# The universe as a black hole

Gisèle Wendl, Saturday, 18 February 2023, English revision 2.0
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To be able to explain the universe as a black hole, I use the formula about black holes developed by the physicist Karl Schwarzschild at the beginning of the 20th century.
But it's not the point to explain the universe as a black hole because locally this is not relevant for our observations of far distant astronomical objects.
What is relevant is the sphere that forms around any observed object and our position of an observer.
And some kind it's evident that objects at the border of our universe, which satisfies the conditions of a black hole, reside in objects that represent black holes – this means no light can escape from it.

I assume that the gravitational force has unlimited range.

This theory is meant to confirm the empirical measurement of the Hubble constant. But it also shows that the universe used to expand less rapidly than it does today.

An essential consideration of this theory is that the escape velocity of galaxies, which increases with increasing distance, is not a real velocity, but the result of a gravitationally caused red-shift in the frequency of the light measured here.

"Spatially speaking, the theory assumes that our visible universe is a tiny section of a huge cosmos.

To derive the red shift caused by gravity from the light of distant galaxies, a gravitational source is assumed that only acts on a photon at the moment of measurement:
The energy of a photon remaining after the influence of the gravitational force, thus the frequency of the light, is determined by the mass of the spherical object whose radius is defined between the photon source as centre and our measurement position.

Depending on the mass density, this results in a maximum possible size of this object. It cannot become larger than this maximum, because from then on it is a black hole: the mass of the object is then so large in relation to the radius that no photon can escape from it.

This maximum possible size is a distance. For light that traverses space, this distance becomes the maximum duration of its existence.

According to this theory, the average mass density of the universe is the only variable that determines the expansion of the universe:

$$t = \sqrt{3 / 8 * G * \pi * \delta}$$

t = time, G = gravitational constant, = mass density.
(Note: Here the expansion is given as time)

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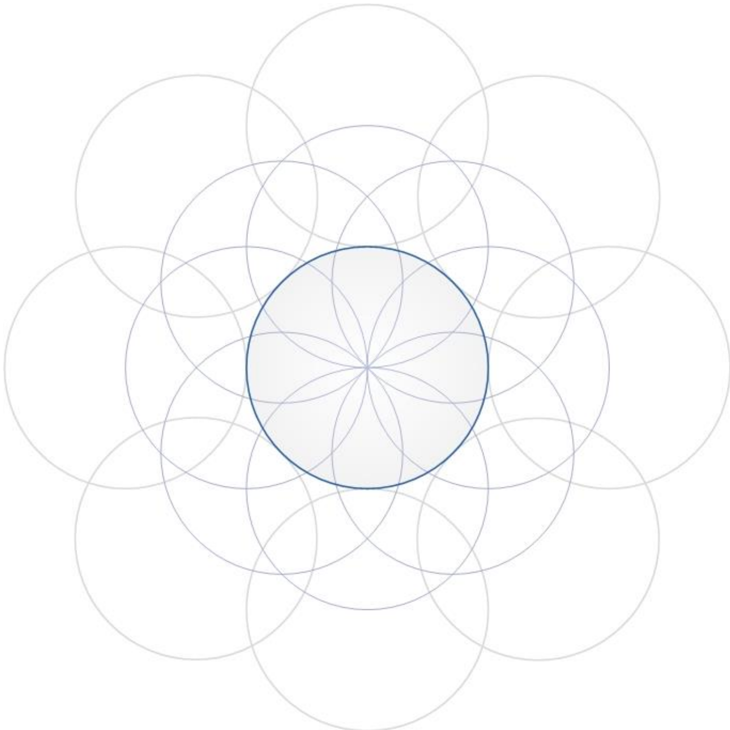


**Introduction**

The universe is the biggest thing we have in sight and we will never be able to see what is beyond it. There is a "cosmic censorship" and our reality ends at the horizon of our universe.
But we might know what is there.

The universe, in my view, is an island of time within the surrounding eternity, a space filled with light and life!

# 1 Summary

*The summary contains expressions and formulae which are explained in detail later in this document.*

The values of many quantities of the universe known from the science of the time around the year 2000 fit the values derived for them from this theory.

In this theory, the universe is assumed to function like a black hole.

A black hole means that a large mass prevents light from travelling further than the event horizon of the black hole. This real phenomenon, which is observed in "dead" stars and centres of galaxies, is primarily a gravitational phenomenon. This phenomenon also occurs on a large scale at the level of the universe. The physical and mathematical foundations for this are shown here.

## 1.1 Light and the time dimension

The connection between light and photons is that when mass is destroyed, typical energy packets are produced. The energy of these pieces, these energy packets, is defined by the radiated mass. In the form of light, this energy determines the frequency, or wavelength, of the light. Light is a photon beam.

The path of the photon along from emission to absorption can be seen as the radius of a sphere. The result is a spherical space spanned along this path.

In the existence of a photon there are only 2 events: Emission and Absorption - light cannot be observed in any other context than the context of these 2 events. Since photons travel at the speed of light, they do not "age". A photon is the same age at its absorption as it is at its emission.

In order to be able to detect light at all, one must be sensitive to light absorption. Before absorption, emission took place. Time passes in between - but this time does not change the information that the light transports to us - the information represents the state of a distant system at a past point in time.

The gravitational force is effective on photons, on light. Derived from the described 2-event existence of the photon, a continuous effect of a force is not conceivable. If a force is effective, then it is certainly at the moment of absorption.
That is the moment when the gravitational force of the space from which the photon comes acts. It is a single moment, therefore.

The formula explained below about photons in closed space,

$$M' = \frac{c^3 * t}{2 * G},$$

reflects this "timeless aspect" of the photon.

This is because the formula takes into account that the effective mass is known exactly at the moment t - and not at every moment.
If the influence of gravity were a continuously acting force that acted on the photon during its journey through space, an integral function would have to be used to define the formula for photons in a closed space:

$$M' = \int_{t_0}^{t} M * \frac{c^3 * \partial t}{2 * G}$$

M'= Sum(dM' [t0->t] of (0.5*c^3*dt)/G)

The integral function over the "time" in which the photon existed cannot be used, because the photon can only be validly described in the 2-point "emission/absorption" grid.

Gravity does not affect photons in the same way as classical "power" or "work", in the sense of the mechanical, physical, definition of work or power. There, as is well known, a force acts on an object during a certain time. Gravity acts on the photon in the second moment of "photon existence" - only in this sense can one say that gravity acts as a force on the photon and thus also on any information from the past transmitted by the photon. The inner time axis of a photon is not linear, not continuous; it is a system consisting of 2 points.

## 1.2 Conservation of total energy

Another important aspect of the formulas is the comparison of

- the mass of the - almost empty - cosmos with
- the mass required to convert the kinetic energy of a photon into potential energy, as occurs in black holes

The visible space of the cosmos, which we call our universe, is exactly as large as the result of this comparison. As soon as a photon has to be assigned to a mass that forms a black hole, it is no longer visible. If we now try to determine the size of such a "universe-sized" black hole, we see that this size depends solely on the average mass density - in such a universe.
The remaining parameter that is responsible for the expansion of the universe is therefore the local mass density of the cosmos.

If kinetic energy of light is transformed into potential energy, the total energy must be preserved. This necessary conservation of total energy can be calculated with the formula

$$E = \frac{2 * c^4 * m}{c^2 - v^2} \quad .$$

Using this formula and with formula $E = m * c^2$ measured shifts of known, typical frequencies of light, the so-called redshift velocity $v$ of an astronomical object can be determined.

The information of this astronomical object is thus brought to us via light and the kinetic energy of these photons is partially converted into potential energy.

This loss of energy, which the photon experiences, results in a negative velocity of the observed object. This in turn represents the potential energy created.

However, this velocity $v$ is not a direct velocity property of the observed object, it is an indirect property.

The measured velocity $v$ of the observed object, is a direct property of the light and not of the object that the observer is trying to measure.

## 1.3 The weak black hole, the logical black hole (LBH)

I understand the universe analogous to a black hole, it is like an almost transparent sphere, with very small mass density, a sphere with active gravitational force.

One can assume that mass - across the "boundaries" of the universe - is distributed more or less homogeneously. The mass density that is constant in this way determines:

- The escape velocity of astrophysical objects (cosmological red shift).
- The mass of the visible universe
- The maximum visible distance of the universe
- The relationship between the "red shift" and the distance to astrophysical objects

## 1.4 Key figures of the universe

Here is a comparison between the ratios of the universe according to the LBH theory and according to current scientific statement.

| LBH theory, under the assumption of a mass density δ (rho) | Key figures from current scientific literature: |
|---|---|
| **Mass density:** Mass density is the only variable in the system.<br>The assumed mass density for calculating the following key figures is slightly larger than currently assumed:<br>δ = 5.6E-24 g/m^3 | Mass density [1]:<br><br>Betwen<br>δ = 4.5E-24 g/m^3<br>and<br>δ = 1.8E-24 g/m^3<br>56% |
| **Mass**: 1.14108E+56 g | Mass: 0.604E+56 und 0.300E+56 g [2]<br>39% |
| **Max. visible distance**: 17.9097 Mia. Lightyears | Max. visible distance: < 13.4 Mia. Lightyears<br>75% |
| Lowest value for **Hubble's constant** at the end of the visible distance:<br>54.32 Km/h/Mpc 85.5% of 73.35 Km/h/Mpc<br><br>Value of the Hubble constant where the universe reaches half its mass: | Hubble's constant (H):<br><br>~ **73.35 Km/h/Mpc** |

| **LBH theory, under the assumption of a mass density δ (rho)** | **Key figures from current scientific literature:** |
|---|---|
| 63.52 Km/h/Mpc<br><br>Maximal value (here)<br>**77.21 Km/h/Mpc** 121.6% of 73.35 Km/h/Mpc | |
| **z**<br>z = 1 at ~ 8.05 Bill. Lightyears<br>**z = 2 at ~ 11.3** Bill. Lightyears<br>z > 13 at ~ 16.6 Bill. Lightyears | **z**, classic model from λ and H =73.35<br>z = 1 ~ 8.0 Bill. Lightyears 99%<br>**z = 2 ~ 10.8** Bill. Lightyears 96%<br>z > 13 at~ 13.2 Bill. Lightyears 80% |

## 2 Derivation of the idea

This model of the universe is based on the theory about black holes. The theory was developed by the German astronomer Karl Schwarzschild (1873-1916) and is still valid today.
The radius of a black hole results from its mass.

In a black hole, the kinetic energy of a photon is totally transformed into potential energy by the gravitational force of the black hole.

The radius of a black hole is defined with the following formula[3]:

$$r = \frac{2 * G * M}{c^2}$$

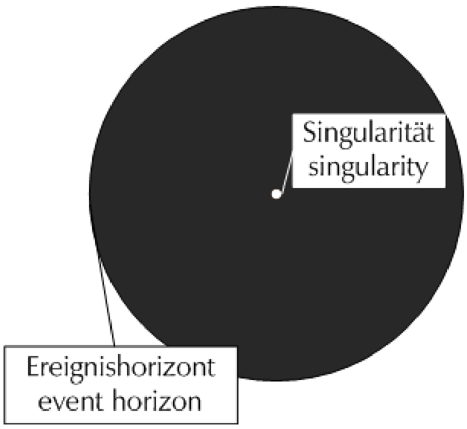
$$G \approx 6.67 * 10^{-11} m^3 kg^{-1} s^{-2}$$

Gravitational constant

The formula shows a general relationship between the distances that light can travel as a function of the mass of a black hole.
When you set $r = c * t$, so the formula refers to time and mass. In our universe, the so-called "end" is about 10 to 20 billion light years away.

This "limited visibility" is the result of this relationship between mass and light.

A black hole is often depicted like this:



For the definition of a black hole, only the ratio between mass and radius is decisive:

$$\frac{M}{r} = \frac{c^2}{2 * G}$$

On the other hand, it is the case that the mass of a spherical space increases with constant mass density in the cubic, and not linearly.

$M$ is responsible for the size of the event horizon. Within the event horizon, the following relationship applies

$$\frac{M}{r} < \frac{c^2}{2 * G} \quad ,$$

If the mass increases with a linearly increasing radius, the mass in the cubic increases and at some point the relationship is the same. This is at the event horizon.

The mass to calculate the final absorption energy of a photon is the mass of the sphere around the emission source and with radius to the observer - the theory assumes that the mass in this sphere has a density of $\delta$ (rho, g/m^3).

In the following, I would like to show that the observed "expansion of the universe" is based on this formula developed by Schwarzschild.

The few formulas required for this and already existing can be adapted in such a way that only the mass density of the universe is needed to calculate the "escape velocity" of distant galaxies - the so-called cosmological red shift.

Hubble's constant can be calculated by this theory and its range of values is effectively where we have made our empirical measurements and assume that the universe is between 10 and 20 billion light years in size.

## 3 Photons in a closed space

The kinetic energy *E* of a photon …

$$E = \frac{1}{2} * m * c^2$$

is changed by gravity …

$$G * \frac{M * m}{R},$$

… into potential energy, and thus defines the closed space from which no photon can "escape".

*m* is the mass corresponding to energy *E* of a photon.

$$\frac{1}{2} * m * c^2 = G * \frac{M * m}{R}$$

$$\frac{1}{2} * c^2 = G * \frac{M}{R}$$

$$R = G * \frac{2 * M}{c^2}$$

Note: R is the radius to the event horizon

$G \approx 6.67 * 10^{-11} m^3 kg^{-1} s^{-2}$

Gravitational constant

This is a property of black holes: as soon as the gravitational force is greater than the energy of a photon, it cannot move any further away from the center of the black hole. It "loses" all its energy behind the event horizon of the black hole.
The kinetic energy converts into potential energy.

Now you can imagine that all visible light emits from the center of a sphere. The radius of this sphere assumes as the distance to the observer. As if there is a sphere around the astronomical object that touches the tip of the nose.
It is like a huge almost transparent sphere with a luminous center.

What is essential about this new idea is that the transformation of kinetic energy into potential energy takes place exactly at the moment of observation. The effective mass is composed of the mass of the astronomical object and all other objects within this sphere. Theoretically, the effect is independent of the distribution of the other objects in this giant sphere.

The radius *R* of such a sphere may interpret as the product of time and the speed of light.
The transformation of Schwarzschild's formula with time as a function to the radius then looks like this:

$$R : R = c * t \text{, } is$$

$$\frac{1}{2} * m * c^2 = G * \frac{M' * m}{c * t}$$

*m* can be eliminated from the formula and after multiplication by *c*, so that *c* is only on one side of the formula, I get the first derived formula:

**First formula is**

$$\frac{1}{2} * c^3 = G * \frac{M'}{t}$$

This formula applies to a closed system in which mass and time are completely dependent on each other.
A system of mass-time cannot have a greater visible past than the inner size of this system. Its radius determines the longest possible time *t* that is observable in the system.

$$t = \frac{2 * G * M'}{c^3}$$

*AND*

$$M' = \frac{c^3 * t}{2 * G}$$

Also, a system of mass-time cannot be observed from the outside if it fulfils the conditions of this formula.

## 4 Mass, mass density and time

**2nd formula:**

Mass, in turn, depends on the density *rho* and the space.
The mass of a sphere is calculated according to this formula:

$$M = \frac{4}{3} * \pi * r^{\wedge 3} * \delta$$

With the time *t*, instead of *r*, as a variable, we get in turn: $M = \frac{4}{3} * \pi * (t * c)^{\wedge 3} * \delta$

I thus obtain a 2nd pair of formulas:

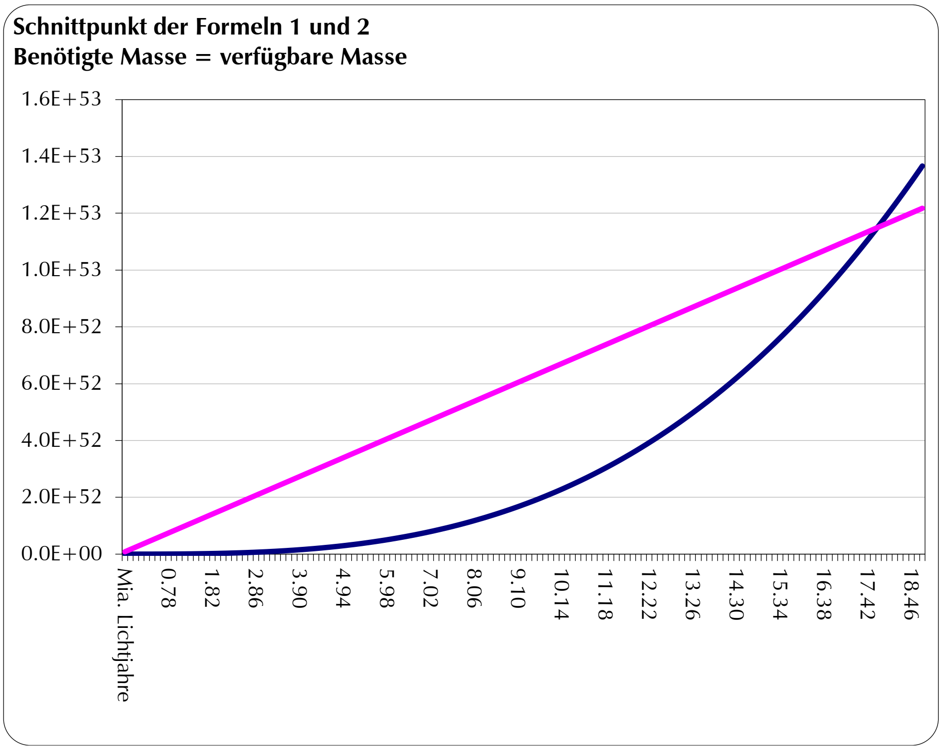
$$M = \frac{4}{3} * \pi * (t * c)^{\wedge 3} * \delta$$

*AND* *(resolved after time t)*

$$t = \frac{1}{c} * \sqrt[3]{\frac{(\frac{3}{4} * M)}{\delta * \pi}}$$

# 5 The maximum visible distance in an enclosed space

The formulas from the previous two chapters can be used to draw function graphs. Common to the graphs is the density rho. Here I assume that the universe has a uniform density rho of $\delta$=5.52E-24g/m^3:




Vertical (y-axis): Mass in grams
Horizontal (x-axis): Distance in billions of light years (LY).

The line in magenta represents the mass required to convert the kinetic energy of electromagnetic radiation into potential energy (formula 1).

The dark dark blue curve shows the mass of a sphere with a density of *$\delta$=5.52E-24g/m^3* (formula 2).

The maximum visible distance is where the two curves cross – there's the maximum visible distance of space with density rho.

Expressed in time *t* it looks like this:

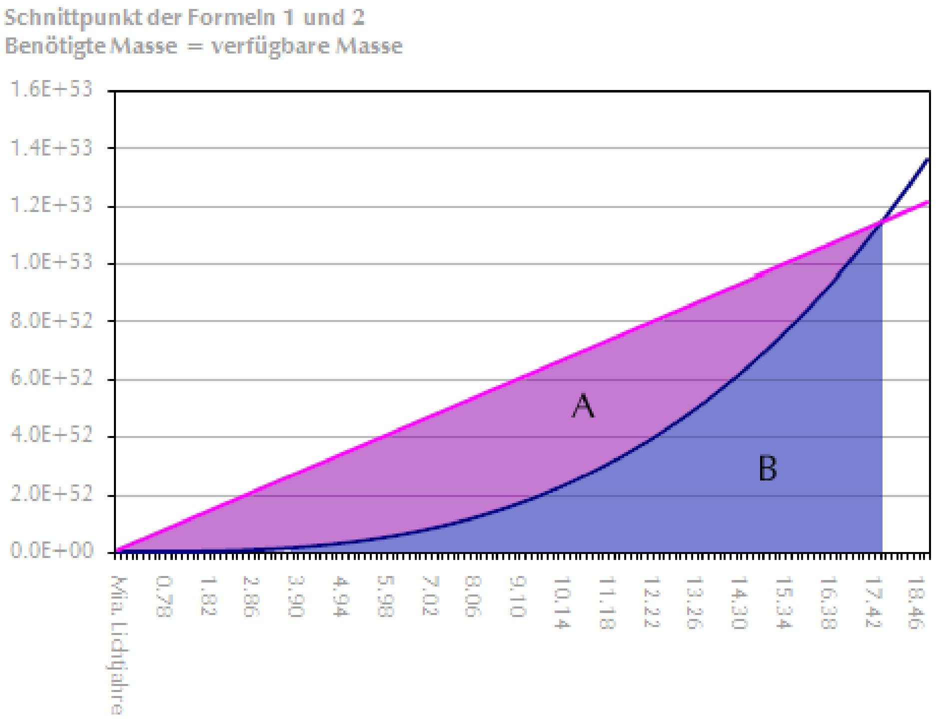
$$t = \sqrt{\frac{3}{8 * G * \pi * \delta}}$$

**Further numerical examples with rho, maximum visibility and mass**

| **δ, rho (g/m ^ 3)** | **Maximal visible distance (Bill LY)** | **Mass (g)** |
|---|---|---|
| 1.0E-23 | 13.4023 | 8.53881E+55 |
| 9.5E-24 | 13.7507 | 8.76121E+55 |
| 8.0E-24 | 14.9842 | 9.54662E+55 |
| **5.52E-24** | **18.07** | **1.15525E+56** |
| 4.5E-24 | 19.9799 | 1.27307E+56 |
| 2.3E-24 | 27.9464 | 1.78061E+56 |

**There's another observation**

Surfaces of forms **A** and **B** are always same:




**A first conclusion**

It's a hypothesis at the same time, because there's no other prove than by logical analysis.
"Massdensity δ (rho) of the universe seems to be constant far behind its visibility."

We can talk about the **cosmos** identifying the visible universe and all what is behind visibility.

# 6 Cosmological Red shift

How can the expansion effect of the universe be explained?

One observes an increasing escape velocity of astronomical objects with increasing distance. This escape velocity is derived from the shift of the frequency range of light into lower energy frequencies, yellow light can thus become red light, for example. The observed phenomenon is therefore called cosmological redshift.
There are 2 possible reasons for such a redshift: It can be caused by a real escape velocity of the observed object, or it can be the result of the action of gravitational force on light:

In the same way as in a black hole, a gravitational field absorbs the energy of a photon. In a black hole all energy of the photon at the event horizon is totally transformed into energy which conceptually corresponds to potential energy.

It is important that the total energy of the observed closed space-mass system (the observation entity) remains constant. With the formula for the description of the total energy of such a system (1) and the formula about the relation between mass and energy of Einstein (2) the total part of a photon converted into potential energy can be calculated, if a gravitational field acts, which is smaller or equal to that of a black hole. This results in a redshift, which can be used to derive an escape velocity.

Because a photon cannot change its velocity, its energy loss over a lower frequency is observed.

It is the mass density and the expansion of the system that makes the photon observable that are jointly responsible for the photon's energy loss, so to speak.

From the previous graph it can be deduced that a photon lacks more and more energy with increasing distance.

It is

(1) $E = \frac{m * c^2}{\sqrt{1 - \frac{v^2}{c^2}}}$ [4] E=mc^2/((1-v^2/c^2)^1/2)

(Relativité restreint, Energie totale, P. 184)

and

(2) $E' = m'*c^2 \Rightarrow m' = \frac{E'}{c^2}$ [5] E'=m'c^2 => m'=E'/c^2

(Relativité restreint, Energie de masse, Energie au repos), P. 184)

*m* from formula (1) is replaced by *m*' from (2) and represented as $\frac{E'}{c^2}$.

In the next step, I solve the two equations for v.
E' represents the energy of the photon at the beginning, at its emission. Depending on the velocity of its source, E, the observed energy of the photon, changes. It looks as if the source is moving away with an escape velocity v.

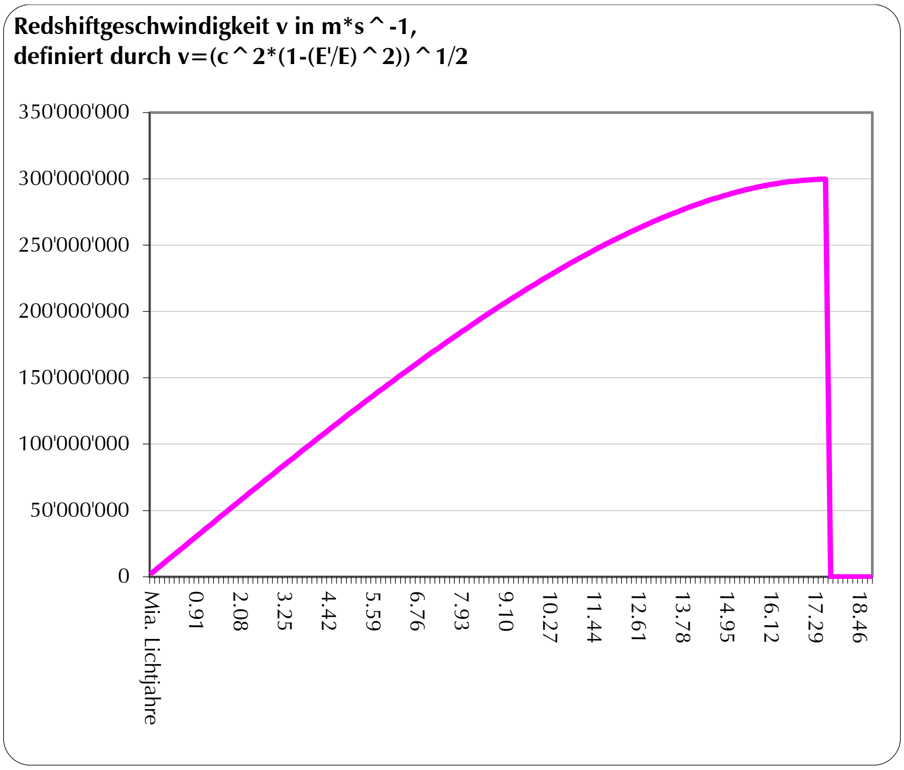
The individual steps for converting the formula (1) to the function on v are as follows:

1. E=(E'/c^2)*c^2/((1-v^2/c^2)^1/2)
2. E=E'/((1-v^2/c^2)^1/2)
3. E/E'=1/(1-v^2/c^2)^1/2
4. E/E'=1/(1-v^2/c^2)^1/2
5. E'/E=(1-v^2/c^2)^1/2
6. (E'/E)^2=1-v^2/c^2
7. 1-(E'/E)^2=v^2/c^2 and in the end we get to:

$$v = \sqrt{c^2 * (1 - \frac{E'^2}{E^2})}$$

v=(c^2*(1-(E'/E)^2))^1/2

If we resolve the formula system according to the velocity v, we get this graph for velocity as a function of distance (in light years):



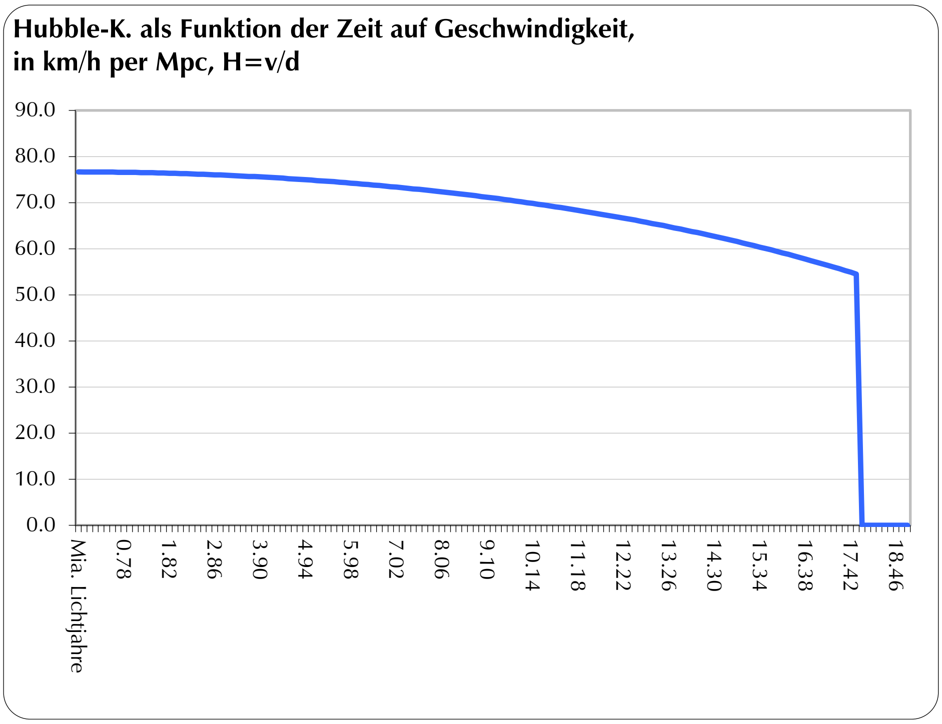

The ratio E'/E, from graph 1, is thus transformed.

In this example, the density rho was again assumed to be **5.52E-24** g/m^3
It resumes in

- ⇨ Maximum distance for light (visibility): 18.07 billion Light years Mass: 1.15525E+56 g

## 6.1 The connection to Hubble's constant

If this escape velocity just described is known, a function for the Hubble constant as a function on time derives. However, it is not a constant value:




The differences of the values obtained in this way deviate up to +- 20% from the function defined as a constant today.

At the end of visibility the value is:
54.50 Km/h/Mpc, this corresponds to a difference of -25.3%;

at half the mass of the universe:
63.21 Km/h/Mpc -13.4% difference

at the beginning, in our direct astronomical environment:
76.65 Km/h/Mpc +5% difference.

However, the "Hubble acceleration" defined in this way diverges only by +/- 5% up to a distance of 9.5 billion light years..

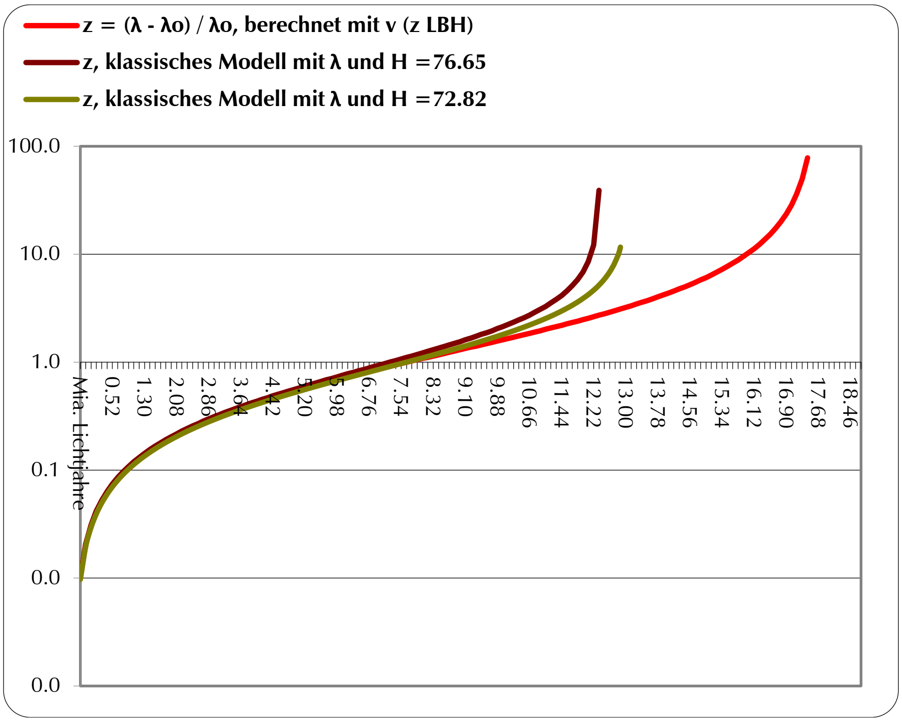
### 6.2 The parameter z for the cosmological redshift

The wavelength $\lambda$ of the light of a moving object is calculated as follows:

$v=c-(c*\lambda o/\lambda)$
$\lambda=(c*\lambda o)/(c-v)$

$\lambda o$: Initial wavelength

z, the parameter that is often used to indicate "red shift" is $\lambda o/\lambda$




Again with rho = 5.52 g/m^3 we reach an initial value for the Hubble acceleration of 76.65 Km/h/Mpc

- if z= 0.9985 the Hubble acceleration is 72.729 Km/h/Mpc
- if z= 1.7 the Hubble acceleration is 69.64 Km/h/Mpc

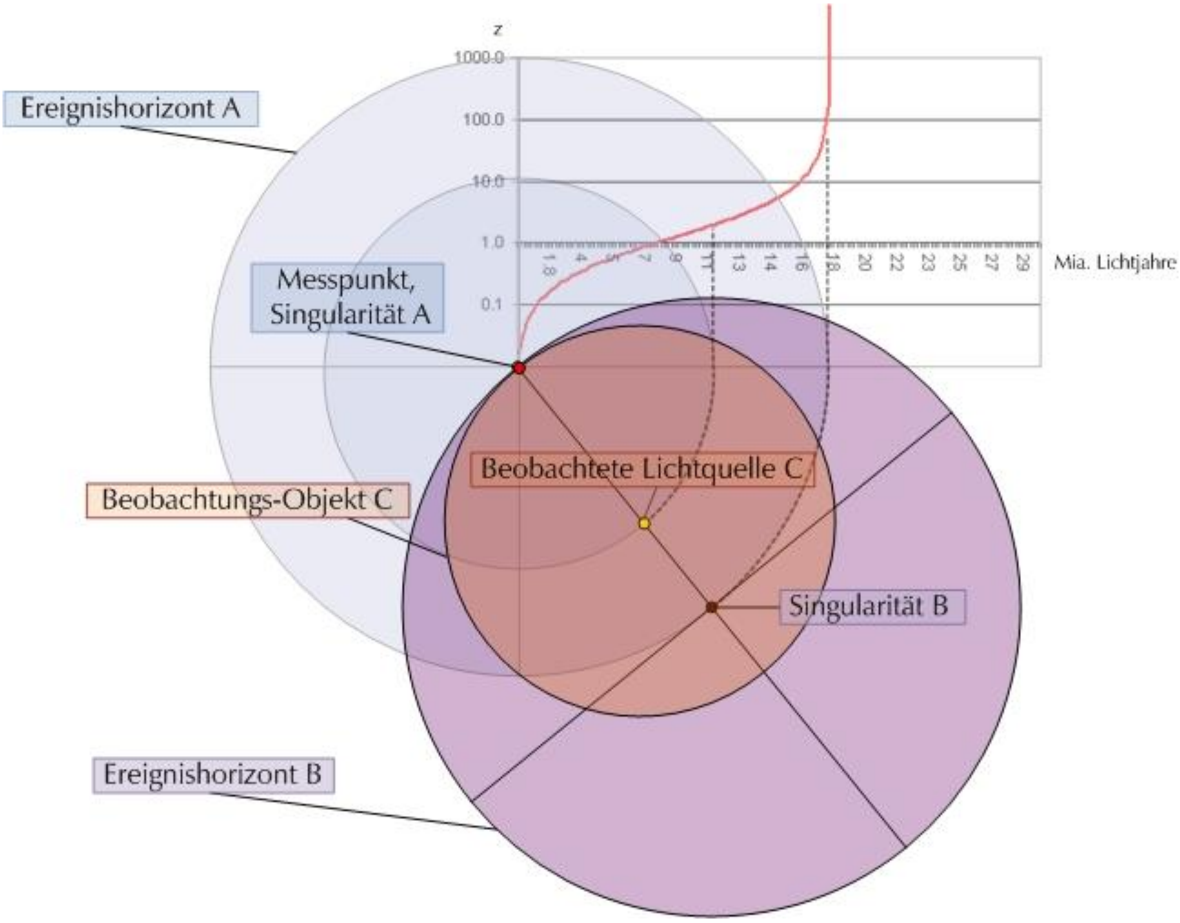
This would mean that, compared to the classical calculation, astronomical objects up to z=0.9, z=1 are a little closer to us - assuming the official Hubble constant is ~ 73.2.

For rho = 5.52 g/m^3 z=13.66 is at ~16.77 Bill. Light years

After z=1, the world is gradually "stretched" up to 25%, compared to the current scientific state around 2020. But until z=1 almost everything remains unchanged.

## 6.3 2D model for Redshift

The further away an observed light source is, the larger the observed object C becomes. If C becomes as large as B, it is a logical black hole.



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