810	0,810
angular speed	$\omega=\sqrt{g/l}$	1,000	rad/s	1,000	0,900	0,810
period	$T=\sqrt{l/g}$	1,000	s	1,000	1,111	1,235
Quantum mechanic						
Reduced Plank constant with	$E=\hbar*\omega$ $\hbar$	1,000	Js	0,810	1,000	1,235
Atom radius Bohr	$\frac{r}{4*\pi}=\frac{\epsilon_0*\hbar^2}{m*e^2}$	1,000	m	0,810	0,900	1,000
Plank mass		1,000	kg	1,235	1,372	1,524
Plank time		1,000	s	1,000	1,111	1,235

This means, that a change of the speed of light wouldn't be noticed, as all surroundings are changed in the same way - One would shrink to fit in with the surroundings.
This sounds a little like the Lorentz transformation in the special relativity theory.

We check length, the time and mass for a system which moves with 0.2 - fold light velocity opposite a resting system.

From the Lorentz transformation one gets himself the following values, the length r = 1 m in the resting system transformed with the relationship $r'=r*\sqrt{1-0.2^2}$ to 0. 980m, the

time = 1 s with the relation $t'=\frac{t}{\sqrt{1-0.2^2}}$ to 1. 021 s, the velocity with $v'=v*(1-0.2^2)$ at

v=1 m/s to 0.96 m/s and the mass for 1 kg with $m'=\frac{m}{\sqrt{1-0.2^2}}$ to 1. 021 kg in the moved

system .

A speed would correspondingly change around the factor 0. 960 . What would happen in a world with a speed of light with factor 0. 960.
One gets the following values if one takes the 0. 960 arising as an original value for speed of light for the above scheme now.

	Initial System	unit	Case 1	Case 2	Case 3
speed of light	1.000		0.960	0.960	0.960
	without Change		Only Spatial	temporal And Spatial	only Temporal
length	1.000	m	0.960	0.980	1.000
time	1.000	s	1.000	1.021	1.042
mass if force is constant	1.000	kg	1.042	1.063	1.085

In case 2 (spatial and temporal component change in the same relation), we get the same values as from the Lorentz transformation for the length change and time change. Only at the mass change looks like different. Immediately it explains it self if one writes down the equation for the mass for the Lorentz transformation exactly.

$$m'=m_0\frac{1}{\sqrt{1-(\frac{v_x}{c})^2}}\frac{1}{\sqrt{1-(\frac{v_y}{c})^2}}\frac{1}{\sqrt{1-(\frac{v_z}{c})^2}}$$

In the Lorentz transformation, the movement is usually only in one direction, that the last two factors are 1.

Of course the speed of light changes in all directions, that the value of the calculated mass change must be different for the Lorentz transformation around the factor

$$\frac{1}{\sqrt{1-0{,}2^2}}\frac{1}{\sqrt{1-0{,}2^2}}=\frac{1}{1-0{,}2^2}$$ here.

The Lorentz transformation as a special case for the analysis of a changed speed of light, with the qualitative difference, that the mass change of the Lorentz transformation is direction-dependent, the mass change in the other calculation is direction-independent as the velocity of spreading of the light.
The speed of light – the relationship between space and time – defining size for all spatial and temporal measurements and interactions.

2.2. What is spacial expansion with application 2.1. ?

Until now:

The universe expands, it grows spatially. This means, the physical matter doesn't only fly out in all directions, but all of space expands similarly to the rubber surface of a balloon being inflated.

The empty space is characterized by fields, there are quantum fluctuations and there is a vacuum energy – **empty space is a physical reality**.

Absolute empty space is exemplary only.

It is of interest at this point that we proceed on the assumption that there is constant vacuum energy which would interfere with the law of conservation of energy for expanding space.

What is space really? If space holds vacuum energy, it also contains mass which, according to the theory of relativity leads to an interplay of mass, or as an equivalent, a mere question of energy.

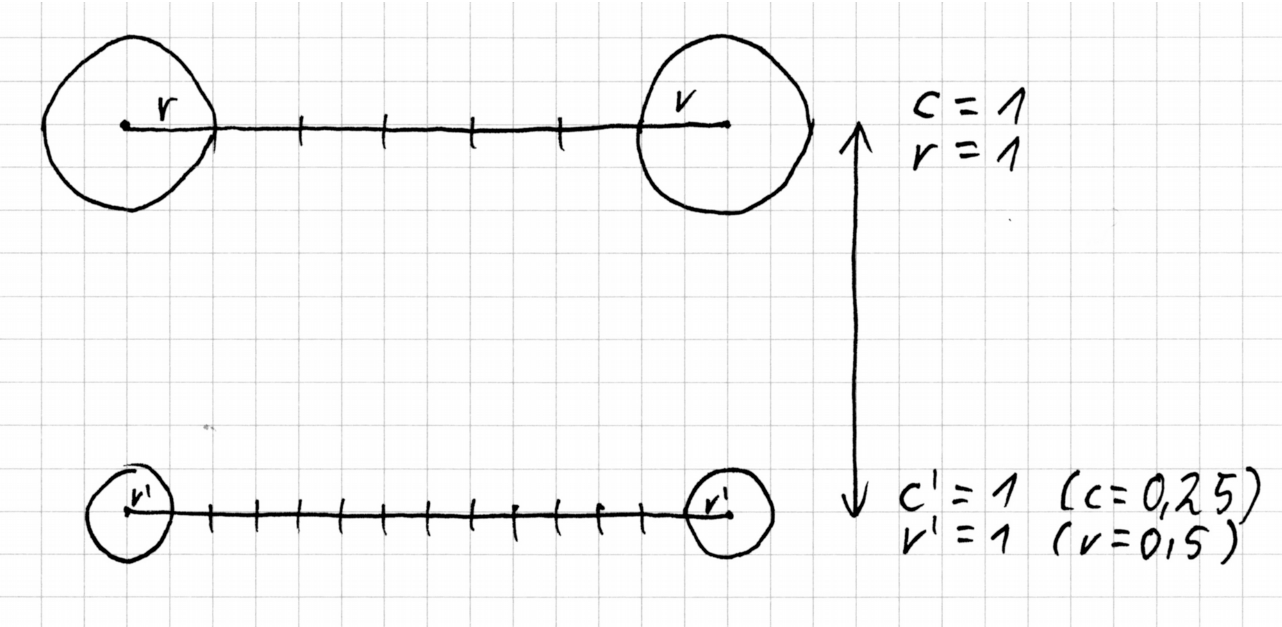
Spacial expansion with application 2.1.
Space may be considered as a measurable distance of definable points in 3 dimensions. The expansion of the space is a measurable increase in the distance of objects to each other. For the determination of distance, length normals are usually used, for example by mechanical means: fixed distance of atoms in a solid or electromagnetic type: over wavelengths (on closer inspection, only the latter remains).

If the speed of light is the all-determining relation, a reduction in the speed of light (from

2.1. Case 1 and 2) only appears as an expansion of the universe.

Example

If the speed of light in a system from c to c' is decreased to 25%, halve all spatial dimensions, which leads to an increase in the measured distances in the image by r and r' are shown.



The unit length r varies with the reduction of the speed of light to r '= 0.5 r. Within the system with reduced speed of light, the unit length is still unchanged 1.
If now two balls with a radius 1 in the starting system are positioned at a measured distance of 7 unit lengths, the measured distance would double to 14 unit lengths after a change in the speed of light to 25% system 1 'at the same position.
A measured expansion of the universe does not require additional space.

2.3. Behind the event horizon

Theoretically, there is also the possibility that there is matter in the universe, for a different "speed of light" is true. If theres "speed of light" be higher than ours, this matter might only interact via gravity with our matter (I am skeptical personally).
An interesting point of view arises for the event horizon, of a black hole. For a changed

speed of light is also another Schwarzschild radius results for cases 1 and 2 above.
By varying all constants corresponding results for the case 2 at double the speed of light a Schwarzschild radius of this matter, which is around the 1.414 times greater than with our matter, while the mass only 0.354 times would correspond to our mass.

Schwarzschild radius $r_S = 2GM/c^2$

M: Mass G: gravitational constant RS: Schwarzschild radius c: speed of light

That would mean, that we could see behind the event horizon of this matter. We would always still be in the known universe. This in turn then suggests that the event horizon is a relativistic appearance.
A crossing over the event horizon is proved to be difficult see topic 7.
However, there is then the possibility that matter for a lower "speed of light "applies to the formation of black holes can contribute.

3. Is the dimension of time real in universe?

The dimension of time is not visible in processes on a molecular level. When observing the processes, a distinction of the direction in dimension of time in the future or in the past is impossible.

This led physicians like Bolzmann (see [2] "es gibt keine objektiv ausgezeichnete Zeitrichtung"-there is no objectively distinguished time direction) to state the case that time exists only within consciousness respectively, time is only a human perception which orders experience, chronologically and causally. It is of no physical relevance.

See also Paul Davies' contribution in „Spektrum der Wissenschaft – Der rätselhafte Fluss der Zeit [3] and „Gestern und morgen sind eins" in „Bild der Wissenschaft", volume 1/2008 [4]

This knowledge is attained by observing a physical model and not by observing reality which also proves to be difficult since the molecular level cannot be observed even up to the present day.

In our daily reality, however, the dimension of time does exist. It is encountered daily in a most simple form, e.g. a hot cup of coffee gets (unfortunately) gradually colder. In thermodynamic terms this is called an increase of entropy. If not shown in the model, the dimension of time cannot be found there either.

Here we have a frequently quoted example: A billiard ball is seen on film rolling over the billiard table, it isn't possible to say after wards if the film is moving forwards or backwards.

The whole functions only in a friction less mode. In reality, one can ascertain that the billiard ball is decreasing in speed and it becomes warmer, therefore one can also tell whether the film is moving forwards or backwards.

The deviation of the model from reality in this case, is even greater than assumed at first sight. It is friction in mechanics which holds the world together. In an attempt to drive a car without friction, - we could or would not move, we wouldn't get any place. Without friction the ball previously mentioned wouldn't roll either, it wouldn't even exist.

Generally, all processes can be understood as an exchange and/or a conversion of energy. In doing so, the interaction with the surroundings within the model is eliminated. That which is commonly accounted for the direction of time, is the interaction with the surroundings. Energy is always being emitted or absorbed to or from the surroundings, depending on whether the observed process is of more or less energy than its surroundings. All attempts to eliminate this, for experimental purposes, unwanted interaction, will fail.

Each system strives for an energetically stable state which leads to a basic dimension of time. Time itself is based on the fact, that the dispersal of interaction takes place at fastest, at the speed of light.

Time within the universe can be defined as follows:
The tangible universe is growing older and expanding in space. Strictly speaking, this is the same, since growing older is an expansion into the dimension of time. **The universe expands into all four dimensions of the space – time continuum. The three dimensions of space are linked up with the dimension of time via the speed of light.**

With the expansion of the universe, each snapshot differs from the previous, or the following one whereby time gains physical relevance. In other words, there is a past and a future, there is cause and effect.

4. The expansion of the universe into spatial directions

It is at this point whether it is based on an apparent expansion as in 2. or a real one - the result of the consideration remains the same.

The early stage the development of the universe was very hot. It was so hot that there was approximately the same amount of particles and their antiparticles present (permanent come into existence and annihilate one another). The temperature sank in accordance with the rise in expansion. All particles currently known to us originated approximately 3 seconds after the big bang [5].

The entire history of the universe is unimaginable without expansion into dimensions of space or depending on the perspective, without cooling down, as one correlates with the other.

It can be imagined, by visualizing a very hot gas mixture: Carbon dioxide in a constant volume cannot exist at very hot temperatures (3000 ° C at 1 bar pressure absolute). It appears in the form of carbon and oxygen. The reaction of carbon with oxygen into carbon dioxide releases energy in the form of heat reaction being emitted to the surroundings. Heat can be released, however, only to colder surroundings. In the case of the surroundings being too hot, this reaction cannot take place.

According to the probability of quantum mechanics, there will be individual CO_2 molecules even at higher temperatures, since energy is not evenly distributed over all molecules and space, but is subject to statistic distribution. In this case, the chemist speaks of chemical equilibrium. From the adiabatic view, there won't be any changes in the situation, the system would be static and look the same at any point in time.

Development can only take place when the gas mixture expands adiabatic, pressure and temperature sink, which leads again to an increasing number of CO_2 molecules. The system would be different at any given point in time.

In a quantum-mechanical context, the existence of CO_2 molecules is possible at any given time and at any given temperature, merely in corresponding probability.

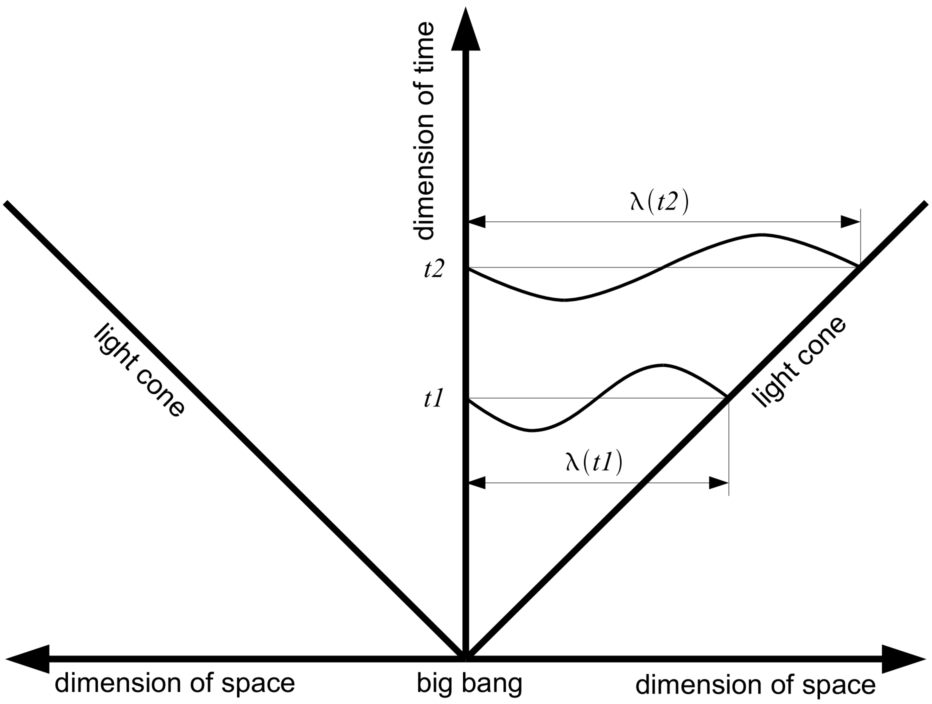
No changing without expansion.

5. Expansion of the Universe into Dimension of Time [6]

What form does expansion into the dimension of time take? Can a process such as the process cooling be shown in a model?

Here is one possibility:

The biggest possible wave length in the universe is defined by the light cone from the theory of relativity (limited by the dimension of space). In other terms, the smallest frequency depends on the age of the universe (limited by the dimension of time). Only one vibration per age of the universe is possible.



$t1$: point of time 1

$t2$: point of time 2 after point of time 1

$\lambda(t1)$ biggest possible wave length at point of time t1

$f(t1)=1/t1$ – lowest possible frequency at point of time t1

$\lambda(t2)$ biggest possible wave length at point of time t2

$f(t2)=1/t2$ – lowest possible frequency at point of time t2

A light cone is the path that a flash of light, emanating from a single event (localized to a single point in space and a single moment in time) and travelling in all directions, would take through space-time. Because it is thought that signals and other causal influences cannot travel faster than light in relativity, the light cone plays an essential role in defining the concept of causality. For a given event E, the set of events that lie on or inside the future light cone of E would also be the set of events that could receive a signal sent out from the position and time of E, so the future light cone contains all the events that could potentially be causally influenced by E.

If the biggest possible wave length is defined by the light cone or by the age of the universe, the biggest possible wave length grows in time (with the spread of the universe in the direction of time). The biggest possible wave length can be, in the area of quantum-mechanics, depicted as an energy level. It would, therefore, represent the smallest possible energy level to the corresponding point in the dimension of time. The lowest energy level is also called vacuum energy or zero point energy E0.

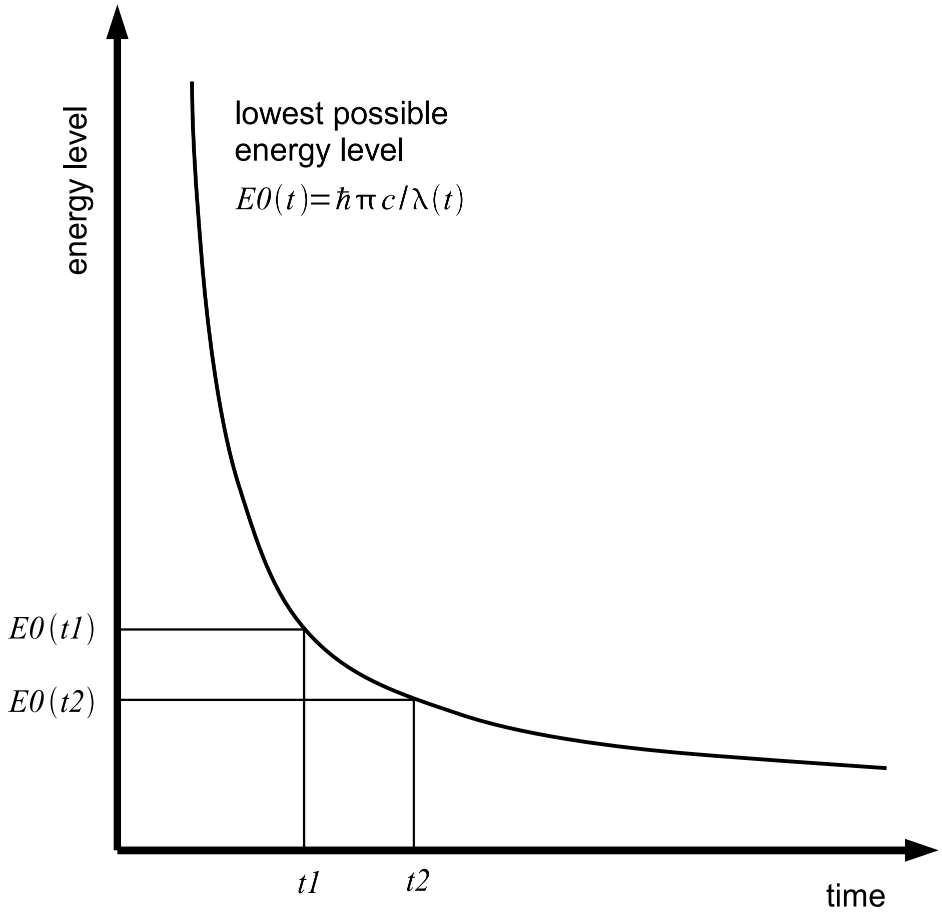
In formulas

The lowest possible energy level E0 arises from
$E0=1/2*\hbar*\omega$
$\hbar$ - reduced Planck constant
ω - related angular frequency

with
$\omega=2\pi c/\lambda(t)$
$\lambda(t)$- wavelength according to the light cone (age of the universe)
c - speed of light

after integration resulting in:

$E0=\hbar\pi c/\lambda(t)$



$E0(t1)$: lowest possible energy level at point of time $t1$ corresponds to wave length $\lambda(t1)$

$E0(t2)$: lowest possible energy level at point of time $t2$ corresponds to wave length $\lambda(t2)$

Only energy levels higher than $E0(t)$ can be taken.
If an event in the past releases energy, e.g. an electron reverts from the animated state to its basic state and releases electromagnetic radiation, the energy balance at the point of time $t1$, is smaller than at the point of time $t2$, since the energy volume to be emitted to the environment is defined by the smallest possible energy potential $E0$. This would become noticeable by a red shift of the emitted radiation at the time $t1$ to the emitted radiation at the time $t2$. Within the atoms, the relative positions of the orbitals to each other, change with the expansion of the universe in time.

The light spectrum of distant galaxies appears shifted to red, which can be put down to the expansion of the universe in the dimension of space. As light has been emitted also at previous points in time, in this case part of the red shift can be attributed to the expansion in the dimension of time.

There are two interpretations with regards to the number of micro states of quantum mechanics;

1. The total number of micro states is constant, only their position to each other changes.
2. The total number of micro states grows in time.

6. Summary 1-5

The universe expands into all four dimensions of the space – time continuum. A pulsing universe would have to contract after its expansion into all four dimensions resulting in the universe becoming warmer and time moving backwards.

The expansion in the dimension of space leads to cooling down, the expansion in time to a drop in zero point energy (also vacuum energy), according point 6.

If space holds vacuum energy, it also has mass which, in compliance with the theory of relativity, leads to interaction of mass or, as an equivalent, is a pure question of energy. Space is of physical relevance. The absolutely empty space can be regarded as having model purposes only.

Point 6 is not proven - only a model, a possible linkage from relativity theory and quantum mechanics. According to relativity theory only events from the past influence on an event as the time t (the distance in the 4 dimensions is determined by the speed of light), and explained it, why one can find only traces of the past and not from future.

7. The end of the time or why black holes can not come into existence in this universe

Singularity– infinite bend of the space time -, Black holes called, arise under certain boundary conditions from the general theory of relativity.

In Wickipedia you can read a lot of interesting thinks about Black holes by yourself - here are only the point about the event horizon

Citation 2011.05.30: Wickipedia-Black hole-event horizon

“The defining feature of a black hole is the appearance of an event horizon—a boundary in space-time through which matter and light can only pass inward towards the mass of the black hole. Nothing, not even light, can escape from inside the event horizon. The event horizon is referred to as such because if an event occurs within the boundary, information from that event cannot reach an outside observer, making it impossible to determine if such an event occurred.[42] As predicted by general relativity, the presence of a large mass deforms space-time in such a way that the paths taken by particles bend towards the mass.[citation needed] At the event horizon of a black hole, this deformation becomes so strong that there are no paths that lead away from the black hole.

To a distant observer, clocks near a black hole appear to tick more slowly than those further away from the black hole. [43] Due to this effect, known as gravitational time dilation, an object falling into a black hole appears to slow down as it approaches the event horizon, taking an infinite time to reach it.[44] At the same time, all processes on this object slow down causing emitted light to appear redder and dimmer, an effect known as gravitational red-shift.[45] Eventually, at a point just before it reaches the event horizon, the falling object becomes so dim that it can no longer be seen.”

The point of interesting is: “...taking an infinite time to reach it”.

What practically this means, the event horizon at no time is passed. Conversely, for the first observer when reaching the event horizon, infinite time has passed in the rest of the universe (all time?).. If nothing can pass the event horizon, as long as the remaining universe exists, then there are black holes in this universe?

G. Rowski g.rowski@web.de

List of Reference

1 Friedrich Engels „Anti-Dühring“

2 Klaus Mainzer "Symmetrien der Natur"

3 Spektrum Plus-article of edition 2/2003

4 Gestern und Morgen sind eins

Die moderne Physik schockiert mit einer radikalen Neuinterpretation der Realität: Die Zeit ist eine bloße Illusion. „Die Zeit, die ist ein sonderbar Ding“, schrieb Hugo von Hofmannsthal im Libretto für Richard Strauss’ 1911 uraufgeführte Oper „Der Rosenkavalier“ „Wenn man so hinlebt, ist sie rein gar nichts. Aber dann auf einmal, da spürt man nichts als sie. Sie ist um uns herum, sie ist auch in uns drinnen. In den Gesichtern rieselt sie, im Spiegel da rieselt sie, in meinen Schläfen fließt sie. Und zwischen mir und dir da fließt sie wieder, lautlos, wie eine Sanduhr.“ Dieser Fluss der Zeit ist uns sehr vertraut und zugleich äußerst rätselhaft – aber trotzdem wohl eine blanke Illusion. Denn immer mehr Physiker und Philosophen kommen zu dem Schluss, dass es die Zeit objektiv überhaupt nicht gibt. „Das zu erkennen, ist vielleicht die größte intellektuelle Herausforderung, mit der die Menschheit jemals konfrontiert wurde“, sagt der Philosoph und Physiker Vesselin Petkov von der Concordia University im kanadischen Montreal.

from „bild der wissenschaft“, issue 1/2008

5 I.D.Nowikow „Evolution des Universums“

6 PDF File of K.Raschke