



Gravitation Demystified

with the critique of the Big Bang cosmology and so necessarily
with the explanation of illusion of universal expansion and
elimination of Λ from Einstein's field equation
and other improvements to the theory
not even mention its quantization

by [W. Jim Jastrzebski](#)
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"Let me also say something that people who worry about mathematical proofs and inconsistencies seem not to know. There is no way of showing mathematically that a physical conclusion is wrong or inconsistent. All that can be shown is that the mathematical assumptions are wrong. If we find that certain mathematical assumptions lead to a logically inconsistent description of Nature, we change the assumptions, not nature."
Feynman "Lectures on gravitation"

"Everything should be made as simple as possible, but not simpler." **Einstein**

" [\$\Lambda\$ \[cosmological constant\]](#) = the biggest blunder of my life." **Einstein**

Abstract

It has been shown that the [big bang hypothesis](#) (BBH) *oversimplified* the physics of [Einstein's general relativity](#) (EGR) by neglecting the [Hubble time dilation](#) (HTD) as the reason of cosmological redshift. Overlooking the coupling between temporal and spatial parts of *Ricci tensor* that makes the spacetime intrinsically flat produced such artifacts as (i) nonvanishing curvature of spacetime, (ii) symmetric metric tensor of spacetime, rejected by Einstein already in 1950 yet still present in BBH, (iii) expansion of space, (iv) acceleration of this expansion, (v) quasars, (vi) "dark energy" a.k.a. cosmological constant Λ a.k.a. "repulsive gravitation", (vii) the 'anomalous' acceleration of cosmic probes Pioneer 10 and 11, and (viii) creation of energy.

Preamble

In 1543 Nicolaus Copernicus (1473-1543) postulated that the movement of the Sun around the Earth was an *illusion* due to Earth rotation (why would the big Sun circle the small Earth instead of a simple rotation of Earth and running around the big Sun as other planets do?) He figured it out much earlier than 1543 but it was not too safe to have a difference of opinions with the establishment so he waited with publishing the news until he was sure that he was dying so if something went wrong with his publication the establishment could be able to burn only his book.

The establishment didn't accept Copernicus' common sense idea for many years. It was even worse than that since one of the greatest astronomers of the time, Tycho Brache, member of establishment himself, ruled out the possibility that the Sun sits at the center of our solar system, on the basis of lack of observable parallax of nearer stars against the farther ones. He maintained that it made no sense for God to place stars so far that the parallax were invisible (having no telescope invented yet he couldn't know that the stars were even thousands times farther).

So establishment astronomers didn't want to support Copernicus' common sense idea and were producing false arguments against it. Not unlike nowadays when the establishment astronomers support the BBH with false arguments, despite that BBH contradicts not only Newton's math and Einstein's physics but its proponents claim also the necessity of invalidity of principle of conservation of 4-momentum. Richard Feynman says: *"a (4) claim based on the stupidity of the author that some obvious and correct fact, accepted and checked for years, is, in fact, false (these are the worst: no argument will convince the idiot)"* [fragment of [Feynman's letter](#) from the Gravity Conference in Warsaw, Poland, to his wife]. This whole establishment's effort might be taking place only not to disappoint creationist foundations that support the establishment's scientists with money given to them as gifts for which the establishment just feels obliged to return the favour pushing the creationism (the "methaphysical boundries of science" as they call it).

Today burning scientists at stake to teach them something is not legal so the opponents are just denied publications by establishment editors and in all cases it suffices. So any new discoveries have to wait with

publications until the old establishment guys die out. Which eventually happens and the science progresses. It takes a lot of time though. E.g. the discovery that the universe is not expanding, the consequence of Einstein's general relativity, waits already over 25 years for publication. This is not as bad as in times when the Catholic Church ruled the world (which reminds us better not to let it happen again).

In **1600** Giordano Bruno (1548-1600) was burned at stake by the Catholic Church for propagating the Copernican idea and maintaining that the existence of God, the creator of the universe has been an *illusion* too. Galileo Galilei (1564-1642) was warned of the punishment for propagating ideas contradicting the establishment. It is like today, when people are scared into complying with the establishment's opinion since, despite that they can't be legally burned at stake any more, they may easily lose their jobs and most of them, especially their families, still need to eat [1].

Incidentally, Galileo became a founder of *scientific method* with which science discovered many more *illusions* that people believed in, in denial of their rather obvious fictitious nature. Example of such things are "*creation of something from nothing*" in which even [some ancient Greeks](#) didn't believe.

The existence of "*fundamental force of gravity*" is another such *illusion* since "*force of gravity*" turned out in 1915 to be only an inertial force that depends on acceleration of the object experiencing this force. Another example is the existence of "*magnetic force*" while it turned out to be electric force from different point of view and then the both forces together were called "*electromagnetic*".

Already in **1687** Isaac Newton (1643-1727) discovered a [mathematical theory](#) of gravitation. He didn't know the *physical reason* for it. He refused to believe that it is [gravitational attraction](#) since he didn't believe in [action at a distance](#). Neither did Albert Einstein (1879-1955) who called it *spooky*. Both considered it an *illusion*.

In **1905** Einstein discovered [relativity](#) that made possible to discover [physical theory of gravitation](#). He developed it between **1911** and **1915** but its [field equation](#) turned out to be unstable and Einstein stabilized it in **1917** with his [cosmological constant \$\Lambda\$](#) . It destroyed the *elegance* of his equation making it a [phenomenological theory](#) as being valid for only one particular value of density of universe. Einstein worried a lot about it, even called it the "*biggest blunder of my life*" but eventually he gave up fixing his field equation and he said "*if you are out to describe the truth, leave elegance to the tailor*".

The observations of galactic redshifts by Vesto Slipher, after he had discovered the blueshift of Andromeda in **1912**, outnumbered the observations of blueshifts by about four to one. It gave some astronomers an idea that the universe is expanding on the average. It was their best guess since the notion of curved space was not known yet. Einstein discovered it only three years later so it was not possible to guess that galactic redshifts are the relativistic effects of curvature of space.

In **1931** consensus of astronomers accepted the idea of astronomer, mathematician, and Catholic Priest George LeMaitre (1894-1966), that galaxies move away from us on average and that the observed redshift may be a Doppler shift due to the recession of galaxies. It would suggest that the universe began in form of LeMaitre's "cosmic egg" and it is expanding ever since. The redshift caused by the alleged expansion of universe has been named "cosmological" and the alleged moment of "creation of universe" (appearing of "cosmic egg" out of blue) has been named in 1949 the "Big Bang" by Fred Hoyle, an astronomer who didn't take seriously this event and offered his own hypothesis about the cosmological redshift in agreement with so called "perfect cosmological principle" but not with the principle of conservation of energy and so impossible from the point of view of physics based on strict conservation of energy.

The thing that has been preventing the discovery of the reason for the [redshift](#) in stationary space was the other flaw left in the theory (except the cosmological constant). It was the symmetric [metric tensor of spacetime](#).

In **1950** Einstein noticed that the metric tensor [must be non symmetric](#). It turned out to be a necessary step in discovering that the reason for the [cosmological redshift](#) is the inability of nature to create energy from nothing.

Einstein was already 71 and despite he opposed LeMaitre's idea he was apparently not interested in fixing all the mathematical details of his theory that he stopped to understand. He said: "*I stopped to understand my theory when mathematicians started to explain it to me*". He left to young mathematicians the explanation of Hubble redshift.

The young mathematicians failed miserably despite Richard P. Feynman's (1918-1988) [warning](#) against treating mathematics as superior to physics (see Feynman's quote on the front page).

In **1973** Charles Misner(1932-), Kip Thorne(1940-), and John Archibald Wheeler(1922-2008) ([MTW](#)) published their own, [mathematical theory](#) of general relativity based on [axioms](#), ignoring the relativistic [interrelation of time and space](#) well known already from the special relativity and the [principle of conservation of energy](#) following from Einstein's assertion of 1950 that metric tensor of spacetime [must be non symmetric](#). They assumed *symmetric metric tensor of spacetime*, and zero value of cosmological

constant in attempt to make Einstein's equation "elegant" again, which, according to Friedmann solution created an artifact of **decelerating expansion of space**. They accepted 1931 idea of George LeMaitre that the universe got created in the Big Bang event some 14 billion years ago and is expanding ever since. MTW book has been adorned with a picture of an angel blowing a horn and a quote from Leibniz "*One suffices to create Everything of nothing!*" on page 1218.

The necessity of calculating the amount of redshift in "[Einstein's \(stationary\) universe](#)" that would falsify the story of creation was avoided by convincing astrophysicists that it is *negligible*. The legend of negligible redshift (despite it being one more *illusion* clarified already by me in 1985) lives till today among astronomers, so they don't even try to calculate it rigorously, just maintain that they [don't understand gravitation](#). The cosmology with *never calculated* amount of [intrinsic redshift](#) and *with the violation of principle of conservation of energy* became a "*standard cosmological model*".

The lack of conservation of energy has been more subtle than the creation of whole universe from nothing. It was an assumption deduced from *assumed* symmetric metric tensor of spacetime that [dynamical friction doesn't apply to photons](#). Consequently photons had to move with no loss of energy in stationary universe despite their gravitational interaction with the masses of universe. Equivalently, the time has to run at the same rate in the whole universe, which has been false even in everyday life as shown already by Einstein's special relativity and also by the [gravitational redshift](#). MTW's hypothesis allowed exceptions from physical laws to save their belief that the universe was *created* and the effect of their efforts was that their gravitation was not Einstein's but Newton's mechanics with its conservative gravitational field, as if there was no other option but to assume that the energy of photons that necessarily was dispersed in universe, was miraculously recreated from nothing to keep redshift of photons in non expanding universe equal exactly zero to keep viable the idea of expansion of universe.

One of the recent additions to the list of *illusions* rectified by science is the "expansion of the universe" falsified only in 1985 due to the help of Newton's math and Einstein's physics but still kept as a secret by the editors of scientific journals.

In February **1985**, neither being aware of logical equilibristics of mathematicians promoting BBH nor knowing that the redshift in Einstein's universe was supposed to be negligible I [calculated this redshift](#) using simple Newtonian math and even simpler Einsteinian physics. The [Hubble constant](#) of Einstein's universe turned out to be $H_o = c / R_E$ where c is speed of light and R_E turned out to be (as I learned later while taking a general relativity course at Harvard) [Einstein's radius of universe](#). So I proposed that the expansion of space was an *illusionillusion* caused by "*Hubble time dilation*", as I named it since he discovered it, and I proposed that this time dilation should be observed as accelerating expansion with $dH / dt = - H_o^2 / 2$ since this turned out to be the second term of Taylor series into which the Hubble redshift could be split.

In **1998** the [Supernova Cosmology Project](#) showed that observations of universe are consistent with the above proposition with accuracy better than [one sigma](#), which allowed also to [eliminate the cosmological constant](#) from [Einstein's field equation](#) making it *elegant* again.

Then it turned out that there is a progress in treating hretics who contradict [creationism](#): I was not burned at stake (so far) for opposing creationism as Gordano Bruno was but only banned for life from some moderated physics and astronomy internet fora and the papers describing the reasons for my proposition were just rejected by editors of scientific journals like "*Nature*", "*Science*", "*Nuovo Cimento*" (defunct since), "*The Astrophysical Journal*" (still in the 20th century) and by "*Physical New Journal*" and many others already in the 21st century, usually without any peer review and they still keep getting rejected when I try to test those journals for the presence of editors interested in progress in science. The only exception in not sending my papers to referees was "*Physical Review Letters*" which gave a decent review by its second referee (the first one resigned the reviewing claiming not understandig my way of describing my derivation). The second referee, after multiple corrections of his/her point of view when I kept clarifying mine, agreed that I'm right formally but recommended rejection of my paper anyway on the grounds of assumed low interest of readers of "*Physical Review Letters*" in the subject.

The plot thickens...

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Introduction

(continued from preamble)

The results proved to be unpublishable despite their agreement with observations of Hubble constant and its acceleration, both predicted by Einstein's GR and both observed by astronomers in deep space.

The cosmology seemed to deteriorate to the point that despite that Hubble constant of Einstein's universe could be calculated from [first principles](#) with just the Newtonian math and high school calculus, by a [sculptor](#) with no formal education in general relativity, and the results of calculations were confirmed by observations of real universe by real astronomers, the cosmologists still maintained that the universe was created in a hot Big Bang and that it is expanding. The cosmologists renamed cosmological constant "dark energy" to keep the creation of energy that the expansion of universe implied. To many of them, as to an astronomer, mathematician, and Catholic priest Michael Heller, who was awarded \$1.6 million by creationists from The Templeton Foundation for his work on attempting to unify science and religion the "dark energy" might have been a direct proof of existence of supernatural and it seemed to be too precious a "scientific discovery" to be given up to common Newtonian math and high school calculus. The cosmologist referring the results at *Phys. Rev. Lett.* insisted that those results "*must not be published*".

For astronomers who this way were cut off from the information on real state of universe it meant choosing what in their opinion was the more probable option. The atheists, like Carl Sagan (1934-1996), have chosen even earlier, an eternal, stationary universe but the consensus of astronomers still prefers the expanding, "standard model" universe controlled by simplified Newtonian mechanics in which the time runs at the same rate in the whole universe except for the *gravitational time dilation* which for sure is not a reason for the [cosmological redshift](#) since its math is different. The [Hubble tensor](#) that explains the math of cosmological redshift became for the astronomers a tabu that can't be even mentioned neither in a scientific journal nor in the moderated Internet fora.

For Einstein's general relativity it meant that there exists, a mentioned above, *Hubble tensor* or tensor of *general time dilation* (actually the temporal, antisymmetric, part of Ricci tensor) formed by second partial derivatives of proper time with respect to coordinate time and coordinate distance. I called this type of time dilation I call "general", to distinguish it from "common" [gravitational time dilation](#) that being of vectoral character disappears in homogeneous space.

Hubble tensor, similarly as Ricci tensor, of which it is a mirror image in certain sense (their sum add to zero) doesn't disappear in physical space. Physical sense of Hubble tensor is that the time at the distance from any observer runs slower than at the observer proportionally to the curvature of space accumulated between the observer and the point at the distance from the observer, similarly as spheres around the observer have smaller surface than they would have at the same distance in empty (Euclidean) space. This effect of slowing the time rate with distance simulates the accelerating expansion of space. Adding up of Hubble tensor with Ricci tensor of curvature of space makes the spacetime intrinsically flat as proposed also by Halton Arp (1927-) and Jayant Narlikar (1938-) team, which is also necessary for the principle of conservation of energy to hold. Besides, the fact that the sum of contractions of Hubble and Ricci tensors vanish, provides the means of [avoiding the necessity of cosmological constant](#), making Einstein's field equation *elegant* again.

Einstein's universe gets vindicated as predicted by Feynman, that *"Whenever the predictions of Einstein have been found to differ from ideas of Newtonian mechanics Nature has chosen Einstein's."*

Feynman could enjoy the success of his prediction if the editors of scientific journals didn't decide to keep the collapse of [MTW](#) mysticism a secret. Officially as *not interesting enough to their readers*. My guess is that they decided not to publish the news that the universe is stationary not to embarrass the theorists who were making living off the idea of *expanding universe* and astronomy seemed to be not important enough to justify such an embarrassment of theorists. After all *"the beauty of astronomy is that unlike in civil engineering one can be 100% wrong and nobody is hurt"* [Don A. Lautman, my astronomy teacher at Harvard Smithsonian Center for Astrophysics, Cambridge, MA].

Since scientific journals like *"Nature"*, *"Physical Review Letters"*, *"Science"*, *"The Astrophysical Journal"*, even popular ones as *"Physics Today"*, *"Scientific American"* and others, refused to publish the news that we live in a stationary Einstein's universe and news of the *Hubble time dilation*, the astronomers still don't know that Einstein's general relativity, explains many gravitational phenomena on which explanation they work, which still doesn't hurt anybody except the taxpayers.

The necessary in such scenario creation of energy from nothing astronomers might attribute to miracles that are especially good news to creationists. Einstein already said that he stopped understanding his theory when mathematicians began to explain it to him. He knew that mathematics is not science (which, since "Russels' paradox", is known also to matematicians) and only physics is. But the contemporary astronomers tend not to know that science is divided only into two parts: physics and stamp collection. And that's maybe why [physicists don't understand gravitation](#) as described by mathematicians.

Feynman called some cosmologists idiots for supporting a *"claim based on the stupidity of the author that some obvious and correct fact, accepted and checked for years, is, in fact, false (these are the worst: no argument will convince the idiot)"* [fragment of [Feynman's letter](#) to his wife from 1962 Gravity Conference in Warsaw, Poland]. In the above fragment Feynman might have meant the principle of conservation of components of 4-momentum which is true in regular physics (see Feynman's statement on separate conservation of components of 4-momentum in *"Feynman lectures on physics"*) while it is invalid in the BBH where the BBH theorists maintain that it is possible to convert in the same reference frame the energy into momentum and v.v. and they just work on ways of achieving it.

After 1998 disastrous for BBH observation of accelerating expansion of space (while assuming that cosmological redshift is Doppler shift) the opponents of stationary space patched their hypothesis of expanding space with assumed ad hoc "[repulsive gravitation](#)" called now "cosmological constant" and with the existence of exotic "[dark energy](#)" contained in this "cosmological constant" that allegedly were using this "[repulsive gravitation](#)", through action at a distance, to expand the universe faster and faster.

The editors of scientific journals might have known that cosmology is a pseudoscience created to employ scientists who couldn't earn living in any legitimate branch of science. But cosmologists aren't even smart enough to keep low profile, to admit cautiously that "they actually don't know", and to limit their activity to picking up their salaries, allowing at least astronomy to develop at its own pace. Instead they insist, against Einstein's physics, that quasars and black holes exist, space is expanding, spacetime is curved (of unknown yet intrinsic curvature and direction, they still work on finding it out), the metric tensor of spacetime is symmetric, and the energy is constantly created (most likely through divine intervention) an idea supported by creationist businessmen with their millions of dollars in awards to cosmologists who support creation.

But the worst of all is, that they consider investigating the nature of "dark energy" the most important problem of physics of 21st century, blocking resources that are needed in real science and being the referees of gravitation papers they control the publication of papers dangerous to the BBH. The cosmology from cheerful and harmless activity of the previous century became a damper on science. The creationism got into science through the back door of cosmology using mimicry, calling their hypothesis of creation "general relativity", the name by which Einstein's theory has been already known.

Support of creationists for the BBH has been documented by the mentioned already The Templeton Foundation's March 2008 award of \$1,600,000 to an astronomer, cosmologist, mathematician, and Catholic priest, Michael Heller from the Papal Academy of Krakow, Poland, "*in recognition of scholarship and research that has pushed at the metaphysical boundaries of science*".

If this trend continues we might be in a danger of establishing laws against engaging in science without a license (applied especially to sculptors). Even now people are banned for life from scientific fora, as it happened couple of times to me, just for trying to discuss stationary universe which creationists apparently consider dangerous to the idea of creation. With complacency of people responsible for maintaining those fora, not even creationists themselves. So far...

Einstein's *real* general relativity doesn't allow neither "[repulsive gravitation](#)" nor "[creation of energy](#)" (even in "[negligible amounts](#)"). They are [empty ideas](#) that differentiate between physics and mysticism. The spacetime requires intrinsically flat geometry (as long as the space is curved and time dilated). It doesn't need "[dark energy](#)" (another [empty idea](#)) and gravitation is so simple that high school education suffices to understand it. Even a [sculptor](#) with a high school education may explain it to anyone who wants to learn why things fall. That's why "*few of the best men are doing work in it [...] It is not that the subject is hard; it is that the good men are occupied elsewhere.*" [Feynman].

Since the editors of scientific journals claim that their readers ain't interested in the results that I got (as e.g. editors of "*Phys. Rev. Lett.*" wrote me) I show below, to those few who are interested, how Einstein's gravitation works. [Why things fall](#), why the curvatures of spacetime cause the illusion of gravitational attraction and the [illusion of accelerating expansion of space](#). Then I [compare](#) the Big Bang general relativity and Einstein's general relativity in an attempt to show to the readers who are interested, why there is no reason for believing in neither that the Newtonian gravitation is physics nor that the Big Bang GR is.

To mention the quantum nature of Einstein's gravitation it suffices to mention that quanta of gravitational energy are any elementary particles that carry mass from one atom to another (e.g. leptons of spin 1/2, so they don't need to be of spin 2, as Feynman has been guessing, but may be like photons or electrons and so unifying gravitation and electromagnetism is already contained in Einstein's theory just not stated clearly enough. As Hertz said: "*Some physical theories are often smarter than their creators*". The reader may deduce the quantum nature of gravitation from the [basics of gravitation](#) and find out that role of *gravitons* may be taken on by any particles that atoms exchange between themselves like photon's, gluons, neutrinos (or shmutrinos if they exist).

Einstein's gravitation can be really explained to anyone's grandmother especially when the granny attended a high school, liked physics and math, and is not prejudiced against Einstein, which almost never happens to grandmothers but often to physics professors. Some physics professors would like to abolish the conservation of energy under pretext of reconciling Einstein's gravitation with quantum mechanics. Apparently those professors don't know that Einstein's gravitation is already a quantum theory.

In the big bang hypothesis we have a collision of physics (the redshift of photons interacting gravitationally with the rest of universe) with assumed math (the symmetric metric tensor that prevents photons from interacting gravitationally with the rest of universe and having redshift in stationary universe). That's most likely why Einstein solved this contradiction in 1950 by assuming *non symmetric* metric tensor for the spacetime which allows the Hubble redshift in stationary universe.

[Simple calculation](#) reveals that the Hubble redshift observed in our universe is *equal* with accuracy better than one sigma to the redshift resulting from dispersion of kinetic energy of photons in a stationary universe. Yet, the cosmologists (like MTW) assumed the *symmetric* metric tensor of spacetime and got necessarily an artifact of expanding space. Despite [Feynman's warning](#) the view of nature has been changed to accommodate for mathematical assumptions.

Finally, Einstein's 1950 assertion that *metric tensor of spacetime* must be *non symmetric* was not even mentioned by [MTW](#). Those gentlemen *assumed at the onset* of their monograph a symmetric metric tensor, as also Einstein did at the beginning but for Einstein it was in 1911 when no one yet heard about the cosmological redshift. [MTW](#) did it in 1973, 23 years after it was known that Einstein maintained in 1950 that *symmetrical tensor field must be replaced by a non-symmetrical one*. Yet [MTW](#) didn't try then to examine the Einstein's assertion allegedly because it wouldn't be as elegant a metric tensor as the symmetric one. To which Einstein had already said: *"If you are out to describe the truth, leave elegance to the tailor."*

Basics of Einstein's gravitation

Why Einstein's gravitation is a quantum theory.

"Gravitational force" is a name given to inertial *pseudo force* that pushes particles of universe *against anything that restricts their free movement*. Without such a restriction the movement of a particle is controlled only by the probability of finding the particle at the positions of its lowest internal energy $E(x^i) = mc^2(x^i)$, where x^i is the position of particle. Without restricting the free movement of a particle there is no gravitational force.

Gravitational force is therefore not a "fundamental" force of nature but only an inertial force resulting from restrictions on the free movement of a particle along geodesic in spacetime. Einstein has assumed that the consecutive positions of lowest energy of a particle (positions of highest probability of finding the particle there) are determined by the curvatures of spacetime that depend on position x^i and that they form a geodesic in spacetime (and so far it looks like he was right). The above demonstrates that Einstein's theory of gravitation is a quantum theory automatically: no "force" decides about the movement of a particle but only the probability of finding it at the position of its lowest energy.

The reason for diminishing internal energy of particle in vicinity of material objects, along direction towards these objects, is that along this direction the time happens to run slower (effect known as [gravitational time dilation](#)) and there is also an equal (in relational units) *expansion of space* (effect known as the [gravitational curvature of space](#)) so it takes even more time to cover the expanded space at any velocity. Both effects result in the slowing down of all velocities. Anything that does any movements, rotations, or vibrations is doing them slower in the "vicinity" of material objects and so it contains less *energy* than before the particle got into the vicinity of a material object. The energy of each particle diminishes along this particular direction by the amount that the square of gravitational speed of light is diminishing. If the free movement of the particle is restricted the restriction produces an inertial force pushing the particle along this particular direction of diminishing energy against the restricting object. This force (being by its nature an inertial force, since it shows up only when the free movement of the particle is restricted) is called traditionally "gravitational

force" and internal energy of the particle is its "gravitational energy" since its derivative with respect to displacement is equal the "gravitational force" $F_i = - (d/dx^i)E(x^i) = ma_i$, where a_i is acceleration with which the particle moves while in "free fall" when no forces act on it and its position is determined only by the gradient of its internal ("gravitational") energy.

The acceleration must be such since the excess internal energy that the particle loses while the gravitational speed of light gets diminished, changes into kinetic energy of the movement of particle and so the energy is conserved automatically. And of course in a free fall the total change of energy of particle is automatically zero: $dE_{total}(v^j, x^i)/dx^i = 0$. This is the reason for conservation of energy in gravitation. Since nature can't make energy from nothing there is acceleration a_i in a free fall that follows from this inability of nature to make energy from nothing.

Since gravitational force is a derivative of internal energy with respect to distance it implies that gravitational energy of a particle in Einstein's physics is just its internal energy $E = mc^2$ and so it has a well defined location in space, the gravitating particle itself. The gravitational force is an inertial force generated by certain, in general varying (and the results of changes propagate with speed of light), distribution of energy in this space, the principle of conservation of energy, *and nothing else*. It is an important feature of Einstein's gravitation that there is nothing else beyond geometry (the curvatures of spacetime and the principle of conservation of energy is controlling all gravitational phenomena in universe including its apparent accelerating expansion).

The gravitational force will be derived below and then it might be seen why it must have quantum nature automatically: An atom, exchanging a quantum of energy, e.g. a photon, with another atom, loses by it also a quantum of its gravitational energy ($\Delta E = \Delta m c^2 = h\nu$) which says that photons are also quanta of gravitational energy, and so Hertz actually discovered also the gravitational waves not even suspecting the significance of his discoveries in either case (he didn't believe that radio waves could be used for any practical purpose beyond experiments in labs). Apparently physicists alone are not enough to create progress of science and without engineers we might be still sitting in caves pondering the creation of energy from nothing.

Why gravitational force is $F_g = - (d/dx)(mc^2)$

In our frame of reference the total energy of any particle is

$$E = m(v) c^2(x) \quad (1)$$

where $m(v)$ is inertial mass of the particle depending on the velocity of particle in our frame of reference, or

$$m^2(v) = m^2 / [1 - v^2(x) / c^2] \quad (2)$$

where m is the rest mass of particle, an expression familiar from special relativity, where v is velocity of the particle in our frame of reference, x is displacement within this frame, and $c(x)$ is "gravitational speed of light" within this frame, or

$$c^4(x) = c^4 [g_{00}(x)] \quad (3)$$

where g_{00} is time-time term of metric tensor of spacetime, or $(d\tau/dt)^2$, where τ is the proper time of point in space and t is the coordinate time of observer observing this point in space. So the time at point in space (the *proper* time of that point in space) is different than the time shown by observer's watch (*coordinate* time or observer's *proper* time).

The derivative of energy (1) with respect to displacement x (a derivative that when with opposite sign is called "force that pushes the particle" since the particle always tries to achieve a lower energy level), putting $c(x=0) = c$ and $m(v^2=0) = m$, is

$$(d/dx)E = c^2 [(d/dx)m(v)] + 2 c m [(d/dx)c(x)] \quad (4)$$

Since for a particle at rest in our frame of reference $v = 0$ then from (2) $(d/dx)m(v) = (d/dx)m = 0$. What is left is $(d/dx)c(x)$ and in the real world the light ray bends in the vicinity of a material object twice as much as it is required by curvature of space and so it means that around material objects the "gravitational" speed of

light (speed of light seen beyond the center of particle in curved space) *changes* and it better be $(d/dx)c(x) = -g/2c$ because otherwise energy (1) couldn't be *gravitational energy*. But if it is then in a static situations we should get some force $F(x) = -(d/dx)E/dx$ acting on a particle pushing it in the direction of its diminishing energy. Substituting $(d/dx)m(v) = 0$ and $(d/dx)c(x) = -g/2c$ into (4) we have

$$F_g(x) = -(d/dx)E = g m \quad (5)$$

and therefore exactly the same as Newtonian inertial force. And it is our static *gravitational force* the same as Newtonian gravitational force. Except that we figured out this force directly from the diminishing speed of light in direction of *gravitational field g* (which we intend to show that it is a necessary consequence of *time dilation* and the *curvature of space*) being the same (in relative units).

Then our *gravitational energy* is the *internal energy* of a particle, given by (1) at $v = 0$ and so for $m = \text{rest mass}$ being the *rest energy* of the particle. This *gravitational energy* being the *rest energy* is located not in the "*field*" but within the particle itself. Which is different than in Newtonian gravitation where gravitational (potential energy) is located "*somewhere*" in "*some Newtonian field of forces*". There is no such field needed (nor it exists) in Einstein's gravitation.

Now we have to prove that our working assumption that $(d/dx)c(x) = -g/2c$ is actually true.

Why $(d/dx)c(x) = -g/2c$

We need to find out how the gravitational speed of light $c(x)$ is related to *gravitational field g* (to the curved space). To figure out this relation we need to remember the following facts:

The angle of deflection of light ray in vicinity of material objects is twice as large as it would be predicted by existence of Newtonian *gravitational field* due to *gravitational time dilation*. Einstein's guess was that half of this angle of deflection is due to *time dilation* that simulates the Newtonian gravitation and the other half is due to the *curvature of space* that has no counterpart in Newtonian gravitation (this was the way he discovered the curvature of space and its role in gravitation) and was an original discovery of Einstein's.

The next fact is that when the time slows down everything is running more slowly in the same space. When one side of a light ray runs more slowly than the other the light ray bends in direction of smaller $c(x)$ and the angle of deflection is

$$\phi = -(d/dx)c(x) t \quad (6)$$

where $(d/dx)c(x)$ is change in speed of light per unit of distance across the ray and t is the time of light passing the area of changed speed of light so in our case it is the time of passing the width of the space ship.

In a flat space the angle of deflection of light ray would be due only to the change in speed of light across the ray. In a situation when space is curved the curvature of space bends the light ray without any change in the speed of light since then both sides of the light ray move in the (curved) space *straight*. The light "gets bent" (but actually going straight in a bent space) due to the space curvature without a difference between speeds of light across the ray. So to find observationally $(d/dx)c(x)$ we need to take a half of the observed angle of deflection of light in gravitational field g and apply equation (6) to it.

The angle of deflection of light ray may be derived from an example with a rocket ship in space, sufficiently far from all material objects not to *feel* any influence of those objects, accelerating let's say as much as the particles that fall on the Earth. If there is a light ray that enters the rocket ship perpendicularly to the direction of acceleration of rocket ship the observer in the rocket ship will feel *gravitational field* but the light ray won't and so it will move along a straight path in relation to the fixed points outside accelerating rocket ship. The observer accelerating with the rocket ship however will see the light ray bent towards the rear end of rocket ship (assuming that the rocket ship accelerates forwards). In relation to the rocket ship that is accelerating "up" with acceleration g the ray is dropping "down" with the same acceleration g . The height of this drop is (integrating the acceleration g twice with respect to time)

$$h = g t^2 / 2 \quad (7)$$

In relation to observer accelerating with the rocket ship the light is moving along a parabola, which for our purposes may be approximated very well by an arc of a circle. The tangent to this circle at the point where the ray enters the rocket ship crosses halfway through the rocket ship the tangent to the circle at the point of

leaving the rocket ship. It makes the angle between these tangents (angle of deflection of ray), substituting h from (7):

$$\Theta = h / (t c / 2) = g t / c \quad (8)$$

According to Einstein's principle of equivalence of acceleration and *gravitational field* this case is identical to the case when the light ray moves across a rocket ship that is standing on Earth, and so the ray bends in *gravitational field* g , the same as the ray seen by observer in accelerating rocket ship. Since half of this angle comes from the curvature of space and the other half from the change in speed of light across light ray we take $\varphi = \Theta / 2$ and get change in speed of light from (6) and (8) as

$$(d/dx)c(x) = - g / 2c \quad (9)$$

Quad Erat Demonstrandum

Vanishing gravitational force in free fall

So we've showed that energy (1), the total energy of a particle, is composed of its (in general huge) gravitational energy $E_g = mc(x)^2$ that produces a required gravitational force by changing itself along a distance due to the changing gravitational speed of light in curved space where the time is dilated, plus (in general tiny) kinetic energy $E_k = [m(v(x)) - m]c^2$. The value of gravitational force might be obtained by reversing the direction of the derivative of gravitational energy with respect to displacement as in $F = - (d/dx)E_g(x)$.

It turns out that in the real world it is not a gravitational "pull" by "attraction" of some external body but inertial "push" by inertia of the particle in space where there is a change of internal energy of the particle as a function of displacement. So it is not a body attracting other bodies but other bodies are pushed by themselves towards an "apparently attracting" body with this body not attracting them but just modifying the spacetime around herself by her presence in such way that those other bodies get themselves pushed towards the "apparently attracting" body. "Attraction" is a figure of speech here and what is real is the "push" towards this "apparently attracting" center.

Now we need to do the test with free fall to see if total energy of a particle in free fall doesn't change.

Since in a free fall in *gravitational field* with acceleration g , velocity $v^2 = 2 g x$, where x is the distance by which the particle has fallen (in direction of its acceleration g) then substituting v^2 into (2) we get

$$m^2(v) = m^2 / (1 - 2 g x / c^2) \quad (10)$$

Differentiating with respect to x and ignoring small higher order terms

$$(d/dx)m(v) = m g / c^2 \quad (11)$$

After substituting (9) and (11) to (4) we have a change of total energy of a free falling particle as

$$(d/dx)E(x) = 0 \quad (12)$$

which shows that there is no change in the total energy of a free falling particle and so the whole kinetic energy of a free falling particle is the energy by which its internal energy ($E_g = mc^2$) (a.k.a. "gravitational energy") diminishes.

Illusion of accelerating expansion of space

If one assumes that the [redshift](#) of galaxies is due to their velocity (effect called "[Doppler effect](#)") then universe looks as if it were expanding and its expansion were accelerating. This is so since the light coming from distant galaxies has on average a smaller frequency (is "redder") than the light generated by the same sources close to observer.

The reason for this smaller frequency of photons was assumed by [BBH](#) theorists to be a recessional velocity of galaxies causing redshift through Doppler effect but it turned out that the time at those galaxies runs slower than at observer and so the effect of the expansion of space has been simulated. Furthermore the simulated expansion looked as if the space were expanding with accelerating expansion.

This effect of the time running slower in deep space turned out to be necessity if energy couldn't be made out of nothing and the simple derivation of this effect, from the principle of conservation of energy, is presented below for a spherical light wave and a derivation with a different method for a planar light wave, with a more detailed explanation of the method of obtaining the result, is in [Appendix 2](#).

The Hubble constant of *Einstein's universe* calculated for a spherical light wave

Introducing c the speed of light, G the Newtonian gravitational constant, ρ the density of dust of Einstein's universe, $E_d = E_o - E$, the gravitational energy acquired by the dust due to gravitational interaction between dust and photons (and so "lost" by the light after light of energy E_o got radiated out from a point in space at radial coordinate $r = 0$, due to the principle of conservation of energy) so the linear density of simulated "*Newtonian gravitational force*" acting on the dust of Einstein's universe inside the shell of spherical wave is

$$4\pi G\rho (E_o - E_d) / c^2 \quad (13)$$

On the other hand this "linear density of gravitational force" is from its definition equal to

$$d^2E / dr^2 \quad (14)$$

Substituting "[Einstein's cosmological constant](#)" Λ_E for $4\pi G\rho / c^2$ and E for energy of photons one gets

$$d^2E / dr^2 = \Lambda_E E \quad (15)$$

Solving this equation, with initial conditions $E(r = 0) = E_o$ and $(dE/dr)(r = 0) = -\sqrt{\Lambda_E} E_o$ and selecting solution that has physical sense, one gets

$$E = E_o \exp[-\sqrt{\Lambda_E} r] \quad (16)$$

or using "[Einstein's radius of universe](#)" to simplify the result since $\Lambda_E = 1 / R_E^2$ the result is

$$E = E_o \exp(-r / R_E) \quad (17)$$

It is not a strange coincidence that we get the radius of curvature of space through Newtonian math but a necessary result following from a fact that in universe in which energy is conserved, if the math is right (as the Newtonian math is), the relation between the Hubble redshift and the curvature of space must be as expressed by the above equation.

The Einsteinian interpretation of the above is of course the time running slower at a distance from observer according to relation

$$d\tau / dt = \exp(-r / R_E) \quad (18)$$

where τ is proper time at observed place in deep space and t is coordinate time (the proper time of observer).

This equation presents this "big leap" from Newton's math to Einstein's physics that has to be made to see why Newton's math reflects so faithfully Einstein's physics and how the curvature of spacetime (which by-the-way turns out to be *intrinsically flat*) is the reflection of *Newtonian force*, which Newton in his wisdom refused to accept as being a physical force but only a mathematical model of something. Now we know the physics that the Newtonian "force" is a model of. It turns out to be the curvature of *flat* (as it is shown in the next equation) *Einstein's spacetime*. After differentiating eq. (18) at $r = 0$ we get a relation between the time dilation in deep space per unit of distance (in radial direction) ($d^2\tau / dt dr$) and the curvature of space ($1 / R_E$) as

$$d^2\tau / dt dr + 1 / R_E = 0 \quad (19)$$

which shows that the spacetime is intrinsically flat as suggested already by [Narlikar and Arp, 1993](#). In a general form it might look like $(d^2\tau / dt^\mu dr^\nu) g^{\mu\nu} = H = -2 \Lambda_E = -R_{\mu\nu} g^{\mu\nu} = -R$ where d's are partial,

indexes μ and ν [0, 1, 2, 3] denote directions, in particular $(d\tau / dt)^\mu$ is *general time dilation* in direction μ , and $R_{\mu\nu}$ is Ricci curvature tensor. If $2 \Lambda_E = R$ then Einstein's modification of his [field equation](#) from 1917 by

adding to it cosmological constant might be not needed since it might produce the same result of stationary universe additionally with [Hubble redshift](#) explained by plain math. Then Einstein's field equation loses its cosmological [constant of 1917](#) and becomes

$$R_{\mu\nu} = 8\pi T_{\mu\nu} \quad \text{or equivalently} \quad H_{\mu\nu} = -8\pi T_{\mu\nu} \quad (20)$$

The redshift produced by the effect of general time dilation is

$$Z = \exp(r / R_E) - 1 \quad (21)$$

and therefore it simulates the expansion of space with [Hubble constant](#) of this apparent expansion

$$H_o = c / R_E \quad (22)$$

The obvious application of this effect is the calculation of density of space of our universe from the value of observed *Hubble constant*. The value of Hubble constant $H_o = 70 \text{ km/s/Mpc}$ implies density of space

$\rho = 6 \times 10^{-27} \text{ kg/m}^3$ with only twice less relative accuracy as the Hubble constant is determined since $H_o \sim \text{sqrt}(\rho)$. Another application might be calculations of densities and sizes of clouds of dust that quasars are located in from the redshifts of those quasars.

After splitting the Hubble constant into Taylor series the acceleration of this apparent expansion comes out as

$$dH / dt = -H_o^2 / 2 \quad (23)$$

and it has been observed within a fraction of standard deviation already in 1998 by [Supernova Cosmology Project](#) team and therefore predicted by Einstein's theory of gravitation (a.k.a. Einstein's general relativity) over 80 years earlier (see [Einstein's photo](#) at front page).

Since now Einstein's theory can't be falsified by observations as it predicts strict conservation of energy (non falsified yet), Einstein's universe (non falsified yet), and other (non falsified yet) observational results within *one σ* , (which in astronomy means a *perfect agreement*), then now we may suggest the [metric tensor of spacetime](#) not only non symmetric but also degenerate. Despite that, the resulting metric is quite decent

$$d\tau^2 = \exp(-r / R_E) dt^2 + 2 \sinh(r / R_E) dt dr / c - \exp(r / R_E) dr^2 / c^2 \quad (24)$$

shown above for one spatial direction only, since it is [isotropic](#). For $r \ll R_E$ it approximates to Minkowski metric

$$d\tau^2 = dt^2 - dr^2 / c^2 \quad (25)$$

Now let's look at the [CBR](#).

Cosmic Background Radiation (CBR)

This radiation cannot be just the redshifted starlight since then it could not have the black body spectrum that it has. It seems therefore that it has to be the radiation from non-luminous matter that is in thermal equilibrium with the redshifted starlight. If it is so then we can calculate the average size of the pieces of non luminous matter of universe. This is because the probability P of a photon hitting an obstacle of diameter D on it's way, and transferring to it its energy, which then becomes thermal energy, is approximately proportional to the area of the obstacle D^2 and to the number of obstacles along the photon's way (inversely proportional to the cube of the distance L between obstacles $P \sim D^2 / L^3$). Since for a fixed mass density of the whole space (already determined from Hubble parameter) the distance between obstacles is proportional to their linear size $L \sim D$, the total probability of the photon hitting an obstacle becomes inversely proportional to the linear size of the obstacle: $P \sim D^2 / D^3 \sim 1 / D$.

So, knowing the temperature of the redshifted starlight, presumably re-emitted as a thermal radiation from the non luminous matter, and assuming specific density of the matter that the non luminous matter is made of, one may determine the average size of the pieces of non luminous matter of universe (see [Appendix 3](#) for details).

Element abundancies

One thing that is not yet known, nor any theory about it is worked out (similarly as a theory of creation of galaxies) for the belief of astronomers that the universe has been created and there is not enough time from the alleged time of creation (13.7 billion years ago, according to the BBH), is what is the cycle of conversion of hydrogen into other elements and then back to hydrogen.

It is already known that most of light elements (from He to Fe) are made from hydrogen through gradual burning hydrogen into heavier elements (H -> He -> Li -> ... -> Fe) in stars and elements heavier than iron are produced in supenova explosions when the pressure in them is sufficient to form the heavier elements. Yet, if the universe is to be eternal (as Eistein's universe model is) there is needed a mechanism for converting all those elements back into hydrogen.

It might be something that happens when two so called "[black holes](#)" meet and then got torn appart by tidal forces (as it happens to moons that get too close to their planets). It may be a moment in which all the elements accumulated in those black holes get converted into separate protons and electrons that combine then into hydrogen atoms. It might explain the cycle but it might be also that for discovering the cycle we need to know something that will be discovered only in the future and so the speculations about the cycle might be futile for the time being.

Second law of thermodynamics

This "law" has been "discovered" in 19th century when people thought that energy can move only from the place of higher energy density (high temperature source) to the place of low energy density (low temperature sink) as in thermodynamic engines and doing all the useful work on its way. There was a fear that when all high energy density sources are exploited all energy in the universe will be dispersed in cool environment with no way of getting energy from this cool environment. It would mean the "thermal death" of universe, mathematically expressed by "law of growing entropy" (a.k.a. Second law of thermodynamics). Now we know that all energy in the universe is gravitational, see eq. (1), and there must be a simple way (if not discribed yet in detail) of extracting useful energy from the cycle talked about in the previous section. So the fear of growing entropy is only metaphysical, important only in BBH, which is invalid anyway (because of conservation of energy expressed by the [first law of thermodynamics](#)) as it's shown elsewhere. In real universe the amount of energy is constant and constantly floating from the high energy hydrogen back to the high energy hydrogen, which invalidates "second law" and makes the universe eternal, as Einstein's universe is.

Correction of Einstein's field equation

The [Einstein's field equation](#) except invisible 1950 [abandonment of symmetric metric tensor](#) contains a well visible [cosmological constant](#) of 1917 that, as mentioned in the preamble, makes his theory (to Einstein's great discomfort: "the biggest blunder of my life") a [phenomenological theory](#). But Einstein's GR is in fact a [physical theory](#) therefore also a quantum theory as all physical theories must be. The cosmological constant makes no sense in it.

Luckily, due to the value of Einstein's cosmological constant $\Lambda_E = 4\pi G\rho / c^2$ it may be replaced by $(R / 2)$ and therefore Einstein's field equation reduces to

$$R^{\mu\nu} = 8\pi T^{\mu\nu} \quad (26)$$

(in units in which $c=G=1$) which makes Einstein's GR again an *elegant* physical theory and restores [Einstein's universe](#) as the legitimate model of our universe, unfortunately creating the same problem that Einstein had at the beginning when he thought that this might be the field equation. The solution of this problem will be presented in the one of next revs of this paper so please be patient :)

Origin of [big bang hypothesis](#)

As it was mentioned in preamble the "expansion of space" has been suggested by astronomers because of galactic redshifts discovered by an American astronomer Vesto Slipher in the years following his discovery of blueshift of Andromeda in 1912. Most of these shifts turned out to be redshifts, with ratio of red to blue 4:1. Then these redshift, because of absence of Einstein's gravitation at the time, were interpreted by astronomers as Doppler redshifts that were taken by theorists for a *proof* that the universe is expanding. In 1931 Georges LeMaitre proposed an explanation of this expansion, known later as the [big bang hypothesis](#).

In the big bang hypothesis it has been assumed (after Einstein, who changed his opinion only in 1950 when he proposed a non symmetric metric tensor) that the geometry of spacetime is [pseudo Riemannian](#) and that the metric tensor of spacetime is *symmetric*. At such conditions it is impossible to have redshift of photons that move along closed loops in stationary space (Hubble type redshift). Therefore it has been considered an established fact that the Hubble redshift is a result of no other phenomenon but the expansion of universe and that in a stationary universe there wouldn't be any Hubble type redshift.

But *it has been overlooked that the principle of conservation of energy implies the existence of [dynamical friction of photons](#)* which would cause Hubble redshift anyway. Therefore the metric tensor of spacetime couldn't be symmetric. Einstein realized this only in 1950 when he proposed a [non symmetric metric tensor](#) for the spacetime.

In the meantime it was the 1929 line of reasoning of Fritz Zwicky (1898-1974) who maintained that because of asymmetry of gravitational interaction between photons and the universe there must be a Hubble type redshift in any light. It was called [tired light effect](#) but ignored in favor of the expansion of universe by the gravity physicists for whom it was too exotic an effect not fitting in any way the general relativity since they strongly believed, against reason, in Riemannian geometry of spacetime with its symmetric metric tensor.

Zwicky didn't know how to calculate the redshift properly and so he didn't get the results that he could use to convince the opponents of *tired light effect*. It was the common problem of many astronomers and astrophysicists who apparently tried to do calculations in Newtonian, approximate (and illegal) way to get the *tired light effect*.

Apparently the first person who calculated the redshift of photons rigorously, not using any approximations and so getting in 1985 a right result was me. I was not a physicist though but a sculptor, therefore my credibility was zero, so no one (except referees) wanted ever to see my result (and there were only a few of them in over 25 years). The referees didn't find any formal problems with this result but all recommended the rejection of the solution for the reason of not proposing any new physics which apparently referees thought was necessary to solve such a *profound problem* that *even they* couldn't solve. So the first result of solving the problem of presence of cosmological redshift in stationary space exactly along Einstein's lines of reasoning were rejected by *Nature*, *Physical Review Letters*, *Science*, *The Astronomical Journal*, and even *Nuovo Cimento* (defunct since then), not to mention many popular science journals like *Scientific American* and *Physics Today*.

Zwicky's idea was not even mentioned in [MTW](#) who being gravity physicists rather than astronomers might have not even known about *dynamical friction*, and maybe that's why they had never calculated its value for photons assuming zero value as best fitting their purpose. Had they calculated the value of dynamical friction of photons there wouldn't be a need to assume that the universe is expanding and that the energy is created from nothing, not even to mention that the true nature of quasars could be discovered decades earlier to satisfaction of Halton Arp (an astronomer) and Jayant Narlikar (a pure mathematician) who seem to be the most informed opponents of the expanding space hypothesis.

The plot thickened when Arthur Eddington suggested in 1929 that according to the general relativity (as he understood it) *Einstein's universe* was unstable with respect to the small fluctuations of radius of curvature of space and so the universe has to either expand or contract. It is an analog of suggestion by some gravity physicists that the orbits of planets are unstable with respect to small fluctuations of their radii since centrifugal force increases with radius and therefore leads to even greater increase of the radius (which would be true if other factors, like conservation of angular momentum, didn't take part in this phenomenon).

So Eddington's suggestion may be ignored as long as all the factors taking part in the stability of universe are not taken under consideration. Besides, it is risky to tell how a system of 10^{11} galaxies is going to behave if

we don't know yet how to predict analytically the behavior of three.

However, most [gravity physicists](#) led by Gamov (1904-1968) and later by Wheeler embraced the idea, baptized "Big Bang" by Fred Hoyle (1915-2001) that was proposed in 1931 by George LeMaitre, a priest of Jesuit background, as the only possible way of creation of universe. He might have been right and maybe that's why the universe was always there (Einstein's eternal universe). Never created for the impossibility of creation, even in the way imagined by George LeMaitre.

Since the Hubble redshift was already included in the so called *Big Bang general relativity* as a result of expansion of space, and the expansion of space became the basis of the *Big Bang GR*, the *conservation of energy had to be dropped to avoid the contradiction within the theory* and the dynamical friction of photons had been assumed exactly zero to the bewilderment of those astronomers who still believed that energy can't be created.

In the *Big Bang GR* the contradiction between expansion of universe and the conservation of energy had been decided by the theorists against the conservation of energy. The *dynamical friction* has been assumed to be limited only to Newtonian physics despite that Einsteinian physics as more general should explain all observed Newtonian effects. This limitation of dynamical friction to all particles except photons in the *Big Bang GR* is an equivalent to an assumption that while all other particles are subject to the principle of conservation of energy and so to the dynamical friction the photons aren't (they are supposed to have zero redshift in a stationary universe), and so, *while photons are moving through the universe, carrying energy and modifying the gravitational field, the energy needed to compensate for the dynamical friction of photons is assumed by theorists like A. J. Wheeler and others to be created from nothing*. It is a point where divine intervention into the affairs of universe is to be assumed by the gravity physicists.

It has been tacitly assumed by astronomers (in order to understand the gravity physicists) that this energy is so small that assuming that it is created from nothing won't change any observational results [source: Dr. Bohdan Paczynski, astrophysicists].

Actually there exists even a back-of-envelope Newtonian calculation that convinces astrophysicists that this is really the case. Consequently the amount of this energy has been never calculated, just *assumed* on the basis of this back-of-envelope calculations to be negligible. Unfortunately for the *Big Bang GR* it isn't negligible and consequently it is a fatal flaw of this hypothesis. Obviously one has to return to *Einstein's GR* with global conservation of energy and consequently with non symmetric metric tensor and possibly also to assume the non Riemannian geometry of spacetime.

I have been explaining many mysterious features of cosmology as simple relativistic effects of Einstein's gravitation, explaining physics of the illusion of accelerating expansion of space, providing calculation of [Hubble constant](#) of apparent expansion of space and its (apparent) acceleration (confirmed by observations after 1998 with data from Super Nova Project), predicting the Density of universe, estimated already by astronomers within a fraction of order of magnitude.

The calculations narrowed the uncertainty of the density of space to 16% standard deviation (twice the uncertainty of the Hubble constant). Even the average size of pieces of non luminous matter of universe has been provided. And all was done from first principles and Einstein's general relativity.

It has been shown that restoring the *principle of conservation of energy* as a valid physical principle and with it restoring the dynamical friction for photons allows to drop the assumption that the universe is expanding, however not, as it might have been expected, through restoring the Newtonian idea of *tired light* proposed by Zwicky. It has been done by demonstrating that *in a world where energy is conserved the dynamical friction of photons is a relativistic effect of general time dilation. An effect of the rate of time dilation compensating for the curvature of space for the reason of inability of nature to produce energy from nothing*.

Einstein's theory, by separating itself for good from the magic of expanding space, became again a physical theory explaining all the controversial or not understood elements of Einsteinian physics. It showed the location of gravitational energy, and by this the origin of gravitational force and it explains also the surprisingly high redshifts of [quasars](#) that, as Halton Arp has insisted, are associated with galaxies of much smaller redshifts and so not even located at the distances assumed by the theorists.

Because of all those things there are several differences between *Einstein's GR* and *Big Bang GR*. They are in assumptions about the real world and necessarily in conclusions from these assumptions. These assumptions and conclusions are specified separately in the two tables below:

Differences between Big Bang GR an Einstein's GR

ASSUMPTIONS	Big Bang GR	Einstein's GR
reason for gravitation	geometry of spacetime	
conservation of energy	invalid	valid
speed of light	constant throughout the whole space	local is constant c , non local (coordinate speed of light) depends on displacement within reference frame: $c=c(\mathbf{x})$ [see Basics ...]
accelerating expansion of space	fact due to <i>dark energy</i>	see <i>conclusions</i>
metric tensor of spacetime	expanding, symmetric, Riemannian	

CONCLUSIONS	Big Bang GR	Einstein's GR
accelerating expansion of space	see <i>assumptions</i>	illusion due to <i>conservation of energy</i> predicting Hubble parameter as $H_0 = c / R_E$ where c is speed of light and R_E is Einstein's radius of curvature of space [see Appendix 2]
metric tensor of spacetime		stationary, non symmetric and degenerate, (non Riemannian) [see Illusion ...]
reason for Hubble redshift	Doppler shift due to recession of galaxies	conservation of energy [see Appendix 2]
reason for CMBR	redshifted light from Big Bang	absorption of redshifted starlight by non luminous matter of universe and re-emission at temperature of thermal equilibrium 2.7°K [see Appendix 3]
reason for high redshift of quasars	speed of recession	conservation of energy in clouds of dust, $Z = \exp(r \sqrt{4\pi G\rho}) / c - 1$ where Z is redshift, r is radius of cloud, G is gravitational constant, ρ is density of cloud, c is speed of light [see paper (in PDF format) The general time dilation: relativistic redshift in stationary clouds of dust]
reason for gravitational	<i>"acceleration of space"</i>	$F_i = - (d/dx^i) E_0(\mathbf{x})$, where $E_0(\mathbf{x})$ is

force		internal energy of particle depending on position in space (\mathbf{x}) [see Basics ...]
gravitational (potential) energy	?	the internal energy of particle $E_0(\mathbf{x}) = m c^2(\mathbf{x})$, where m is mass of particle and $c(\mathbf{x})$ is coordinate speed of light depending on position in space (\mathbf{x}) [see Basics ...]
location of gravitational energy	?	location of gravitating particle: \mathbf{x} [see Basics ...]
density of space	?	$6 \times 10^{-27} \text{ kg/m}^3$ [see Appendix 2]
acceleration of expansion in terms of dH/dt and H_0	?	$dH/dt = -0.5 H_0^2$ [see Appendix 2]
acceleration of space probes	?	$-7 \times 10^{-10} \text{ m/s}^2$ [see Appendix 2]
average size of pieces of non luminous matter	?	order of one meter [see Appendix 3]
angular size of galaxies as function of distance from observer	?	should have minimum at redshift $Z_0 < \exp(\pi / 2)$ because of the apparent accelerating expansion of space that is closed into a 3-sphere

The areas that a theory has no answers for are marked with question marks. All of them are in the *Big Bang GR* and it suggests that Einstein's original theory is OK while the *Big Bang GR* is wrong. Therefore we might assume that gravitational force and energy may be explained according to the old Einstein's theory based on conservation of energy and explain them as such. Therefore we seem to be justified in explaining gravitation as it is explained in the following section.

Observational evidence for *Einstein's GR* as opposed to the *Big Bang GR*

Variable	Einstein's GR predictions		Observed value	its $\sigma(\text{sigma})$	Units
	theoretical	numerical			
Radius of curvature of space	R_E	4.3	?	?	Gpc
Hubble parameter at Earth	$H_0 = c / R_E$	69.6*		2.8	km/s/Mpc
Acceleration of space probes Pioneer 10 and 11	$a_0 = c^2 / R_E$	7	8.7	1.3	10^{-10} m/s^2
Density of universe	$\rho = c^2 / (4\pi G R_E^2)$	6	5.5	4.5	10^{-27} kg/m^3

(of "gravitational energy")					
apparent acceleration of expansion of space in H_0^2	$dH/dt = 1 / 2$	0.5	0.45	?	$- H_0^2$
redshift of minimal angular size of galaxies [verify]	$Z_0 < \exp(\pi / 2)$	$< \exp(\pi / 2)$	1.6	?	1

* value observed and assumed for calculation of R_E

Notes

- Most of the observed values are functions of the *radius of curvature of space* a.k.a. [Einstein's radius](#) (R_E) that is adjusted so that H_0 comes out exactly as observed.

In the equations for theoretical predictions the unspecified variables are: G is Newtonian gravitational constant, c is speed of light, t is coordinate time.

- The acceleration of the apparent expansion of space is made a function of H_0 for easier comparison with the observed value given as function of H_0 .
- Five of the above values are predicted by *Einstein's GR*. None of the observed values is predicted by the *Big Bang GR*.

Glossary of terms pertaining to gravitation (and some [added for entertainment](#)).

Abandonment of symmetric metric tensor. In 1950 Einstein might have realized that symmetric metric tensor implies violation of the [principle of conservation of energy](#) and abandoned it. He wrote in his "*On the Generalized Theory of Gravitation*", *Scientific American*, April 1950: "*The answer on which the theory under discussion is based is that the symmetrical tensor field must be replaced by a non-symmetrical one. This means that the condition $g_{ik} = g_{ki}$ for the field components must be dropped*".

Einstein's abandonment of symmetric metric tensor has been ignored by authors of [MTW's](#) monograph "*Gravitation*" who apparently didn't mind the violation of the principle of conservation of energy. It made their theory ([BBH](#)) a [magical theory](#).

It turns out that to apply [Einstein's field equation](#) to explain gravitation in a sensible way that doesn't contradict any other physics (e.g. the principle of conservation of energy) it is necessary to assume that the metric tensor of spacetime is non-symmetric and degenerate (to prevent its diagonalization). The observational data imply then that the expansion of universe is an illusion. A non symmetric tensor has more independent components so they might be enough to provide for the illusion of expansion. This non-symmetry of metric tensor provides for an effect not yet discovered by astrophysicist which I call [general time dilation](#) and Halton Arp calls [intrinsic redshift](#). Without it any gravitational interaction with any moving object could be used to create energy from nothing in a similar way as energy is created in the tidal power plant, by the Earth's oceans moving in relation to the Moon. In case of the Earth-Moon system the part of rotational kinetic energy of the Earth is converted into electricity in a tidal power plant, and part is transferred to the Moon making it flying higher and higher. So in general the effect puts a small Newtonian drag on any moving object in the universe that which is a Newtonian counterpart of the relativistic effect that is observed in the real world as reddening of light called [Hubble's redshift](#). If we apply that drag to particles of light (*photons*) it turns out that they really look as if they encounter such drag. The astrophysicists interpret this effect as a Doppler shift caused by recession speed of galaxies and consequently as the evidence that the universe is expanding while this effect is caused only by the time running the slower the farther we look as required by a non-symmetric metric tensor and relation between time and space as expressed by identity $\text{sqrt}(R) (d/dr^k)(d\tau/dt)_i + R_{ik} = 0_{ik}$ where R is Ricci curvature scalar, τ is proper time at observed place in deep space, t is coordinate time (the proper time of observer), r distance from observer

to observed point in deep space, R_{ik} is Ricci tensor of curvature of space. The effect has been also observed in the alleged accelerating expansion of space and in the behavior of space probes Pioneer 10 and 11 but since most astrophysicists still think that the metric tensor is symmetric they can't explain the behavior of the space probes and call the effect "anomalous". It seems that it's all that there is to the mystery of [why the universe looks as if it were undergoing accelerating expansion](#).

Accelerating expansion of space is a hypothetical phenomenon of another hypothetical phenomenon of [expansion of space](#) that happens to be a relativistic illusion.

Action at a distance is an action through empty space without any carriers of this action that, as it is now known, have to carry energy from one object to another since energy has to be carried on some carrier of energy, e.g. photons, gluons, or whatever, but can't get through "empty space" which would be analog of energy disappearing in one place and appearing without any good reason in another, which would contradict the most important principle of physics, the [principle of conservation of 4-momentum](#). Einstein called action at a distance "*spooky*", as if caused by "black magic" in which Einstein, being an [atheist](#), didn't believe.

Agnosticism is an indifference to supernatural and the lack of opinion on its existence. Adherents to this philosophy usually believe that there is a God or gods but it does not interest them one bit. This lack of opinion on how the world works might make them objective observers of nature as opposed to [theists](#) who are rather strongly biased in favor of existence of supernatural even while being scientists (more physicists than mathematicians among whom theism is rare). Agnostics are not biased neither for, nor against supernatural or at least not as strongly as [objectivists](#), who don't allow the existence of anything supernatural at all, being strict [atheists](#).

Anaxagoras is a Greek who said "nothing comes from nothing".

Angular diameter of galaxies as function of distance of those galaxies from us shows a minimum at about redshift $Z = 1.6$ and it seems to confirm Einstein's idea that the universe is a 3-sphere of "[Einstein's radius](#)".

Applied mathematicians are guys who can handle equations better than computers though not the same fast so they may never be able to replace computers, however one of their subspecies, [gravity physicists](#), hope to replace physicists one day.

Atheism is a symptom of [critical mind](#) and a belief, that the universe is not controlled by supernatural beings (like "ghosts" or even Santa Claus) but rather by a string of events each possible to be explained without an [action at a distance](#) of some "ghosts". It is a general disbelief in existence of supernatural as e.g. the creation of matter from nothing would be. That's why it may be important for [theists](#) to "prove" that creation of matter (or energy) from nothing, as it is assumed in [BBH](#), is possible. Atheists didn't believe neither in creation of something from nothing, nor in ghosts, nor in Santa Claus. They might believe to have another beer though...

Axiom is a feature of a [phenomenological theory](#), an assumption that can't be proved within the given set of assumptions of a phenomenological theory of which it is an axiom. Unlike in a [physical theory](#) where it has to be checked all the time whether its assumptions are true, one does not bother with truth or falsehood of an axiom. It is admitted as if it were "obviously true". If it turns out to be false the hypothesis based on it becomes a [magical hypothesis](#). Since the big bang hypothesis requires an assumption that energy lost on [dynamical friction of photons](#) is created from nothing, it is admitted as an axiom of big bang hypothesis. Creation of energy from nothing it can't be disproved (being a negative proposition: that something *doesn't exist*). It can be made more and more *improbable* by [science](#).

Big bang hypothesis (BBH). "Big Bang" is a term coined in 1949 by Fred Hoyle (1915-2001) to distinguish the hypothesis that the whole matter of universe has been [created](#) at one instant about 14 billion years ago as a geometric point and it has been expanding ever since [4], from Hoyle's own hypothesis of constant creation of matter called "Steady State Cosmology". The BBH has been accepted by the majority of [gravity physicists](#) and included into their version of general relativity in which, unlike in Einstein's General Relativity (EGR),

but the same as in Hoyle's hypothesis, the energy has been created from nothing (in "negligible" amounts though).

Since about the half of the 20th century the consensus of gravity physicists considered BBH to be true, and papers falsifying this cosmology for violation of the principle of conservation of energy were recommended for rejection by referees of scientific journals (gravity physicists themselves) with editors complying with the recommendations. It was similar to rejecting the inventions of perpetual motion machines without even checking the viability of their principles after the discovery of the principle of conservation of energy some time ago. The gravity physicists were so sure of correctness of BBH despite its violation of the conservation of energy that there was even a proposal directed to Alan Guth (one of believers in this Hypothesis), to create another universe in a lab by creating proper conditions for such an event (I witnessed the proposal while driving Alan, and his friend from Columbia University, to some meeting downtown Boston, MA since both guys were too drunk to drive themselves after the weekly "Early Universe Seminar" at Harvard University in Cambridge, MA, for which Harvard University provided free beer to promote science).

BBH explains the [Hubble redshift](#) as caused by the expansion of universe and because of this it postulates constant creation of energy in "negligible" amounts, just sufficient to compensate for the [dynamical friction of photons](#) that would exist in the world in which energy is conserved but can't exist in spacetime with symmetric metric tensor postulated by [Wheeler's physics](#) [4] in which the conservation of energy is dropped, presumably to allow the creation of material things from nothing and to allow to reconcile science with religion. This creation of energy must happen through divine intervention to keep the metric tensor symmetric since there is no other mechanism available in physics to create energy from nothing except divine intervention. The value of this dynamical friction has been never calculated by BBH theorists just assumed to be "negligible" as it should be in a spacetime with assumed symmetric metric tensor (*bad science* or *good religion*, take your pick).

When I calculated in 1985 the dynamical friction of photons it turned out to be as it should be in [Einstein's universe](#) of observed density. I drew from it a very unpopular among BBH [gravity physicists](#) and astronomers conclusion that our universe is Einstein's stationary universe with the Hubble constant of about observed 70 km/s/Mpc [2]. For this conclusion I was banned for life from several moderated Internet fora losing connection to scientists who still believed in a scientific explanation that respected the principle of conservation of energy.

Richard P. Feynman in his [comments on gravity physicists](#) (point 4 of his critique) called [gravity physicists](#) idiots for assuming that an "*obvious and correct fact*" [like the principle of conservation of energy] "*accepted and checked for years, is, in fact, false (these are the worst: no argument will convince the idiot)*". In this controversy I support Einstein and Feynman, while [theists](#), at least those from Kansas, consider attempts to falsify the big bang hypothesis "[an atheist plot](#)".

Conservation of 4-momentum means that in an isolated system (one with no connection to the outside of it) there is always the same fixed amount of energy and 3-momentum (momentum in 3 spatial directions) making together so called 4-vector of 4-momentum. Since all 4 components of this 4-vector are conserved separately no energy (the first component of 4-vector) in this isolated system can be created or destroyed. This assumption is dropped in [big bang hypothesis](#) to accommodate for a possibility that the universe was created 14 billions years ago and is expanding ever since. The big bang hypothesis is called rather illegally *general relativity* but it is only a magical hypothesis based on Riemannian geometry describing quite inaccurately the Einstein's physics of gravitation trying to make a [phenomenological theory](#) out of it in which energy is not conserved (which as far as we can tell is not happening in the [real world](#)). The whole universe is necessarily an isolated system as there is nothing outside of it. Here we are considered only with accurate description of Einstein's physics, and so not with description of the big bang hypothesis. We are showing in this article that (i) conservation of energy is a basic part of Einstein's theory of gravitation without which it isn't working at all and (ii) that with the conservation of energy being a valid assumption it is not necessary to assume that the universe is expanding. The conservation of energy, dropped in BBH, is the main difference between Einstein's [physical](#) and Big Bang's [phenomenological](#) (based on the [axiom](#) of creation and expansion) cosmologies from which all the other differences follow.

Copernican principle a.k.a. **Cosmological principle** says that the space of universe is (roughly) [homogeneous](#). The "Perfect cosmological principle" states that the Cosmological principle is time independent. [Einstein's general relativity](#) states that our universe behaves as required by the [Perfect cosmological principle](#).

Cosmic Microwave Background Radiation before 1963 was thought to be the thermal radiation, of temperature about 3 K, of the non luminous matter of universe being in thermal equilibrium with [redshifted starlight](#). It was measured by the radio engineers from the density of noise that the radio engineers noticed as coming from the sky and it couldn't be assigned to any other known source of noise. They assigned it to the thermal energy of non luminous matter of universe assuming that the *temperature of the universe* was about 3 K (according to my recollections of my pre 1955 high school lecture of a radio technology textbook and that's why I knew "since always" that the temperature of universe is about 3 K and I was surprised that it has been "discovered" only in 1963 by Wilson and Penzias).

Cosmic Microwave Background Radiation after 1963 (a.k.a. CBR or CMBR) is radiation that comes from the sky as black body radiation of temperature 2.716 K being most likely the thermal radiation of non luminous matter of universe being in thermal equilibrium with [redshifted starlight](#) as it was assumed before Wilson and Penzias "discovered" that it might be the radiation left in the universe as the result of the Big Bang event for which "discovery" (see "[Cosmic Background Radiation before 1963](#)") they got Nobel Prize in 1978.

Cosmic time is a hypothetical *absolute time* to which all the times of events in universe could be scaled (if such *absolute time* existed) simply by scaling their *rates* by some suitable number. Since there is no *absolute time*, as seen from special relativity in which the time may run at different rates in different reference systems, seemingly "simultaneously", there is no *cosmic time* neither ([OMPDD](#)).

Cosmological constant a.k.a. *Einstein's cosmological constant*, or Λ is a constant of [Einstein's field equation](#) and its nature is similar to *constant of integration* that needs to be determined while calculating integrals. The value of this constant has been a subject of [Big Bang controversy](#) since the value assumed by Einstein in 1917, $\Lambda_E = 4\pi G\rho / c^2$, implies stationary universe but the idea of stationary universe is supported only by about 5% of cosmologists, about 5% of astronomers, and me. Most astronomers and [gravity physicists](#) assume that the Hubble redshift is the [Doppler shift](#) caused by recession of galaxies which implies that the universe is expanding. Therefore the value assumed by Einstein is the very value not accepted by most astronomers and gravity physicists. They assume various values of Λ consistent with expanding space. I happen to know the reason and the value of cosmological constant so for me it's easy to agree with Einstein's assumption.

After discovering cosmological constant Einstein was constantly bothered by visits from cosmologists who kept proposing their pet values of cosmological constant. Finally Einstein told his secretary not to let in anyone who wanted to talk to him about the universe (source: prof. Roy Glauber, Einstein's co-worker, telling the story to me, his one time listener to his series of lectures dedicated to the nature of light, that I took to verify my ideas on cosmological redshift). Then Einstein resolved the *Big Bang controversy* with a joke, telling George Gamov: "the discovery of cosmological constant *was the biggest blunder of my life*". The cosmologists (at least those deprived of sense of humor) treated Einstein's joke as his admittance that he *was wrong discovering the cosmological constant* and they assumed its value as zero (see [\[4\]](#) p. 411).

Before 1998 the gravity physicists supported by Stephen Hawking who advised to try to make finally some observations confirming the big bang hypothesis (BBH) (namely that the cosmological constant doesn't exist, that it was just "Einstein's blunder") and so the expansion of universe is decelerating, as required by the zero value of the cosmological constant. Around 1998 it turned out that the value of cosmological constant can't be zero since the alleged expansion of universe, instead of slowing down looks like speeding up. Then the gravity physicists proposed the existence of "[dark energy](#)" of unknown yet properties as the way out of discrepancy between the BBH and observation of accelerating expansion. The cosmological constant has been renamed "dark energy" and its nature is investigated ever since, providing interesting material for scientific papers. Especially interesting to the future historians of science.

In reality Einstein's equation might not need the cosmological constant at all, due to its value coupled to the density of space. See also [Einstein field equation](#).

Cosmological redshift a.k.a. *Hubble redshift* is a phenomenon of light coming from distant galaxies with [redshift](#) increasing approximately exponentially with distance from the observer. The big bang hypothesis assumes that this redshift is [Doppler shift](#) due to the expansion of universe ([Misner, Thorne, and Wheeler, 1973](#)) plus 1998 correction for the exponential change of this redshift with distance observed only since 1998 by [Supernova Cosmology Project](#) team and explained through the big bang hypothesis by the existence of "[dark energy](#)" of unspecified yet properties. Einstein's gravitation explains it by the rate of time slowing down in curved space proportionally to the [curvature of space](#). It is required by the principle of conservation of energy since as it follows from this principle the sum of [general time dilation](#) and the [curvature of space](#) vanishes according to equation $d^2\tau/dt^2 + 1/R = 0$, where τ is proper time at point in deep space, t time coordinate (time of observer), r is radial coordinate (distance from observer to point in deep space), R is radius of curvature of space ([Jastrzebski, 1985](#)).

Creation is an act of creating something from nothing. Since it is not possible to prove that it is impossible since it is a negative proposition and it is impossible *to prove* a negative proposition there is a lot of people who believe it is possible to *create* (something from nothing).

Scientists usually don't believe that anything has been created this way except the scientists who are promoting the [big bang hypothesis](#) (BBH) which shows that BBH is a [creationist science](#), in which the energy of light lost to [dynamical friction of photons](#) is created from nothing (due to the symmetry of metric tensor that is *assumed* in BBH). However according to Stephen Hawking (1942-) BBH is not a scientific theory yet since it didn't manage to predict anything right, which is necessary to call a theory *scientific*. So far Einstein's general relativity (EGR) predicts stationary universe on the basis of conservation of energy but the majority of cosmologists and astronomers rather believe in the creation of energy than that our universe is stationary ("Einstein's universe"). Presently the scientists promoting BBH are trying to prove that "dark energy" exists due to the possibility of creation of energy from nothing and it is (allegedly) working as a "repulsive force" behind the "accelerating expansion of universe". Science seems not to be what it used to be anymore (an old folks standard complaint :).

It should be mentioned that the "expansion" is not an *observational fact* but it is assumed by BBH proponents on the basis of cosmological redshift assumed to be [Doppler shift](#). This redshift is explained by EGR through rather trivial coupling of the time dilation to the curvature of space carried on from the Newtonian math as the explanation of [dynamical friction of photons](#) known since 1929 in the Newtonian math as "tired light effect". The effect was postulated by Fritz Zwicky but not understood properly due to the difficulties with its derivation and so it was given up as a viable explanation of the cosmological redshift in favor of the expansion of universe. As it turned out it was given up prematurely since I corrected Zwicky's derivation in 1985 providing EGR with a viable explanation of the cosmological redshift restoring Einstein's stationary universe and at the same time getting rid of [cosmological constant](#). Also since 1950 the metric tensor is non symmetric in EGR^[1] and since 1986 it is also degenerated^[2] (its determinant vanishes).

Creationism is a philosophical system based on an idea that some supernatural being or beings, usually called "*God*" or "*gods*", can [create](#) whatever they want to create. It is imagined that this supernatural being or beings control everything what happens in the universe including the possible [evolution](#) of organic life on the Earth. It is a philosophical base of the [Big Bang Hypothesis](#).

Critical mind is a mind that does not believe in anything that is not confirmed by a reliable experiment or a reliable observation. Taking also under consideration that "reliable" depends on interpretation which may be source of errors in otherwise neat theory. Newton's theory of gravitation once was such a neat theory (not to Newton himself though, since he had a critical mind himself and he didn't believe in "[action at a distance](#)") that his theory indicated. He turned to be right (there is no "[action at a distance](#)" in gravitation). The list of things that *critical minds* don't believe in would be too long for this article so it is skipped here.

Curvature of space means that at some places of universe there is more space than at a "flat space" of Euclidean geometry (space of everyday experience). The space curved in such way that there more space than in Euclidean one is called *positively curved*, when there is less space, it is called *negatively curved* space. Since curvature is proportional to the amount of energy contained in space the physical space is always positively curved. Illustration of the above is that a sphere of certain surface area can hold greater amount of water in positively curved space than in "flat" space where it can hold only volume equal $(4\pi r^3) / 3$, where r is radius of the sphere. We may say that there is an excess radius of such sphere in curved space equal $\Delta r = \text{real radius} - \text{radius imagined for a Euclidean geometry sphere of surface of } 4\pi r^2$. Furthermore it turns out that whenever there is "more space" also the time "slows down" in such way that product of the amount of space and the amount of time ("volume of spacetime") is constant. It means that the spacetime of universe is "intrinsically" flat. This is a necessary result of the principle of conservation of energy. So one may say that the curvature of space, or concurrently, the time dilation, is the result of presence of energy in space and the other is the *result of the inability of Nature to make energy from nothing*.

Curvatures of spacetime are numbers that for each [event](#) in spacetime tell how much [space at this event is curved](#) and [time is dilated](#) in relation to events far away from any material object (where space and time are "flat" i.e. the same as in Euclidean spacetime). In Einstein's spacetime the *dilated* time (less time) implies increased amount of space in such way that their product (volume of spacetime) is the same in the whole universe meaning that the spacetime of universe is *intrinsically flat*. Einstein's gravitation is considered having [flat geometry](#) (not by [MTW](#) though who assume non vanishing curvature of spacetime without determining its value nor proposing even whether it is positive or negative).

Cybernetics is science of automatic control in organisms of various types, either alive or artificial. All of them employ at least one circuit of *automatic control* employing a *feedback loop* consisting of an *error detector* comparing the desired value of controlled variable $x_0(t)$ with its actual value $x(t)$, an amplifying branch that amplifies the *error signal* $\varepsilon(t) = x_0(t) - x(t)$ by some suitable gain $k(t)$ being in general a complex and non linear function of time and then feeds this amplified signal back into the system through a driver producing output signal $y(t) = k(t)\varepsilon$. This output signal is used to adjust the controlled variable often directly as in $x(t) = y(t)$. The linear systems may be described by their Laplas or Fourier transforms, $X(s)$, $X_0(s)$, $K(s)$ where s is complex so the whole control loop may be described by equation $X(s) = X_0(s) [1 - 1 / K(s)]$.

Stability of a linear system is investigated by investigating the complex transfer function $1 - 1 / K(s)$ which depends strongly on its phase characteristics. It is stable if its left side interior while moving along the function from lowest frequency to the highest frequency doesn't contain point $(-1, 0)$ of complex plane.

Therefore in stable systems the phase of transfer function in general don't exceed 180° but occasionally they might go over this limit if the above condition of stability is fulfilled and then the system stays stable as it happens to the radius of curvature of universe.

Dark energy. Hypothetical energy allegedly discovered in 1998 by [Supernova Cosmology Project](#) team of astronomers working on confirmation of prediction of the Big Bang theorists that the expansion of universe is decelerating. The team discovered that the observations are opposite to what was predicted by the Big Bang theorists. The expansion of universe instead of looking decelerating looks accelerating as predicted by Einstein's (not published yet) theory and also with the predicted value of acceleration. Then this discrepancy has been blamed by Big Bang theorists on an unknown yet "dark energy", set most likely by nature (that, according to Feynman, takes always Einstein's side) this time, presumably, to destroy the elegance of big bang hypothesis. The properties of this hypothetical "dark energy" are investigated ever since by the Big Bang theorists.

Doppler effect. The common effect of changing the length of any wave when the wave is emitted by a moving source or received by a moving observer. When the source of wave is approaching the observer the observed wavelength gets shorter (so called "*blueshift*" as lightwave becomes then more blue) and when it moves away from observer it gets longer (so called "*redshift*" as lightwave becomes then more red).

Dynamical friction of photons is a relativistic effect of photons reaching the observer with a redshift depending exponentially on the distance that they travel, $d\tau / dt = \exp(-r / R_E)$, where τ is proper time (at source of light), t is coordinate time (at observer), r is distance from observer to source of light, R_E is [Einstein's radius](#). The reason for this effect is slowing of the time rate at the source of this light called here the [general time dilation](#) as opposed to [gravitational time dilation](#). It is named *dynamical friction (of photons)* through analogy to the *dynamical friction*, a Newtonian effect of the dispersion of kinetic energy of things that move through the universe and interact gravitationally with its matter losing in the process the kinetic energy to the matter of universe (the effect opposite to *slingshot effect* used to accelerate cosmic probes while rejecting them from the Solar System). Within the Newtonian [magic](#) (phenomenological description of gravitation by Newton) the *dynamical friction of photons* is represented by the *tired light effect* in which the photons move against dynamical gravitational field c^2/R_E , where c is speed of light, as it might be observed in "anomalous" acceleration of space probes Pioneer 10 and Pioneer 11.

Einstein field equation is a set of 10 differential equations describing the geometry of the spacetime. The equations may be combined together in tensoral form as follows:

Original version of 1915, "elegant":

$$R_{\mu\nu} - (R / 2) g_{\mu\nu} = 8\pi T_{\mu\nu}$$

where $R_{\mu\nu}$ is Ricci tensor, R is its contraction, $g_{\mu\nu}$ is metric tensor of spacetime, and $T_{\mu\nu}$ is stress-energy tensor.

Einstein's version of 1917, with Λ :

$$R_{\mu\nu} - (R / 2 - \Lambda_E) g_{\mu\nu} = 8\pi T_{\mu\nu}$$

where Λ_E is cosmological constant of Einstein's value $\Lambda_E = 4\pi G\rho / c^2$.

Jim's version of 1986, with contraction of [Hubble tensor](#) (and without cosmological constant, again "elegant")

$$R_{\mu\nu} - (R / 2) g_{\mu\nu} = 8\pi T_{\mu\nu} + (H / 2) g_{\mu\nu}$$

where H is contraction of [Hubble tensor](#) replacing cosmological constant.

Wheeler considered Einstein's original version of field equation "elegant" and Λ "the biggest blunder of Einstein's life" since, as he has written in his "*Gravitation*" [MTW](#) p. 411): "*had Einstein stuck by his original equation, he could have claimed the expansion of the universe as the most triumphant prediction of his theory of gravity*". Einstein said "*If you are out to describe the truth, leave elegance to the tailor*" and he was right since Jim, being a sculptor, knew at the time as much about general relativity as an average tailor, and yet he managed to make Einstein's equation elegant again.

It might be also proper to quote here Einstein's response to a question from a journalist on how to make scientific discoveries. "*It is simple*" said Einstein "*when all the experts decide that there is no solution to certain problem there comes an ignorant who does not know that and solves the problem*". Of course Einstein couldn't foresee that when the ignorant like Jim solves the problem the experts may still not allow to publish the solution just by setting strict rules who is allowed to publish (experts, like gravity physicists) and who is not (ignorants, like sculptors). This way other experts won't learn the solution for many years (in this case well over 25) and in the meantime the taxpayers will finance the attempts to solve the already solved problems. As in this case some astronomers don't know that the problem whether the universe expands or not has been solved before their birth, just weren't allowed to be published in any scientific journal since there were still money to be made on the old BBH.

Comment: Had Einstein stuck by his original equation as Wheeler advised, he would make the same fool of himself as Wheeler and his team of Big Bangers did when it turned out in 1998 that the alleged expansion of the universe looks accelerating instead of decelerating as the original equation of 1915 "predicted".

It would be even worse when it turned out that the universe, as [Einstein's universe](#), is not expanding at all since its expansion would violate the principle of conservation of energy. Einstein, being a patent office clerk and an atheist might have not supported the violation of conservation energy since the Patent Office had a policy of rejecting applications for perpetual motion machines without even testing their viability, and atheists didn't believe in supernatural, while Wheeler, being one of 126 dopes attending the World Conference on Gravity, as his student Richard P. Feynman disclosed in the book "[What Do You Care What](#)

[Other People Think?](#)", might consider the ability of creation of energy from nothing, a necessary attribute of God and even of his angel whose picture blowing a horn adorns page 1218 of his "*Gravitation*".

It might be good to put more light on [Big Bang](#) controversy by mentioning here that according to the University of Kansas [gravity physicists](#), [Einstein's universe](#) is an *atheist plot* and "*The Templeton Foundation*" gave 1.6 million dollar award to a cosmologist Michael Heller "*in recognition of scholarship and research that has pushed at the metaphysical boundaries of science.*".

Einstein's radius a.k.a. Einstein's radius of universe, $R_E = c / \sqrt{4\pi G\rho}$, where c is speed of light, G is Newtonian gravitational constant, and ρ is mass density of space. It is the radius of 3-sphere being the 3-space of [Einstein's universe](#), about 4.3 Gpc. The relation between [cosmological constant](#) of [Einstein's universe](#), Λ_E , and Einstein's radius is $\Lambda_E = 1 / R_E^2$.

Einstein's theory of gravitation a.k.a. Einstein's general relativity is a theory of gravitation that explains the gravitational force not as the force of "gravitational attraction", that even Newton refused to accept (for its implied [action at a distance](#)), but as the force resulting from the internal energy of the particle itself, diminishing along certain direction because of [curvatures of spacetime](#). Gravitational force in Einstein's general relativity is therefore a force pushing the particle in a direction of its diminishing internal energy while the free movement of the particle is restricted. The excess energy resulting from diminishing internal energy of the particle in curved spacetime, is changing into kinetic energy of movement of particle while the total energy of particle remains constant. We may see in this the working of the principle of conservation of energy that can't be violated in a physical theory and so it can be used to tell a true theory from fictitious one in which energy can be created from nothing. The curvatures of spacetime is all that is needed to explain the shape of diminishing energy of particle in space and in turn this shape is described by the geometry of spacetime. That's why Einstein's theory is called a "geometric theory of gravitation".

Einstein's universe is a stationary (i.e. neither expanding nor contracting) model universe described by [Einstein's field equation](#) with $\Lambda = \Lambda_E$ "[Einstein's value of cosmological constant](#)". Einstein discovered this value in 1917. It was rejected by the theorists of [BBH](#) since such value stabilizes the field equation and makes the model stationary contrary to the opinion of BBH theorists who assumed at the time that the universe is expanding.

Empty idea is idea of something that does not exist in the real world, as e.g. angels, elves or unicorns, that we can imagine, even draw them, but it doesn't make them existing objectively as separate entities except as (empty) ideas. Many things which existence was taken for granted turned out to be empty ideas. E.g. absolute simultaneity: idea of two events happening in two various points in space "simultaneously" is empty (since there may be observers for whom one event is earlier than the other and observers for whom it is just opposite, so simultaneity can be only relative, in relation to a particular observer) so it never happens in the real world that events happen "absolutely simultaneously" or in other words it has no meaning for nature which one is earlier. Only collision (one event happening in the same point in space) has meaning for nature. Lack of absolute simultaneity was an important discovery of Einstein's relativity. "[Action at a distance](#)" is another empty idea.

Elimination of cosmological constant from [Einstein's field equation](#) became possible when it turned out that dynamic friction of photons is controlled by equation with cosmological constant of Einstein's value in it. The minus contraction of [Hubble tensor](#) (-H) became equal to contraction of Ricci tensor (R) which became double of Einstein's value of [cosmological constant](#) ($R = 2 \Lambda_E$). Therefore the cosmological constant could be replaced by half of contraction of Ricci tensor as shown in description of [Einstein's field equation](#).

$E = m(v)c^2$ is an [identity](#), discovered by Einstein in which E is total energy of a particle, $m(v)$ is its inertial mass and c is invariant speed of light. Some of this energy is called "kinetic energy" if it is due to linear motion of the particle with velocity v , but if it happens to be due to some rotations within the particle that

aren't visible outside of it then it is called "internal energy" or the "invariant energy" of the particle since it is the same for all observers of the particle of this type regardless of their total energy (internal energy + kinetic energy). Since around half of 20-th century m started to mean the rest mass (invariant mass, formerly called m_0), the equation $E = mc^2$ became only equation for internal energy of particle and total energy had to be changed to $E = m(v)c^2(x)$ to distinguish $m(v)$ from m while $m(v)$ is related to m by equation $m^2(v) = m^2 / (1 - v^2 / c^2)$, and to distinguish $c(x)$ from c , which now means speed of light that a particle sees itself, at its actual position in space and not necessarily what observer sees which is his "coordinate speed of light". The value $c(x)$ depends on the curvature of spacetime and is related to c by equation $c^4(x) = c^4 g_{00}$ where g_{00} is the time-time component of the metric of spacetime). Total energy of a particle is still an invariant number which means that it does not change while the particle changes, in a free fall, its position in relation to a coordinate system.

Event is a "point in (4 dimensional) spacetime" that has four coordinates: three spatial coordinates (telling *where* it happened) and one temporal coordinate (telling *when* it happened).

Evolution is something that is responsible for creation of all species, also those extinct, but many of them being just auxiliary structures for developing other more sophisticated structures, culminating in creation of (quite accidentally, as it is shown below) [human female](#) and to a lesser degree [humans in general](#). Evolution acting randomly not always succeeds as it happened e.g. with H. sapiens who has been evolved, with the original purpose of converting bananas into proteins to feed with them the saber-toothed tiger, but something went wrong with that scheme and the saber-toothed tiger got extinct by H. sapiens whose brain evolved faster than that of the saber-toothed tiger and survived not as evolution intended, as the saber-toothed tiger's food, but as a pest destroying the other species which evolution planned to populate the planet Earth with, creating a [paradise on Earth](#). Luckily H. sapiens managed to invent also H. bomb that soon will wipe out the H. sapiens from the face of the Earth and so the evolution will be able to start again from scratch, with its purpose being easier to achieve because of the enhanced radiation that H. sapiens will leave on the Earth as its main achievement. So maybe the real purpose of creation of H. sapiens was not to provide proteins for the saber-toothed tiger but to accelerate the mutations by releasing more radiation? Then the evolution might not be as stupid as some of us think it is but it is doing the best it can to bring the [paradise on Earth](#) around? And so we shouldn't call it "it" but more respectful name like "SHE" and start believing in "HER"? Another bad news for [theists](#) who don't believe in HER but aren't listening to [agnostics](#) advice that believing is safer than not believing.

Expansion of space is a hypothetical phenomenon postulated by creationists and [MTW](#) after them. It requires [creation](#) of energy (from [nothing](#)) and happens to be a relativistic illusion produced by the [general time dilation](#).

Feynman's opinion about gravity physicists from his letter to his wife published in book "What Do You Care What Other People Think":

I am not getting anything out of the meeting. I am learning nothing. Because there are no experiments this field is not an active one, so few of the best men are doing work in it. The result is that there are hosts of dopes here (126) and it is not good for my blood pressure: such inane things are said and seriously discussed here that I get into arguments outside the formal sessions (say, at lunch) whenever anyone asks me a question or starts to tell me about his "work". The "work" is always: (1) completely un-understandable, (2) vague and indefinite, (3) something correct that is obvious and self evident, but a worked out by a long and difficult analysis, and presented as an important discovery, or, a (4) claim based on the stupidity of the author that some obvious and correct fact, accepted and checked for years, is, in fact, false (these are the worst: no argument will convince the idiot), (5) an attempt to do something probably impossible, but certainly of no utility, which it is finally revealed at the end, fails (dessert arrives and is eaten), or (6) just plain wrong. There is great deal of "activity in the field" these days, but this "activity" is mainly in showing that the previous "activity" of somebody else resulted in an error or in nothing useful or in nothing promising. It is like a lot of worms trying to get out of a bottle by crawling all over each other. It is not that the subject is hard; it is that the good men are occupied elsewhere. Remind me not to come to any more gravity conferences!

Feynman's warning "Let me also say something that people who worry about mathematical proofs and inconsistencies seem not to know. There is no way of showing mathematically that a physical conclusion is wrong or inconsistent. All that can be shown is that the mathematical assumptions are wrong. If we find that certain mathematical assumptions lead to a logically inconsistent description of Nature, we change the assumptions, not nature." [*Feynman lectures on gravitation*].

First principles. Calculations *from first principles* are ones that start from the established laws of physics without making assumptions about any particular model.

Flat geometry means that a certain aspect of the space under consideration is the same everywhere, as in Euclidean *flat* space. A convenient thing for measuring flatness of 2-dimensional (2D) surface may be the ratio of a circumference of a circle on this 2D surface to radius of this circle. If it is always 2π the surface is flat. It may be also the ratio of area of circle to radius squared. If it is always π the surface is flat. For 3D space it might be more things: as above the ratio of circumference to radius and the ratio of area of surface to radius squared (2π and π respectfully for all circles imply flatness) and also the ratio of area of surface of 2-sphere (our regular 3D sphere) in this 3D space to the radius of this 2-sphere squared (if always 4π the space is flat) or the ratio of 3-volume of 2-sphere to the cube of radius (if always $4\pi/3$ the space is flat). For 4D [spacetime](#) it may be even more things.

It seems that spacetime of our universe is flat but the space is surely curved and its radius of curvature is about 4.3 Mpc since speed of light divided by this radius turns out to be 70 km/s/Mpc. For space being curved and spacetime being flat the 4th dimension (our "time") must fit the curved 3D space so that the 4-volume remains the same as in Euclidean 4-space (our "spacetime"). So the flatness of spacetime by adjusting the time rate to the curvature of space seems to be the sufficient reason for the illusion of accelerating expansion of space. Especially when parameters of this apparent expansion predicted with Einstein's theory fit the observations.

General time dilation a.k.a Hubble time dilation (HTD) is an effect valid for any space containing energy in any form due to the effect of [interrelation of time and space](#) in Einstein's general relativity (not present in *BBH* though). It is an effect of proper time (τ) running outside an observer slower than observer's coordinate time (t). In homogeneous space of [Einstein's universe](#) it is proportional to the exponent of distance from the observer to the observed point in deep space (r), and inversely proportional to the radius of curvature of space (R_E or [Einstein's radius](#)). It is expressed by equation $d\tau/dt = \exp(-r/R_E)$. The effect, in agreement with [perfect Copernican principle](#), shows up for any observer in the universe, at any time, supplying the reason for the [Hubble redshift](#). The observed [Hubble constant](#) ($H_o = c/R_E$) of 70 km/s/Mpc implies the density of stationary space of 6×10^{-27} kg/m³, which is roughly what is observed in the universe. Calculations based on conservation of energy while calculating the [dynamical friction of photons](#) indicate that this effect reflects the curvature of space in such way that the tensoral sum of three dimensional Ricci tensor of the curvature of space and the *tensor of general time dilation* (known as [H tensor](#)) vanishes.

Gravitational energy is something that used to be called [internal energy](#) of a particle $E = mc^2(\mathbf{x})$, where m is mass of a particle and $c(\mathbf{x})$ is coordinate speed of light. The derivative of this energy with respect to displacement turned out to be [gravitational force](#) with negative sign ($dE/d\mathbf{x} = -\mathbf{F}$) then $E = mc^2(\mathbf{x})$ satisfies the definition of gravitational energy.

Gravitational force in Einstein's theory is the same as in Newton's theory: $\mathbf{F} = m\mathbf{g}$, where m is mass of a particle and \mathbf{g} is acceleration of the particle in free fall. Also it is the derivative of [gravitational energy](#) with respect to displacement with minus sign ($\mathbf{F} = -dE/d\mathbf{x}$). However unlike in Newton's theory which is a mathematical theory in which gravitational energy is a mathematical quantity defined only with accuracy to an arbitrary constant, in Einstein's theory it is a precisely defined physical quantity $E = mc^2$ localized at the particle itself (a fact possibly not known yet to Einstein himself). The derivations of gravitational force and energy are in section "[Basics of Einstein's gravitation](#)".

Gravitational time dilation is an effect of time running slower at the source of light located at an object containing energy in any form (e.g. an atom, planet, star, or a galaxy). The effect is approximately (for ratios of mass to distance $M / r \ll c^2 / G$) proportional to the amount of the energy located in the object (contained in its mass M) and inversely proportional to the distance from the object: $d\tau/dt = 1 - G M / c^2 / r$, where τ is proper time (at source of light), t is coordinate time (at observer), G is Newtonian gravitational constant, c is speed of light, r is distance from observer to the source of light.

Gravitational redshift is [redshift](#) caused by the time running slower due to [gravitational time dilation](#)

Gravitational twin paradox (GTP) is an effect of time running faster for each twin separated from the other by a distance in [curved space](#). I.e. in space containing energy (as in our physical space of positive curvature) Alice looking at Bill is seeing his time running slower and Bill looking at Alice is seeing her time running slower as well. It follows directly from the [general time dilation](#) and looks like a logical contradiction since Alice's and Bill's times run faster and slower seemingly "simultaneously". Therefore the GTP is a paradox different from standard (special relativistic) twin paradox (STP) in which twins have to move with respect to each other, experiencing different relativistic time dilations, while in the GTP they don't need to move at all with respect to each other.

The solution of GTP is the fact that the same as STP it doesn't cause any logical contradiction which may be readily verified by a possibility of a "gedanken universe" in which the "[cosmic](#)" time accelerates. In such a universe Alice is seeing Bill at the time which already runs faster for her but not yet for Bill whom she is seeing at earlier cosmic time as the light signals from Bill need time to reach Alice (and v.v. since the situation is symmetric). So both, Alice and Bill are seeing their twins at earlier cosmic time and therefore when their times were running slower than their own present (constantly accelerating) cosmic time. They both will see the [cosmological redshift](#) simulating the accelerating expansion of space (because of the [exponential character](#) of this redshift).

Gravity physicists are subspecies of [applied mathematicians](#) who due to their ideas about physics believe that physics can be replaced by math, even Newtonian math (with "relativistic corrections" though) due to the belief of many of them that gravitational force is a real attractive force mediated by "gravitons" (not just a pseudoforce mediated by photons as it follows from Einstein's GR). See also [Richard Feynman's](#) impressions from his participation in a World Gravity Conference that he applied to gravity physicists who propagated [BBH](#). Feynman also warned gravity physicists saying: *"Let me also say something that people who worry about mathematical proofs and inconsistencies seem not to know. There is no way of showing mathematically that a physical conclusion is wrong or inconsistent. All that can be shown is that the mathematical assumptions are wrong. If we find that certain mathematical assumptions lead to a logically inconsistent description of Nature, we change the assumptions, not nature."*

Homogeneous means that the thing under consideration is the same everywhere. Things with some feature of their geometry being everywhere the same as in Euclidean geometry are called [flat](#). E.g. a surface is "flat" if the ratio of area of a circle to its radius squared is the same everywhere on this surface and equal π . So by the above criterion the surface of the Earth isn't flat as some people ("flatearthers") think that it is. They think so because the "curvature" of the Earth is too small to be noticed. They can't notice it, that's why they think it's none. Similarly as with [gravitational force](#) that depends on tiny changes of speed of light outside of particle, but so small that people thought that there are none and so this force must be caused by "gravitational attraction" which as it was discovered by Einstein doesn't exist in the nature but only in what some humans think about this nature (hopefully no one who's read this article).

Hubble constant a.k.a. Hubble parameter, is the velocity of (apparent) expansion of the universe. It is equal to the ratio of (apparent) recessional velocity of galaxies to the distance to them. Hubble constant of [Einstein's universe](#) is equal $H_0 = c / R_E$ where c is speed of light and R_E is [Einstein's Radius](#). The time derivative of difference of this velocity, dH/dt , and the velocity of uniform expansion is the (apparent) acceleration of (apparent) expansion of space. Einstein's theory of gravitation predicts its value as $dH/dt = - H_0^2 / 2$. In 1998 it was observed as such by the [Supernova Cosmology Project](#) team of astronomers.

Hubble law is the relation between distance to an astronomical object and its redshift, approximately exponential with distance. [Quasars](#) redshifts don't seem to fit this law and so their redshifts seem to be produced by a different mechanism than redshifts of galaxies (or the same mechanism if we allow the Einstein's version of general relativity, which then would be the [general time dilation](#)). However the big bang hypothesis can't tolerate a different mechanism of redshift than [Doppler shift](#).

H-tensor (a.k.a. *Hubble tensor*, a.k.a. *tensor of [general time dilation](#)*, a.k.a. *tensor of curvature of time*) is a tensor mirroring the properties of space curvature in the time domain and describing the physical properties of [general time dilation](#) in agreement with Feynman's opinion that "*it would be kind of crazy to have something happening to space, without the time being involved in the same thing*". The properties of H-tensor are defined by identity $H_{\mu\nu} + R_{\mu\nu} = 0_{\mu\nu}$ where R is Ricci curvature tensor. Hubble tensor is built from partial derivatives of proper time (τ) at observed place in deep space with respect to coordinate time of observer (t) $d\tau/dt$ in direction μ differentiated second time with respect to distance from observer to observed point in deep space along spatial coordinate ν : $(d/dr^\nu)(d\tau/dt)^\mu = d^2\tau/dt^\mu dr^\nu$. Contraction of H-tensor, $H_{\mu\nu} g^{\mu\nu} = H = -R = -2\Lambda_E$ eliminates "*Einstein's biggest blunder of his life*" the cosmological constant.

Identity is an "equation" that is valid no matter what, while a "real" equation, that is not necessarily an "identity" is valid only for some particular case, a particular combination of variables in that equation. E.g. $y = x^2$ is valid only for a particular sets of numbers, e.g. for $(x,y) = (3,9)$ but not for $(x,y) = (3,7)$. Finding what particular sets of numbers are valid for a given "equation" is called "solving the equation". One can't "solve" an "identity" since by definition it is "valid no matter what". So "identities" are just ways of stating that something is "the same as something else". E.g. the identity $E = mc^2$ means that energy "E" and inertial mass "m" are the same things at certain coordinate speed of light "c". May be in different units, and then "c" takes role of a unit, but they are physically indistinguishable. There are no physical features that can be used to tell one from another.

Illusion of accelerating expansion of space is an illusion that the space of the universe is expanding and that this apparent expansion is accelerating. This is an artifact caused by the interpretation of the [Hubble redshift](#) as [Doppler shift](#), allegedly caused by the recession of galaxies.

Illusion is something that looks like something else but ain't.

Illusion of gravitational attraction is an illusion that all particles of universe attract each other. This illusion is caused by the [curvatures of spacetime](#) that change the coordinate speed of light around each particle in such way that there shows up a gradient of particle's [internal energy](#) ($dE/d\mathbf{x}$, where E is internal energy of the particle and \mathbf{x} is displacement vector in the frame of this particle) that when the particle is immobilized it produces an inertial force equal $-dE/d\mathbf{x}$. This force has been called *gravitational force* and it is a force *pushing* the particle in the same direction towards which it starts falling when it is in *free fall* (in direction \mathbf{g}/g). Then it makes an illusion that this force is due to external "Newtonian attraction" as indicated by the known Newtonian equation ($F = G M m \mathbf{r} / r^3 = m\mathbf{g}$), while it is an internal *push* from the inside of particle itself, due to the Einsteinian push, as the value of this push ($F = -dE/d\mathbf{x} = m\mathbf{g}$) indicates. Both forces are the same $m\mathbf{g}$ and that's why it was so difficult to discover the truth about gravitation and which part is accidental math (which turned out to be "Newtonian attraction") and which part is real physics (which turned out to be Einsteinian push, see [Basics of Einstein's gravitation](#) for derivations).

Interrelation of time and space is the effect of Einstein's relativity expressed by Feynman in his "*Feynman Lectures on Physics*" as "*As you know from special theory of relativity, measurements of space and measurements of time are interrelated. And it would be kind of crazy to have something happening to space, without the time being involved in the same thing*" [p. 42-7] and "*It is impossible with space and time so intimately mixed to have something happen with time that isn't in some way reflected in space*" [p. 42-14].

Intrinsic redshift is a hypothetical [redshift](#) postulated the first time by [Halton Arp](#) or even by [Fritz Zwicky](#) (to my best knowledge) for a redshift existing in the universe as the reason for [Hubble redshift](#). It was

suggested as a separate redshift from all then known forms of redshifts. It turned out to be the same redshift that I used to call "*general redshift*", since 1985, not being aware of Arp's term or the existence of Arp or Zwicky or anything regarding cosmology, except the (alleged, as it turned out) possibility of expansion of universe which astronomy books mentioned as the possible explanation of observed "cosmological redshift". This redshift is described in this article as one that shows up in any physical space (*curved space* of positive curvature) and caused by *general time dilation*.

Isotropic is a property of being the same in any direction. The *Copernican Principle* states that the space of our universe is roughly *homogeneous* and therefore also "isotropic".

Joseph Medard Namyslowski is a physics professor and a particle physicist. He is accidentally involved in cosmology by the virtue of having a doctoral student, one W. Jim Jastrzebski, who is doing his PhD work in the universe, also accidentally. Joe is trying to promote *Jim's* work among physics professors. So far with no luck.

Legend of "*negligible redshift in Einstein's universe*". When I tried to learn what is the amount of redshift in stationary universe I learned from an astrophysicist Prof. Bohdan Paczynski (1940-2007) that such a legend existed. Prof. Paczynski *assumed* that the Big Bang theorist would have calculated the redshift due to the dynamical friction of photons if it were not negligible. In his opinion it *must have been negligible* so those theorists just needed to show that it is negligible and he believed that they did and that such calculations existed somewhere in the literature. He maintained that "*it obviously couldn't be zero*", claiming that he had to calculate the dynamical friction of many objects for many years though different than photons. He was surprised when I told him that it was assumed by *MTW* that *it is zero* due to the *assumed* symmetry of metric tensor of spacetime.

Magic is a mechanism through which a mathematical (*phenomenological*) model that uses non existing entities works. The same as the ordinary magic it works through accidental similarity of the model to the physical phenomenon. A good example is Newtonian gravitation with its *gravitational forces* that act at a distance. Newton didn't believe in such forces considering them mathematical entities that are only imagined and therefore a kind of *magical things*, as unicorns. Yet knowing their magical nature through the Newtonian equations that describe their behavior we may use these magical things in calculations and get almost true results due to the similarities between the equations that control their magical behavior to the real equations that control the behavior of the real gravitation (unknown in times of Newton). The magical things are useful as long as one does not consider them real and does not conclude about the real world as if those magical things were real. A newer example of magical thing is the *expansion of universe* that has been considered real by many 20th and 21st century *gravity physicists* despite that it requires dropping the principle of conservation of energy that most of them consider *accepted and checked for years*. Dropping a well tested principle for some, at best highly hypothetical, and at worst totally impossible, thing changes the phenomenological theory into a **magical theory** usually favored by *theists* though not by all of them since many of them believe that facts shouldn't be explained by magic.

Mathematical theory, a.k.a. "phenomenological theory" or sometimes, when it is applied outside its *domain of application*, a "*magical theory*". A theory that predicts everything that happens *within its domain of application* but doesn't explain why it happens this way. Examples: Newton's gravitation, the quantum mechanics, Einstein's gravitation with cosmological constant, the big bang hypothesis. The "Copenhagen school" maintains (against common sense) that theories can be mathematical only and so the question "why?" is epistemologically empty. Some proponents of *BBH* maintain that questions to which scientists don't know answers shouldn't be asked at all since they may be asked "on wrong assumptions", which I learned after asking prof. Baez, one of *gravity physicists*, about *conservation of energy* in gravitation and was told by him that "in Einstein's gravitation energy is not conserved as opposed to Newtonian physics where it is conserved". It prompted me to figure it out on my own how it is conserved in Einstein's gravitation and place it in section titled "*Basics of Einstein's gravitation*".

Metric tensor of spacetime is a tensor that describes distances along temporal and spatial coordinates in terms of their differentials. Symmetric metric tensor has only 4 independent elements and so it might be

turned into diagonal form (when only non zero elements of the tensor are the diagonal terms of this tensor) while a non symmetric tensor can't be diagonalized since all 10 elements of the tensor are independent of each other (other 6 always depend on other 10). If $g_{\mu\nu}$ is metric tensor of spacetime then the square of distance in spacetime is equal to $ds^2 = g_{00}dx^0dx^0 + g_{01}dx^0dx^1 + \dots + g_{33}dx^3dx^3$. In non symmetric spacetime (as in our universe) $g_{\mu\nu}$ is not the same as $g_{\nu\mu}$. The metric tensor of isotropic universe proposed by me (for one spatial dimension, since it is the same in all directions) is not only non symmetric but also degenerated but despite that the resulting metric is quite decent:

$ds^2 = c^2 \exp(-r/R_E)dt^2 + 2\sinh(r/R_E)dtdr - \exp(r/R_E)dr^2$ which approximates to Minkowski

$ds^2 = c^2dt^2 - dr^2$ for $r \ll R_E$.

Misner, Thorne, and Wheeler, authors of a creationist version of general relativity, an over 1200 page book titled "*Gravitation*" (a.k.a. "*The Bible*") in which they push the hypothesis of creation of universe in a Hot Big Bang about 14 billion years ago. The hypothesis has been falsified by my 1985 calculation of [Hubble constant](#) of [Einstein's universe](#) that came the same as Hubble constant observed in our universe strongly suggesting that our universe is Einstein's and therefore not expanding.

Mysticism is opposite to [objectivism](#) invented by Ms Ayn Rand.

Objectivism is a philosophy invented by Ms Ayn Rand based on an assumption that there are no supernatural forces acting in the universe (see [Atheism](#)) with added ethical and epistemological teachings gathered in her works that can be found on the Internet and in her novel "*Atlas Shrugged*" written specifically to popularize her philosophy (the book reportedly being one of the most popular books on the market, second only to the Bible, the embedment of [mystic](#) philosophies of the world).

One more prejudice down the drain is an unavoidable result of activity of science. Of course this result doesn't apply to all humans since even now there exist humans who, after nearly a century of Einsteinian physics, not only still believe that the [Earth attracts them](#) but they are also [professors of physics](#). Einstein said: "*There are only two things infinite: universe and [human stupidity](#) though I'm not sure about the former*".

Paradise on Earth is a projected purpose of evolution and situation on the Earth when the Sun has already used its all available H and is powered by burning He but it makes no diff to species populating the Earth, since the life on the Earth is now 100% inorganic (see wiping out the organic life by H. sapiens in 20-something century and leaving it with industrial robots that evolved into intelligent species) and all Earth organisms are eternal since made of 100% replaceable parts so they don't need even to eat one another just enjoy life and art since they are even more then their ancestors sensitive to [beauty](#) (especially [female](#), which happens to be the highest achievement of [evolution](#)).

Perfect cosmological principle is a principle that says that the universe should look not only from every place in the universe (roughly) the same ([Copernican principle](#)) but should look (roughly) the same always, i.e. that the spacetime is [homogeneous](#) (which obviously violates the [BBH](#)).

Physical theory is a theory which its all predictions are true: really happen in the real world. Examples: corpuscular theory of gases, Einstein's special relativity, Einstein's gravitation, a.k.a. Einstein's general relativity (EGR) as opposed to the Big Bang general relativity, a.k.a. Big Bang Hypothesis (BBH) which is a creationist hypothesis propagated between others by The Templeton Foundation with awards bigger than Nobel Prize to reconcile religion, that is based on [axioms](#) with science that is based on verifiable facts. Because of the nature of a physical theory one can never be sure whether any particular theory is a physical theory. One can be sure only when it ain't (if it contradicts facts, unless they aren't facts but just some prejudice about facts, which happens a lot). That's why the basic scientific endeavour is removing illusions from science.

Pioneers 10 and 11 are cosmic probes that flying through space undergo constant deceleration predicted by Einstein's general relativity and observed by John Anderson and Slava Turyshev. The deceleration is not accepted by establishment's creationists promoting the Big Bang hypothesis who still call the deceleration 'anomalous' since they assume that the additional energy created (how?) during the flight by the assumed by them [symmetric metric tensor](#) should compensate the deceleration.

"Physicists don't understand gravitation" is a quote from my first semester ("*Physics I*") physics teacher prof. Zharnecki who expressed the opinion of majority of physicists. I myself heard the opinion many times before. Most likely the opinion is caused by the poor way the physics of gravitation is taught. This poor way of teaching leaves over 99% of physicists without a slightest idea what is the reason for [gravitational force](#) which is the most common force in nature that every living thing feels whole its life. The physicists just know it is not "*gravitational attraction*" since they heard rumors that in Einstein's general relativity a.k.a. "[Einstein's theory of gravitation](#)" there is no such force acting through vacuum (also Newton was squarley against the existence of such force) yet teachers of physics assume that (screw Newton and Einstein) the best way of teaching physics is to imbue high school students, who later become physicists and astronomers, with the idea of "*gravitational attraction being a real force of nature*" (even one of "four fundamental forces" of nature). They know that later it is going to prevent physicists from understanding gravitation and not to protest (except those with [critical minds](#) which is only about 5% of any population) when the [gravity physicists](#) tell them that "the universe is expanding". And it may hold true even if they learn that the expansion of universe contradicts the principle of conservation of energy (remember, we are talking about ones without critical minds). This lack of opposition might allow *intelligent design* aficionados sneak into science some of their creationist ideas like e.g. possibility of creation of energy. The physicists just "won't understand gravitation" and so they won't suspect a large scale creationist fraud such as the [Big Bang](#).

Pseudo force is inertial force. The word "pseudo" signals that its value is not coordinate system independent as many physical quantities (as scalars, vectors, and tensors) are. It depends on the coordinate system and so in general it depends on the choice of coordinate system in which it is measured. Therefore it is not considered a *real* force as e.g. electromagnetic or nuclear forces are (which then are called *fundamental forces of nature*). There are though humans, even physicists, who don't believe in Einstein's GR and assume that gravitational force is fundamental force of nature. They are trying to invent a theory which would unify "gravitational force" with other fundamantal forces. Most of the time they "work" on quantum gravitation not even realizing that Einstein's GR is already a quantum theory and finding a different one is highly unlikely so far all gravitational phenomena can be predicted, and their values calculated, from Einstein's GR.

Pseudo Riemannian geometry differs from the four dimensional Riemannian geometry by signature which in Riemannian geometry is + + + + while in pseudo Riemannian geometries it is either + - - - (so called *modern* signature, with positive timelike intervals, used mostly in physics) or - + + + (so called *traditional* signature, with negative timelike intervals, used mostly in math).

Quantum features of Einstein's gravitation follow from the fact that an atom exchanges energy with another atom through exchange of a photon or a nucleus with another nucleus by the exchange of a meson. It means that whenever one object loses part of its gravitational energy (mc^2) it happens in quanta. Calculations of probabilities of finding a particle somewhere in its direction of diminishing internal energy is more probable than it is at its old position or any other. So Einstein's theory turns out to be also a quantum theory that explains things with probabilities of certain events being more probable than others.

Quantum gravity is something the gravity physicists hope to release them from necessity to understand Einstein's gravitation. They hope that it will be a "*real*" theory of gravitation since they believe that the theory of gravitation should be a quantum theory and due to their way of [understanding of physics](#) of gravitation they don't realize that Einstein's theory is a quantum theory.

Quasars, a.k.a. quasi stellar sources of light are astronomical objects that look like stars (light points) but have redshifts much greater than the ones reasonably corresponding to their distance as calculated from their luminosity. Their existence indicates that they may be much closer to us than it would be indicated by the

Hubble law and therefore their redshift may be due to something else than Doppler redshift assumed by the big bang hypothesis.

Real World is since about half of 17th century a subject of what physicists like Einstein investigate. It is thought by those physicists to exist *objectively* i.e. regardless of what [H. sapiens](#) thinks about it.

Redshift is an effect of wave coming to observer with longer wavelength (lower frequency) than wave emitted by sources close to observer. The reason for it may be either "[Doppler shift](#)" or the effect of time running at the source of the wave at different rate than at observer. The reason for the latter may be either "[gravitational redshift](#)" (difference of gravitational potentials between the source of light and observer) or "[intrinsic redshift](#)" (the effect of space curvature causing redshift regardless of the difference of gravitational potentials between the source of light and observer).

Repulsive gravitation is an attempt to save the big bang hypothesis through a magical force, apparently consistent with the big bang hypothesis, and making universe expanding faster and faster due to the alleged existence of "[dark energy](#)" in universe. There is no repulsive gravitation in Einstein's theory since gravitational force is neither repulsive nor attractive but an inertial force. See [Basics of Einstein's gravitation](#).

Ricci tensor is a tensor which spatial part is describing the curvature of our common 3-D space.

Riemannian geometry is geometry proposed by Einstein as the geometry of spacetime when he still didn't understand fully the implications of application of this geometry to solutions of gravitational problems. In 1950 Einstein started to realize that to unify gravitation with electromagnetism (as it is done today) the spacetime can be only approximately described by symmetric metric tensor and he proposed that the metric must be non symmetric (Einstein, "[On the Generalized Theory of Gravitation](#)", *Scientific American*, April 1950). In reality it must be also a degenerate, which makes Riemannian geometry non applicable in gravitation since Riemannian metric is non degenerate.

Science is a set of methods (called then *scientific*) of learning what's true and what ain't) and the body of what science gathered as true results of scientific methods of learning the truth. The opposite to science is *faith* in which things are admitted as [axioms](#) in which one *believes* without necessity of examining their relation to the *truth*.

Learning what's true and what ain't is usually done by *observing nature* and drawing conclusions out of observations of *facts*. This is done by physics. Methods of drawing right conclusions are investigated by a branch of science named "epistemology" that discovers and sets rules of proper ways of concluding something out of facts. E.g. such an epistemological rule is that one can't prove a *negative proposition* (proposition that something doesn't exist, e.g. Santa Claus or God). The only thing that can be done is to make the existence of something improbable. And this is what science is most of the time engaged in. Proving that something is an [illusion](#). And that's why it takes so much scientific work and time to decide whether something is true or it is an illusion and that's why there are still people who believe in Santa or that the universe is expanding while most likely it's an illusion created by the faith in intrinsic curvature of spacetime that is another illusion caused by the faith in "gravitational attraction" that is an illusion for sure (explained in [Basics of Einstein's gravitation](#)).

σ (sigma) is *standard deviation* of the measured value. It is a measure of the accuracy of measurements. Physically it is the effective amplitude of the noise that is added to the measured variable by the measurements regardless of their number. It is also known as the *rms (root mean square)* value of the noise of measured value.

In astronomy the accuracy of $<1\sigma$ usually means "perfect agreement", $<2\sigma$ "good agreement", $<3\sigma$ (difference of about one order of magnitude) is still "acceptable agreement", $>6\sigma$ is considered not supporting the idea that the theory predicts the calculations.

Somehow is a favorite way of explaining by creationists the ways that nature might be working when they introduce a contradiction with known physical principles to support their particular hypothesis. It is the way energy is created from nothing to support the big bang hypothesis.

Spacetime is space and time considered together as one four dimensional object. The spacetime has a property that the sum of [general time dilation](#) in any direction plus the curvature of space in this direction, vanishes which means that the spacetime is flat (proper volumes of spacetime are [isotropic](#)).

Structure of time dilation means how amount of [time dilation](#) changes along any particular direction. We know how much because it is relatively easy to figure out what mass causes what time dilation since we know the relation between *gravitational field* and *gravitational time dilation* (see [Appendix 1](#) for the relevant equations) and the relation between *gravitational field* and mass that generates it we know from Newton's equation. Time dilation reflects exactly the Newtonian gravitational *potential* except that it does not contain its ambiguity about its absolute value since it has natural zero value at infinity.

[Supernova Cosmology Project](#) was a project that was supposed to prove that the expansion of universe is decelerating to confirm the prediction of [MTW](#) that [Einstein's cosmological constant](#) should be set to zero to provide the first correct prediction of the [BBH](#). It would also confirm that discovery of cosmological constant by Einstein was a biggest blunder of his life. Unfortunately for MTW the prediction turned out to be wrong and the observation of expansion turned out to be corresponding to acceleration expansion as predicted by [Einstein's universe](#) model which proved that [Einstein's cosmological constant](#) was at least a valid discovery (called jokingly by Einstein "the biggest blunder of his life" for causing the cosmologists bothering Einstein about value of this newly discovered constant of nature preventing Einstein from doing any useful work, to the point that Einstein forbid his secretary to let in anyone wanting to talk to Einstein about the universe [Source: Roy Glauber, who worked at the time with Einstein as his assistant]. Yet the cosmologists took Einstein's joke as an admittance that cosmological constant should be deleted from Einstein's equation for the reason of *elegance* (Einstein then said: "*If you are out to describe the truth, leave elegance to the tailor*").

Support of theists for the BBH has been documented by March 2008 Templeton Foundation's award of \$1,600,000 to a cosmologist, mathematician, astronomer, and Catholic priest, Michael Heller from the Papal Academy of Krakow, Poland, "*in recognition of scholarship and research that has pushed at the metaphysical boundaries of science*".

Symmetry is esthetics of idiots. Discovery of *counter position* (a.k.a. "contraposto") in Greek sculpture (around 600 BC) in which pelvis is tilted in opposite direction to shoulders, as esthetically superior to symmetrical position of figure cultivated in previous sculptures, has been a breakthrough in art that has been continued in [sculpture](#) and [painting](#) ever since.

Symmetric metric tensor implies conservative field of force a.k.a. "potential field" (no change of energy of an object moving along closed loop) as "gravitational field" of Newtonian gravitation, not Einstein's gravitation though in which there is no such thing as movement without a change of energy, permanent in general. The difference between symmetric metric tensor and non symmetric postulated by Einstein in 1950 is visible in [Pioneer 'anomaly'](#).

Theism. Philosophy, or rather a belief, that the universe is controlled by supernatural beings (a.k.a. "ghosts", also "holy") and/or a supernatural being (a.k.a. "God") instead of [evolution](#). The belief is supported by the belief, also of [gravity physicists](#), most astronomers, and [applied mathematicians](#) (though neither "pure mathematicians" who consider [BBH](#) being [pseudoscience](#), nor the majority of physicists who, as they claim, [don't understand gravitation](#)) that energy (and therefore *the matter* being the same as energy as shown by Einstein's equation $E = mc^2$) can be created, in "negligible amounts" though, from nothing, since otherwise the supernatural beings wouldn't have any possibility to intervene in the affairs of [real world](#). The mathematical theory going with this belief is a belief that the metric of the spacetime is symmetric (despite that "[symmetry is the esthetics of idiots](#)" and Einstein, who believed rather in evolution than ghosts, has maintained that the metric of spacetime [must be non symmetric](#). "[Atheism](#)" is opposite to "theism".

Time dilation means roughly that the time in any particular point in space runs slower than at a point far enough from any material objects. It means that presence of material objects slows down the rate of time in their vicinity.

Tired light effect is an apparent effect of photons reaching the observer with seemingly smaller frequency than they were emitted with behaving as if they lost part of their energy on the way. It turns out that photons don't do this and they just start from their sources with smaller energy since the time runs slower at their sources due to [general time dilation](#).

University of Kansas, which introduced creationism as scientific discipline, declared that opposition to the big bang hypothesis is an atheist plot.

W. Jim Jastrzebski is a [sculptor](#) trained in figurative, realistic, sculpture for more years than he cares to admit, by various Bostonian sculptors of various Art Colleges, mostly by Vincent Ricci of *The Boston Museum School*, Boston, Massachusetts, who in sequence has been the student of [Malvina Hoffman](#) (1887-1966) who in sequence had been a one time student of [August Rodin](#) (1840-1917).

All Jim's knowledge of English comes from that time so please forgive him his poor handling of English grammar, especially the definite articles which don't exist in his native language (Polish) and so his speech may sound on occasions as Charlie Chang's speech in whose native language (presumably Mandarin) they don't exist neither.

Jim is also an electronic engineer holding *MS degree* in [EE](#) specialization *Cybernetics* from Warsaw Politechnic, Warsaw, Poland, and a mechanical technician holding *Technician degree* in [ME](#) specialization *Engines* from Aircraft Technical School, Warsaw, Poland and before graduation he won two Polish National Science Olympics for high school students, one in *mathematics* and another in *physics*.

Jim is the author of this article and of many useful inventions as e.g. a CRT vector type monitor (with built in *Character Generator*) possibly the very first one worldwide, singlehandedly designed, and built by him in 1965 for Warsaw University's Computing Center where Jim was a Chief Engineer at the time. The monitor was built at the cost of \$1,000 (plus \$3,000 for the microfilm camera) and utilized for displaying results of calculations in form of graphs and texts providing at the same time a hard copy on a 35mm microfilm. Another example is a *Magnetic Tape Station Tape Transport System*, with 3m/s tape speed of standard 9 track tape and 5ms start/stop times, also singlehandedly designed and then about 300 pieces of it manufactured in 1960's by Polish Industry. His other inventions are too numerous to count them in an article on gravitation with which they have nothing in common.

Jim has been accidentally involved in gravitation due to his 1985 calculation that predicted the value of Hubble constant of our universe and the rate of the apparent accelerating expansion of space, confirmed observationally with accuracy better than one sigma only in 1998 by the Supernova Cosmology Project, much too late for the scientific world to take notice, since by that time it already decided that the real gravitation is not EGR but BBGR (a false one according to Jim).

Jim's work delivered tools for predicting redshifts of quasars and independently he predicted the average size of pieces of non luminous matter of the universe, neither observed so far, nor accepted by the editors of scientific journals. Since all of his gravity stuff is based on EGR and implies that we live in [Einstein's universe](#), Jim is trying to vindicate *Einstein's universe* and spread the news as a tribute to Einstein. Since the editors of scientific journals (*Nature*, *Phys. Rev. Lett.* etc.) maintain that those things aren't interesting to their readers, not wanting to argue with them, Jim has written the above text in form of PhD thesis for folks for whom they are interesting. At the same time, Jim tries to popularize Einstein's gravitation to explain at a high school level how gravitation works and how the accelerating expansion of universe is predicted as an illusion by EGR in hope that new generations of scientist learning about EGR won't grew up with the same prejudice about gravitation that previous generations grew up with, which is the only way available for the Homo Sapiens, as experience indicates, to improve her [objectivist](#) ideas about Nature and overcome her [misticism](#) embedded in her by the [evolution](#).

Appendix 1: Relation between time dilation and *gravitational field*

In any accelerating system (e.g. an accelerating rocket ship) the time in direction of acceleration \mathbf{a} runs faster and slower in the opposite direction. The effect might be understood as photons radiated from places in the system in direction of acceleration gaining energy while they are passing distance $d\mathbf{x}$ towards the detector. The increase in energy is

$$dE = (d\mathbf{x})\mathbf{a} m \quad (1.1)$$

where m is inertial mass of the photon. Substituting E/c^2 for mass of the photon and dividing both sides by E we get relative change in energy of the photon, which is the same as the relative change of its frequency (because of Planck's relation $E = h\nu$) or in other words relative change of the time rate at the source of the photon since photon may be considered to be a clock ticking as fast as time runs at the place where it is coming from:

$$dE/E = d\nu/\nu = dt/t = (d\mathbf{x})\mathbf{a} / c^2 \quad (1.2)$$

Expressed as a ratio of proper time τ to coordinate time t it looks like

$$d\tau/dt = 1 + (d\mathbf{x})\mathbf{a} / c^2 \quad (1.3)$$

where x is the distance from the observer to the observed place in space.

This way we have a convenient way of translating time dilation expressed by dt/t in (1.2) into *gravitational field* \mathbf{g} that works in opposite direction to acceleration ($\mathbf{g} = -\mathbf{a}$) and *gravitational field* into time dilation by the principle of equivalence. Whenever we have a certain amount of acceleration \mathbf{a} causing certain amount of time dilation we must have also the same amount of time dilation causing acceleration. One translates into the other. Acceleration \Leftrightarrow time dilation (in opposite directions).

To get field in vicinity of mass M we may simply stand on the shoulders of a giant and apply *Newton's equation* since it is accurate enough for our purpose:

$$\mathbf{g} = GM\mathbf{r} / r^3 \quad (1.4)$$

where G is Newtonian gravitational constant, $G = 6.673 \times 10^{-11} \text{ m}^3/\text{kgs}^2$, and \mathbf{r} is the displacement from the point under consideration to the center of gravity of mass M .

Appendix 2: The Hubble constant of Einstein's Universe for planar light wave

The derivation of Hubble constant of Einstein's universe, from [first principles](#) is available also for a planar light wave [Jastrzebski, W. Jim, 1985, [The general time dilation: relativistic redshift in stationary clouds of dust](#)].

In the simplest case of homogeneous space the relation between proper time in deep space and the coordinate time of the observer is [the same as for a spherical light wave](#)

$$d\tau/dt = \exp(-r/R_E) \quad (2.1)$$

where τ is proper time in deep space, t is coordinate time at observer, r is distance from the observer to the observed place in deep space, and R_E is [Einstein's radius](#) and so the [Hubble constant](#) of [Einstein's universe](#) is

$$H_o = c / R_E \quad (2.2)$$

where c is speed of light.

Appendix 3: Average size of pieces of non luminous matter of universe

Assuming that the spectral distribution of energy radiated by a star may be presented, with accuracy to the absorption lines of its atmosphere, by equation

$$I_0(\nu) = c_1 \nu^3 / [\exp(c_2 \nu / T_s) - 1] \quad (3.1)$$

where c_1 and c_2 are constants and T_s is the temperature of the star's surface (with the peak value at $\nu = 2.82 T_s / c_2$), according to $v(r) = v(0) \exp(-r / R)$ and (3.1) the distribution at distance r from the source is

$$I(\nu, r) = \frac{c_1 [\nu \exp(r/R)]^3}{\exp[c_2 \nu \exp(r/R) / T_s] - 1} \quad (3.2)$$

therefore for any observer, the spectral distribution of radiation from all the stars is

$$I(\nu) = c_3 \int_0^{\infty} \frac{p(r) [\nu \exp(r/R)]^3 dr}{\exp[c_2 \nu \exp(r/R) / T_s] - 1} \quad (3.3)$$

where c_3 is a constant and $p(r)$ is probability of light passing distance r without hitting any obstacle on its way, which is

$$p(r) = \exp(-r A / L^3) \quad (3.4)$$

where A is the average area of an obstacle and L is the average distance between obstacles, assuming that $rA \ll L^3$. Combining (3.3) and (3.4) and making substitution $z = c_2 \nu / T_s$, $x = z \exp(r / R)$, and $a = AR / L^3$ one gets the spectral density of the radiation from all luminous sources as

$$I(\nu) = c_4 z^a \int_0^{\infty} \frac{x^{2-a} dx}{\exp(x) - 1} \quad (3.5)$$

where c_4 is a constant. It is visible from (3.5) that this distribution is not a black body distribution, and therefore the background radiation is not just the redshifted starlight. Therefore the background radiation must be a radiation from the non-luminous matter of universe, matter that is in thermal equilibrium with the redshifted starlight. For $a \ll 1$ the peak value of this distribution represented by (3.5) is at $z = 1.55 a^{1/2}$

and therefore the temperature of a black body having the peak value of its distribution of radiated energy at the same frequency is

$$T = 0.55 T_s A R / L^3 \quad (3.6)$$

The average distance between the obstacles L may be determined from the relation $\rho L^3 = \rho_0 D^3$ where ρ is as before the Density of universe, ρ_0 is the density of the obstacle, and D is the diameter of the obstacle (assuming that the obstacles are roughly spherical objects for which approximately $A = D^2$, and that almost the whole matter of universe is composed of such obstacles). R and ρ can be determined from $H = c / R = \sqrt{4 \pi G \rho}$. After all the substitutions the average diameter of the obstacle is

$$D \approx 0.04 c H T_s / (G T \rho_0) \quad (3.7)$$

Assuming value of Hubble constant $H = 10^{-18}$ 1/s, average temperature of stars $T_s = 10^4$ K, the temperature of thermal equilibrium of universe 2.7 K, and the density of the matter of obstacles $\rho_0 = 10^3$ kg/m³ (H₂O), the average diameter of the obstacle is of order of 2 m. It is large enough size to make the non luminous matter of universe responsible for the absorption of light in the millimeter wavelength range.

Appendix 4: Other works of the same author

Typical paper: <http://www.fuw.edu.pl/~wjast/164.htm> that Jim tried to publish in "Nature", "Physical Review Letters", "Science", "The Astrophysical Journal", "Nuovo Cimento", even "Scientific American", and "Physics Today" and others too many to count, and every editor rejected it on some basis, mostly on his disbelief in the universe being stationary, even if he didn't know what the word mean but just knew that it is not what is accepted by the establishment.

#20 Krissy as Aphrodite



#10 Charlie as Buddha



#07 Jessica

#11 Lorie sleeping



#19 Jeff



#17 Tim

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Linked articles

1. [\(Alleged\) errors](http://www.fuw.edu.pl/~wjast/errors.htm) in Jim Jastrzebski's texts about Einstein's gravitation as perceived by referees and editors of scientific journals and identified by the visitors to this site.
URL = <http://www.fuw.edu.pl/~wjast/errors.htm>
2. [The general time dilation: relativistic redshift in stationary clouds of dust](http://www.fuw.edu.pl/~wjast/3266.pdf) (*PDF format*) A paper explaining the Einsteinian reasons for greater than predicted by the *Big Bang GR* redshifts in stationary clouds of dust (*quasars* for small clouds, *Hubble redshift* for the whole universe).
URL = <http://www.fuw.edu.pl/~wjast/3266.pdf>
3. [Observational evidence for general time dilation and stationary universe](http://www.fuw.edu.pl/~wjast/3270.htm). A paper presenting five pieces of observational evidence for stationary universe consistent with the radius of curvature of space equal 4.3 Gpc: density of space, illusion of accelerating expansion, "*anomalous*" acceleration of space probes, near quasars, average size of pieces of non luminous matter.
URL = <http://www.fuw.edu.pl/~wjast/3270.htm>
4. [Einsteinian gravitation for poets and science teachers](http://www.fuw.edu.pl/~wjast/gravity.htm). A description of Einstein's gravitation physics for lay people.
URL = <http://www.fuw.edu.pl/~wjast/gravity.htm>

Contact info: e-mail domain: yahoo.com , address: jim followed by my last name separated from the first with an underscore.
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Author/Webmaster: <u>W. Jim Jastrzebski</u>
