

Gravity – the Force of the Fourth Dimension

Stefan von Weber, May 2008

This paper is giving a short description of the [Cosmic Membrane Theory of Gravitation](#) worked out by the author from 1969 to 2006. In the beginning was the Special Relativity of a resting medium, perhaps the quantum vacuum. Then, in 1994, the author has succeeded in the computing of the curvature of a three-dimensional membrane in a four-dimensional hyper-space in a simple and geometrical manner which can be understood by each twelfth-grade scholar. The paper „[Kosmische Membran – ein einfaches didaktisches Modell zur Allgemeinen Relativitätstheorie](#)„, describes this geometrical way. In the further years until 2006 the classical and newer proofs of a theory of gravitation were worked up with regard to the Cosmic Membrane Theory.

Isaac Newton

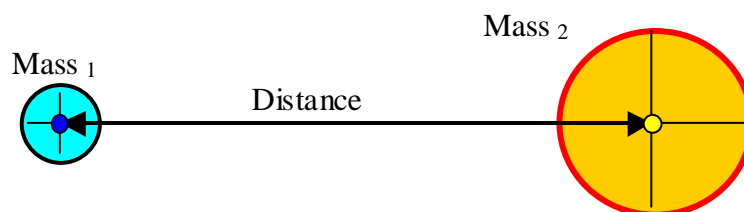
The [gravitation](#) is seen as the most mysterious natural force at all times. The reason is that the gravitation has two strange features which make the difference to the electrical and magnetic force. The first strange feature of gravitation is its vast reach. It is acting not only over a radius of some miles as the electrical force does during a lightning discharge. Also the reach of the magnetic field of the Earth in the Earth's near-space with a value of some ten thousand miles is nothing compared to the vast distances gravitation can overcome. Its action is holding the planets of our solar system on their orbits, also the stars of our galaxy orbiting the center at a distance of many thousand light years. Also the agglomeration of many galaxies to clusters with diameters of millions of light-years follows from the gravitation.

The second strange feature of the gravitation is that it is always attracting. There is no antigravity.

Isaac Newton (1643-1727) was the discoverer of the famous gravitational law named after him. It says that masses attract one another pairwise, and that this force is proportional to the product of the masses, and reversely proportional to the square of the distance between the masses. The constant making an equation from this relation is the [Gravitational Constant G](#) or γ (Gamma), one of the universal constants of nature.

$$Force = Gamma \cdot \frac{Mass_1 \cdot Mass_2}{(Distance)^2} \quad (\text{Newton's Law of Gravitation})$$

But as usual in science, Newton hasn't started at zero. He could refer to the planet laws of [Johannes Kepler](#) (1571-1630). But at first Newton's Law was showing the deeper relations between the three planet laws of Kepler.

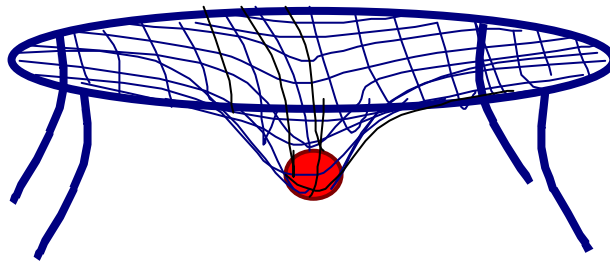


Newton's Law looks simply, but it isn't simple. Till now nobody can say for sure what a mass is. Newton didn't know the value of the gravitational constant G or γ . This constant we can't derive theoretically from other, already known constants. First [Henry Cavendish](#) (1731-1810) could deliver the first numerical value in 1798 by expensive experiments. He used a torsion balance. The value of the constant is today known to some digits after the decimal point ($6.674\ 28 \times 10^{-11} \text{ [m}^3 \text{ kg}^{-1} \text{ s}^{-2}\text{]}$). Also inserting the distance between masses in Newton's Law is not a simple act. Newton has needed twenty years to show that one can simply use the distance of the centers of two spherical masses. In this time he founded also the infinitesimal calculus, a second proof of his genius. If we are standing on the surface of our Earth then each pound mass of the Earth is attracting us differently strong accordingly to its distance. But we hadn't to consider this fact, since according to Newton's result we can imagine the whole mass of the Earth concentrated in the center, and the computing is simplified strongly. (We neglect here the oblateness of the Earth, the inhomogeneous construction of the layers of the Earth and other unimportant details.) Newton's genius gave us an exact law, and it proved true for nearly all computations concerning the orbits of planets, the orbits of space crafts, or concerning terrestrial issues.

But also Newton's genius couldn't explain because two masses, e.g. two celestial bodies, attract one another. Surely, he has thought over, but the first answer came much later.

Albert Einstein

Two hundred years later [Albert Einstein](#) (1879-1955) entered the stage. He was also an universal genius which made pioneering discoveries in different disciplines of physics. He made popular the abstract notion [space-time](#), a four-dimensional space with three spatial and one time-dimension, found by Minkowski. But also Einstein hasn't started at zero. Names as [Carl Friedrich Gauss](#) (1777-1855), [Nikolai Lobachevsky](#) (1792-1856), [Janos Bolyai](#) (1802-1860), [Bernhard Riemann](#) (1826-1866), [Hermann Minkowski](#) (1864-1909) and [Hendrik Lorentz](#) (1853-1928) are representative for a whole series of famous mathematicians and physicists. They all opened the gate into the unknown fourth dimension. If one inspects the four dimensions of Minkowski – $x, y, z, -ct$ – then one can see that the fourth dimension isn't truly the time, but a distance which the light is traveling with speed c during time t . The minus sign has besides a formal meaning but has also a plausible explanation: A point with the spatial coordinates x, y, z disappears with velocity of light into a past, here a hybrid thing of space and time. It is the merit of Einstein that he overcame paltry reservations by his [General Theory of Relativity](#), and despite of all the accentuation of the time in the artificial word space-time he has treated the fourth dimension as a fourth spatial dimension in many cases. Who of us can imagine a space-time? Nobody, but everybody can imagine a curved surface, perhaps a ball or perhaps a trampoline with a heavy sphere in the midst. And exactly this was the breakthrough we are indebted to Einstein – the breakthrough which established the fourth spatial dimension in the minds first figuratively and then theoretically.



That meanwhile the authors of science fiction literature take nearly as reality time travels into the past or into the future that follows to a great extent the inadequate working up of this fourth dimension. Naturally, it's nonsense to believe that one could travel in the time as on a road. The author refers to [Immanuel Kant](#) (1724-1804), or to [Stephen Hawking](#) (*1942). One thing is the time not – a dimension.

The time is a pure product of the human spirit – an important entity for computation – but really a difficult to understand notion. The time of an “Our Father in Heaven”, a moment, a day, an year – all these are courses of events which repeat themselves, or we can repeat them. We can count them or compare to other courses of events. Indeed, there are only processes, chemical or physical processes. There does'nt exist any universal time, also not anywhere in outer space. This has been proved to be valid by physics since clocks change their running by the influence of gravitation and with their velocity. The persons managing the GPS, the [Global Positioning System](#), know best about this. If there doesn't exist any physical entity “time” then that has only a formal meaning what we call “time” in the notion space-time. Well, we can deal with the time, mostly termed as t . One car in each two minutes makes 30 cars per hour which roll off the assembly line. We can measure the time, but it are oscillations only in an electrical oscillatory circuit of an [atomic clock](#) whose frequency is stabilized by cesium atoms and counted by a high-speed counter.

The General Relativity Theory of Albert Einstein contains Newton's Law of Gravitation as a borderline case. Beyond that, Einstein has given the first practicable theory of the phenomenon gravitation at all. His theory says: By the curvature of space-time [reaction forces](#) arise with each movement, so as a train makes a lateral pressure to the rails if it travels through a curve. These reaction forces are the gravitational forces. In the context of the General Relativity Theory is always movement. The reason is the term “-ct”.

One carried out a lot of experiments and evaluated a lot of astronomical observations subsequently. The effects forecasted by Einstein are very small. So, to measure them, one needs a high art of experimentation and expensive instrumentation. But all measurements and all observations have proved to be valid Einstein's General Relativity Theory (or at least not ruled out). Therefore, this theory describes the reality with high precision, in special situations more precise than the simpler law of Isaac Newton.

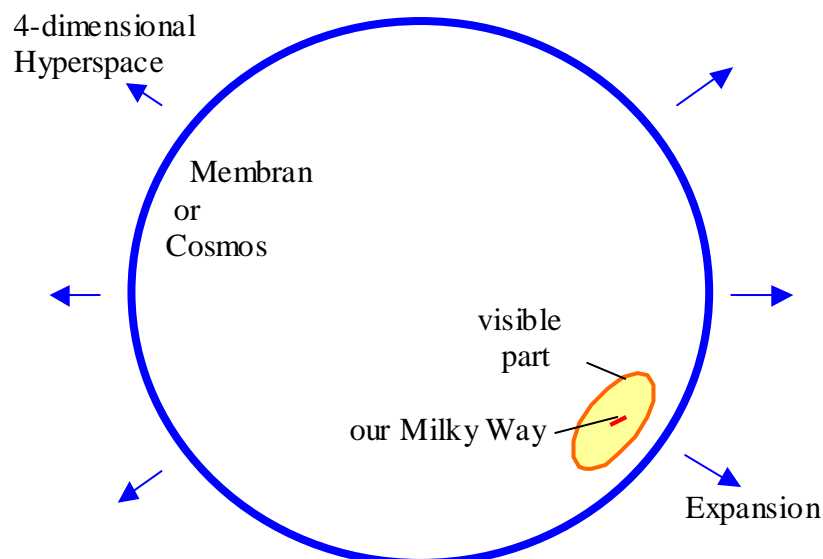
Cosmic Membrane Theory of Gravitation

Despite the success the General Relativity Theory is not fully satisfactory in some points, and has the potential for further improvements. One point under discussion is the space-time. The time is not entitled to have a dimension for its own, because it is, as discussed above, only a derived, mental, not really existent entity. But it looks differently for the construction “ct”. This construction refers to a real distance in a fourth dimension which is still only loosely connected with the time. [Theodor Kaluza](#) (1885-1954) made this step and postulated the fourth true spatial dimension. So he found a unified presentation of electromagnetism and gravitation. Einstein was fascinated by this idea, and arranged the

reprint of the original paper of Kaluza in the [Annals of Physics](#). Later the fourth spatial dimension was “compactified” unfortunately by [Oskar Klein](#) (1894-1977), i.e., it was rolled up to create tiny cylinders of [Planck length](#). Because one couldn’t imagine a fourth spatial dimension one has hidden it simply.

A second point of critics is that Einstein’s [field equations](#) do not directly lead to a solution. They are constructed too general, and they can represent any possible curvature of space – the simple gravitational funnel of a star or of a [black hole](#), but also the famous wormholes. This is the reason, because Newton’s Law of Gravitation is embedded as a borderline case in the General Relativity Theory. It chooses the correct solution from a manifold of possible solutions as a kind of boundary condition.

The [Cosmic Membrane Theory of Gravitation](#) uses the model of a three-dimensional membrane which is expanding in the four-dimensional [hyperspace](#) as a balloon. This theory is a direct further development of the ideas of Einstein and Kaluza by the author. About at the same time a whole series of physicists have worked also on the issue of the noncompactified fourth spatial dimension. The author wishes to mention here some of them, e.g., [Lisa Randall](#) (*1962), [Raman Sundrum](#), [Tuomo Suntola](#) (*1943), [Farhad Darabi](#), [William N. Sajko](#), [Paul S. Wesson](#), [Matej Pavsic](#).

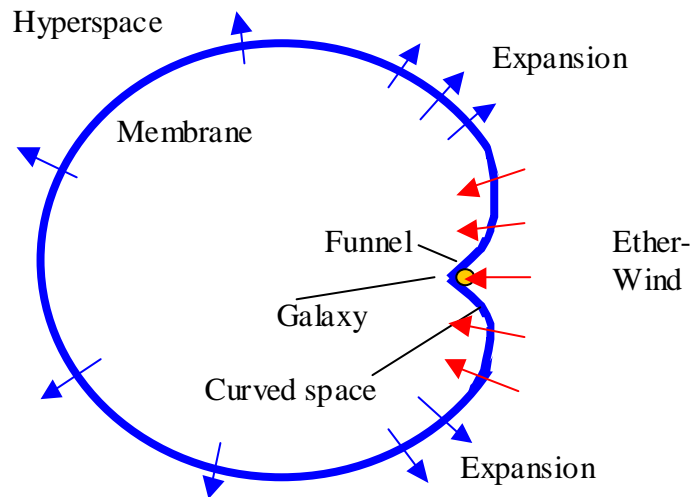


The membrane, in the graph the blue circle, is our Cosmos. After the [Big Bang](#) our cosmos started to expand and will expand further and further. Our galaxy, the Milky Way, is only a tiny point at the 3-dimensional surface of this 4-dimensional sphere. Also the whole visible part surrounding us until a distance of about 14 billions of light years could be only a small area of the surface. How small - that is depending on the unknown speed of expansion V_E . The idea with the balloon isn’t a new one, and was used already in many papers concerning [cosmology](#) by different authors. The surface of the expanding balloon can explain in a simple way, because the space is stretching and distant galaxies seem to fly away from each other, and that without any speed relatively to the background radiation. The kind of material of the membrane is still unknown, although the author has some conjectures in this case. It is enormously tough, porous, elastic, and permits the propagation of all kinds of waves. Further, it is the medium in which elementary particles be created, exist and move. The physicists have chosen for it the notion [quantum vacuum](#). We name it here “mebrane stuff”.

Another conjecture is that the hyperspace is also filled with some stuff. This stuff has the properties of a gas, and we name it here “ether”. The ether is so fine that it penetrates the

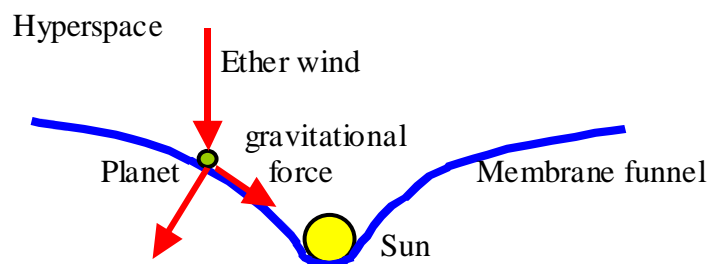
porous membrane without trouble, i.e., it doesn't disturb essentially the expansion. The ether penetrating the membrane during expansion we name "ether wind".

Now gravitation is coming back to the game. Each kind of matter is a distortion in the membrane, and the ether wind builds up there. The picture shows a galaxy where the ether wind builds up. The membrane is stressed at this point, and we get a funnel, a curved piece of space in direction of the fourth dimension.



Our common three spatial dimensions x, y, z are embedded in the membrane. Naturally, the relations in the picture are enormously exaggerated. The Sun sinks about 1000 km, the whole galaxy scarcely more. Having a diameter of 100.000 light years this is precious little. Naturally, one could imagine also that the ether wind is coming from inside the balloon, i.e., an overpressure of ether inside the balloon causes the expansion. Then the relations would be reversely, i.e., the funnel would point outside, but the computations would remain the same.

If another mass is moving in the funnel, e.g. a planet is moving in the gravitational funnel of the Sun, then this other mass is stressed also by the ether wind, and has due to the [downhill force](#) from the decomposition of forces the endeavour to move into the centre of the funnel. This downhill force is our common gravitational force. Only the [centrifugal force](#) is holding the planet in his orbit.



What is supporting this hypothesis? The most striking argument is that a spherical mass, e.g. a star, produces exactly that $(1/r^2)$ -curvature of the membrane which is demanded by Newton's law of gravitation, i.e., Newton's law is not put in the theory, but it is given by the theory. But this special curvature we can find only at a 3-dimensional membrane in a 4-dimensional hyperspace. The author has made a geometrical derivation in 1994 and an analytical derivation in 1997, which are leading both to the same equation of curvature without any use of Newton's law of gravitation. Also a numerical computation was performed by the author in 1997. A 3-dimensional elastic grid structure was simulated in a 4-dimensional

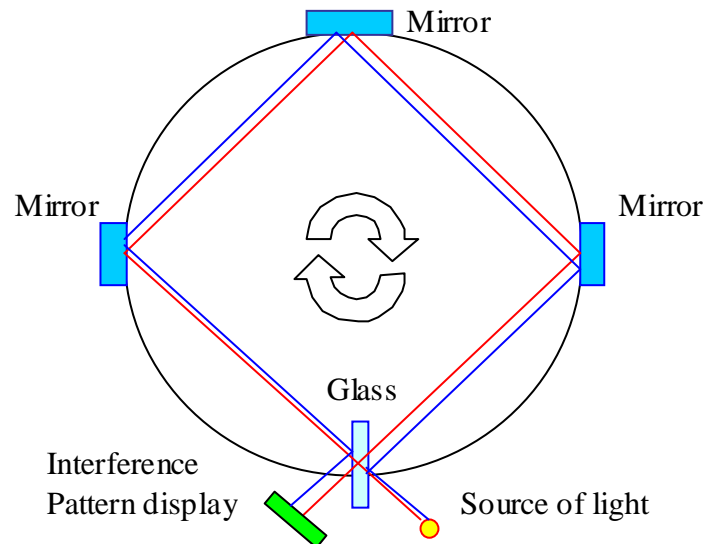
space. A fictive central load was given, and then the flexure of the grid was computed. Also in this case the $(1/r^2)$ -curvature demanded by Newton's law has been found exactly (or the $1/r$ -potential).

A second argument is that the Cosmic Membrane Theory can also explain the effects forecasted by Einstein. A last argument shall be at this point the simplicity and plausibility of the model. It deals with elements familiar to us: Force produces force, and we can see already from the drawing above that gravity is always attractive.

Special Relativity

The assumption of a membrane stuff makes old questions new, questions, from which many physicists think that they are solved. The membrane stuff itself, the quantum vacuum, is used already a long time in the theory. As well as in the present Cosmic Membrane Theory the quantum vacuum works with high amounts of inner energy. But the consequences for the [Special Theory of Relativity](#) are discussed very seldom. Although all results obtained by Albert Einstein in this area remain true there do exist, however, questions concerning the interpretation. The best example is the [constancy of speed of light](#). This constancy is one of the rocks Albert Einstein has built on the building of his Special Relativity. With the assumption of a medium resting at least in our three spatial dimensions x, y, z , through which electromagnetic waves do propagate, the constancy of speed of light becomes an important question. This constancy is proved by numerous measurements. But also here the Cosmic Membrane Theory yields a solution in accordance with Einstein – the speed of light will be measured constant under all circumstances. Also the transformation formulas for a change of the inertial system are nearly the same as those of the [Lorentz transform](#). The time transform is identical, even. The coordinate transform differs a little by the introduction of an additional cross contraction which was found also independently by [Vladimir Onoochin](#). But the ratio of length contraction to cross contraction is exactly the same as in the Special Relativity of Albert Einstein. In several paragraphs the author has proved the validity of Maxwell's equations for the [Cosmic Membrane Theory of Gravitation](#) ([James Clerk Maxwell](#), 1831-1879), furthermore, the far-reaching identity of the special relativity of the Cosmic Membrane Theory with that of Albert Einstein. The author used in the discussion paper the following known and famous experiments:

- The interferometer experiment of [Albert Michelson](#) (1852 bis 1931) and [Edward Morley](#) (1838 bis 1923)
- The rotating capacitor experiment by [Frederick Trouton](#) (1863 bis 1922) and his research student Henry R. Noble
- The interferometer experiment with two oppositely directed light beams on a rotating platform by [Georges Sagnac](#) (1869 bis 1926) (See figure below)
- The explanation of Fresnel's drag coefficient from the experiments of Fizeau and Airy [Augustin Jean Fresnel](#) (1788 bis 1827), [Hippolyte Fizeau](#) (1819 bis 1896), [Sir George Biddell Airy](#) (1801 bis 1892)
- The clock experiment in 1971 by [J. C. Hafele und Richard E. Keating](#) concerning time dilation due to movement and due to the gravitational field of Earth
- The explanation of the Thomas factor „ $\frac{1}{2}$ “.



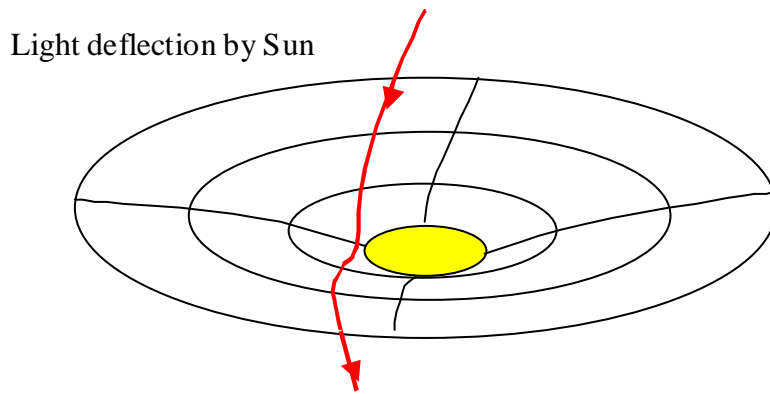
The rotating Interferometer by Sagnac

Classical Proofs of the Cosmic Membrane Theory of Gravitation

Several paragraphs of the [Cosmic Membrane Theory of Gravitation](#) are concerned with classical and newer proofs which a theory of gravitation should give. One expects here an explanation of effects measured already, or forecasts of effects of future experiments. Classical effects which are sufficiently exact measured are the Shapiro effect of signal retardation under Sun near signal trajectories, light deflection by the Sun or by other masses, perihelion advance of the planets, especially of the Mercury.

[Irwin I. Shapiro](#) (*1929) has measured together with his team the [retardation of radar signals](#) in the case of Sun near signal trajectories of the radar waves. This time delay is interpreted in the context of the Cosmic Membrane Theory of Gravitation as a lowering of the velocity of signals in the gravitational funnel of Sun, and yields the amount measured by Shapiro, which is also given by the General Relativity Theory.

Measurements of [light deflection by Sun](#) have been spectacular astronomical observations ninety years ago. In those days one could measure only during an eclipse. Today, satellites can do this job. [Sir Arthur Eddington](#) (1882 bis 1944) was the first who had successfully undertaken such a measurement. The deflection is twice as great as the value computed by the corpuscular theory of light ([Johann Georg von Soldner](#) , 1776-1833). This double value has been forecasted by Einstein and has been proved to be true by Eddington and his succeders. The Cosmic Membrane Theory of Gravitation yields also this double value. Indeed, one half of the value goes back to gravitation. The other half of the effect goes back to the above mentioned descent of the velocity of signals in the gravitational funnel of Sun. This descent has the same meaning as a change of the [refractive index](#) of the vacuum, and is so one of the causes of light deflection.



The [perihelion advance](#) of the orbit of the planet [Mercury](#), the nearest planet to Sun, has already been found soon, so, e.g., by the astronomers [Urbain Jean Joseph Leverrier](#) (1811-1877) and [Simon Newcomb](#) (1835-1909). After a long time of search for a new unknown planet which could have been responsible for the disturbances, [Paul Gerber](#) (1854 bis 1912) has published about twenty years before Einstein the correct formula for the computation of the perihelion advance of planets near the Sun. Paul Gerber's formula was founded on the assumption that gravity propagates at the speed of light. But this assumption is leading to well-known difficulties in the understanding of stable orbits of planets, and so we have to modify the assumption. Then, Einstein has gotten by the methods of the General Relativity Theory the same value as Gerber. But in Einstein's theory a sun near deviation of the gravitational potential from Newton's $1/r$ -potential is playing the most important role. With this change the orbits of the planets remain stable. The Cosmic Membrane Theory of Gravitation is using also a relativistic additional potential of the form $1/r^2$. One can derive this additional potential from the square of the energy under the supposition that gravitation influences the speed of light as well as the mass of a body. The [relativistic increase of mass](#) of moving particles is known since hundred years, and experimentally well proved. But inside the gravitational funnel we find the threefold amount. Only one third comes from the special relativity. The additional $1/r^2$ -potential doesn't explain only the perihelion advance of the orbit of planets, but it can also explain the unexpected negative acceleration experienced by the [spacecrafts Pioneer 10 and 11](#) on leaving the planetary belt of our solar system. This deceleration was discovered by the NASA, and is discussed now controversially by physicists and astronomers. The answer of the author concerning this issue is that the small additional $1/r^2$ -potential isn't taken into account by the NASA in its computations. Within the planetary belt of our solar system the adjustment computation of the errors hides the small deviation. But outside the planetary belt the adjustment computation of the errors fails, and the action of the small potential is becoming visible.

The author proved by a derivation of the additional small potential from the Einstein-Gerber formula that the postulated potential can indeed explain the perihelion advance of the Mercury. Another proof was the numerical integration of the orbit of Mercury under consideration of the additional potential.

Newer Proofs of the Cosmic Membrane Theory

The number of newer proofs of a theory of gravitation isn't fixed. Always again new astronomical observations are made which need an explanation, or physicists forecast new effects from theory, and try to find them. But gravitational waves, [De Sitter](#) precession (also geodesic precession named) and the Lense-Thirring effect have meanwhile a half-classical status. The author adds the phenomenon of Dark Matter, the unexpected negative acceleration experienced by the spacecrafts Pioneer 10 and 11, and the presently discussed accelerated expansion of the Universe, all three as newer effects which should be explained.

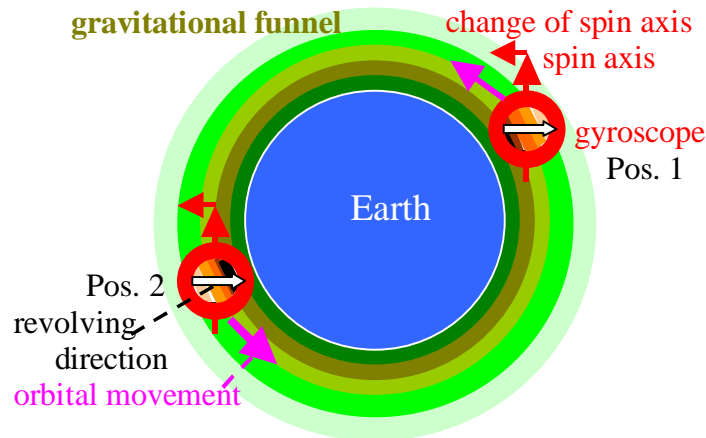
[Gravitational waves](#) weren't measured in the past. But great wave detectors are under construction, and still greater ones are planned for the outer space. In the Cosmic Membrane Theory we can imagine two kinds of waves. The [longitudinal waves](#) (or compression waves) are about comparable the sound waves propagating in a liquid, a solid body or in a gas.

[Transversal waves](#) we can better compare with surface waves on a liquid, e.g., the waves on the sea, or the vibrations of a loudspeaker membrane. The propagation speed of both kinds of waves can differ. We know that sound waves in water propagate much faster than gravity waves at the surface. During the movement of the Earth on its orbit round the Sun both kinds of waves are produced. On the one side, the cosmic membrane is stretched if the planet Earth passes a position of the orbit, after the passing the membrane contracts again. That behaviour produces longitudinal waves. On the other side, the moving Earth presses down the membrane in the fourth dimension and is producing so transversal waves. Since the author was successful only in a rough estimation of the elasticity module of the membrane, one can only give an about value of the density of the membrane and should restrict to longitudinal waves. Under the assumption that longitudinal gravitational waves propagate with velocity of light, and further, that the density of the membrane is equivalent to the energy of the membrane tension, the loss of energy of the Sun-Earth system is 195 watt. This is the same value given also by the General Relativity Theory.

The unexpected negative acceleration experienced by the [spacecrafts Pioneer 10 and 11](#) on leaving the planetary belt of our solar system was discussed already above in the paragraph "perihelion advance of the Mercury". The explanation based on a small additional potential which falls off as $1/r^2$ can yield the value $\Delta a = (8 \pm 1) \times 10^{-10} \text{ [m/s}^2\text{]}$, the value published by the NASA.

The [De Sitter precession](#) (also geodesic precession named) and the [Lense-Thirring effect](#) (or frame-dragging effect) are small changes of the direction of the axis of a free-falling gyroscope, i.e., a gyroscope moving in an orbit in the spherical gravitational field of a central mass. The Lense-Thirring effect appears in theory only if the central mass rotates additionally. The NASA and a team of the Stanford University performed an experiment in 2007, named [Gravity Probe B](#), which should measure both effects. Because of some unlucky reasons the measuring accuracy was only ± 0.1 arcseconds. But both, NASA and the team of the Stanford University are working hard to reduce the error. The geodesic precession is due to theory 6.6 arcseconds per year, a value where the error doesn't play any role. So, the value of 6.6 has been confirmed best. But the Lense-Thirring effect is due to theory only 0.04 arcseconds per year, and hasn't been really confirmed due to the measuring errors of this experiment.

The author had tried also to compute the value of the geodetic precession in 2006 before the Gravity Probe B experiment has been started, only by the means of Special Relativity. He has gotten a value near zero. Meanwhile, this value was ruled out by the Gravity Probe B experiment. In a second try in 2008 the author accepted the zero result of the Special Relativity, and has concentrated his attention on the changing properties of the membrane inside the gravitational funnel. So, the value of 6.6 arcseconds of the Gravity Probe B experiment has been computed. This value shows that the Cosmic Membrane Theory and General Relativity do agree also in this special case.



The figure above shows a spherical gyroscope on its orbit round the Earth in two different positions. In Newton's theory a free-falling gyroscope conserves the direction of its spin axis if no torque is acting on it. Because of the nearly perfect machined spherical shape of the four quartz balls used as gyroscopes in the Gravity Probe B experiment such a torque is excluded. Nevertheless, the spin axis does rotate by the tiny amount of 6.6 arcseconds per year in the direction given by the small red arrow. As cause the Membrane Theory considers two effects. The first effect considered is a deceleration or slowing down of each movement in the gravitational funnel, and is discussed in the Cosmic Membrane Theory for the case of light waves. The application to matter waves as here in the case of a gyroscope is a conclusion by analogy. One had to imagine that that part of the gyroscope which is nearer to Earth has a minimally smaller speed on its trip round the Earth as that part which is more distant. This difference in the speeds causes a minimal rotation of the direction of the spin axis. But the computation of the effect is delivering a value of the precession which is a little too great.

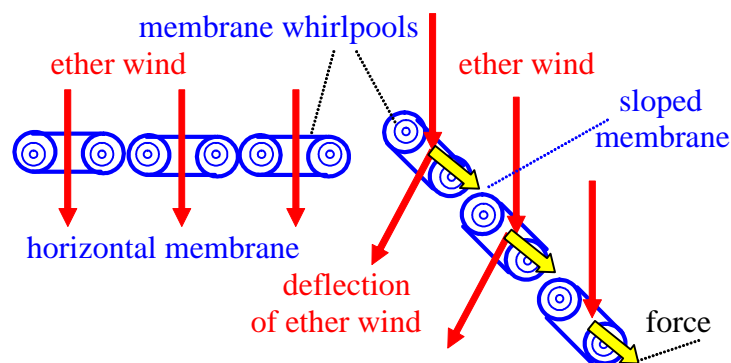
This surplus of precession is canceled by a second effect. The cause of the second effect is the change of mass in the gravitational funnel. This change we can derivate from the square of energy. By the spin of the gyroscope, e.g. in position 1, mass of the gyroscope is transported from Earth away on that side which is seen by the viewer (the little white arrow). Hereby the mass shrinks a little. The surplus of momentum is given to the membrane. The reaction of the membrane is a force acting on that half-sphere we can see in this position, and acting in the opposite direction to the movement of the gyroscope on its orbit (the pink arrow). Because on the backward side of the gyroscope the reverse process is going on, we have a pair of forces which wants to turn the upper half of the gyroscope in direction of the viewer. The direction of this torque does agree with the direction of the little white arrow. Gyroscopes don't follow a torque directly, but move laterally. The Theory of spinning tops says the spin axis of the gyroscope will make a little movement in the opposite direction to the little red arrow. This small precession corrects the above value which was a little too great giving exactly the result seeked for. The value of 6.6 arcseconds found by the Membrane Theory we can compute also with the formula given by de Sitter or other researchers of the General Relativity, and it is also the value of the Gravity Probe B experiment.

In position 2 of the orbit, mass of the gyroscope is transported in direction of Earth on that side which is seen by the viewer (the little white arrow). The mass increases a little by the membrane effect. The missing momentum is delivered by the membrane and acts in direction of the movement of the gyroscope on its orbit (the pink arrow). The torque has the same direction also in this position.

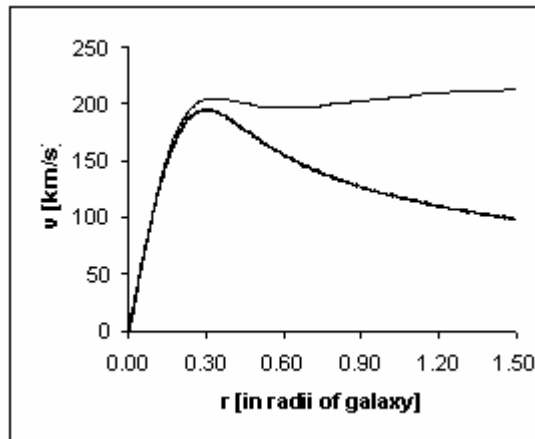
The Lense-Thirring effect doesn't appear in the Cosmic Membrane Theory in the same form as in Einstein's theory, because the transmission of the gravity from mass point to mass point by [gravitons](#) is not assumed. But a similar effect of frame-dragging is thinkable, i.e., the

rotating Earth takes with it a little the surrounding membrane, similarly to a whirl beater which is whirling the soup. But the author has no imagination of the value of the effect. He supposes, if the frame-dragging effect is existing at all, it is smaller than the 0,04 arcseconds of the Thirring-Lense effect.

The phenomenon of [Dark Matter](#) is another support of the Cosmic Membrane Theory. Vera Rubin (*1928) and many others have discovered that the stars of most of the galaxies are moving too fast around the center. If one plots in a graph the speed of the stars against their distances r from the galactic center then the most galaxies are showing nearly flat [rotation curves](#), i.e., the speed of the stars is about 200 km/s, independently of whether they are closer to the center or more distant. In the solar system, however, the inner planets move much faster than the outer ones, and that is good so because otherwise they would fly away. The visible matter of a galaxy is not sufficient by far to hold together the galaxy by its gravitation. The so-called dark matter is filling now this gap. One supposes that 80 to 90 percent of the matter of a galaxy is dark matter. In clusters of galaxies one supposes still higher percentages. Physicists and astronomers have made a series of suppositions what dark matter could be, e.g. brown dwarfs, heavy neutrinos or exotic particles, the so-called weakly interacting massive particles (WIMPs). Today one knows from astronomical observations that dark matter does appear always only together with common matter, i.e., together with stars or clouds of gas. This phenomenon has induced the author to seek a mechanism of the membrane which is triggered by the common matter, and which causes an additional deepening of the gravitational funnel. Base and starting point is the supposed granular structure of the membrane stuff. It could consist of tiny [torus-shaped](#) (donut-shaped) whirlpools. Besides, these tiny whirlpools could be a thinkable basis of a quantization of the space, and they could become a connecting member between Quantum theory and theory of gravitation. If the membrane is perpendicular to the ether wind then the whirlpools are not influenced. The ether wind is pervading through the pores without any resistance.



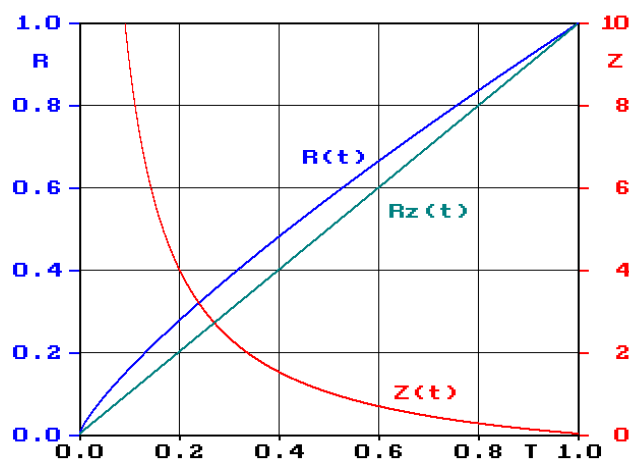
If the membrane is sloped as inside of a gravitational funnel then forces can arise which change the membrane, e.g., its density is increasing. Such changes can produce an additional resistance, i.e., the gravitational funnel will become deeper. But under certain circumstances the change can also cause a lift, i.e., exactly do the opposite. The author has established an [ordinary differential equation \(ODE\)](#) of curvature of space yielding the typical flat rotation curves for models with radial symmetry, e.g., [elliptical or spherical galaxies](#). The downward-sloped curve in the figure below is the expected rotation curve without dark matter. This curve shows the speed stars should have at distance r from the center if no dark matter is involved.



Rotation curves

[Spiral galaxies](#) and their baby form, the [bar galaxies](#), are more difficult to handle. But the author has solved numerically the partial differential equation (PDE) using a spatial grid, and again a nearly flat rotation curve has been computed. So the Cosmic Membrane Theory is delivering a model of the nature of dark matter which is worthy to discuss: *dark matter is not matter in the really sense, but an effect of the cosmic membrane induced by ordinary baryonic matter*. Besides, the effects of the dark matter are so small that they don't influence the movements of the planets in our solar system.

[The accelerated expansion of the Universe](#): Adam Riess and Mario Livio from Space Telescope Science Institute had presented in 2001 a supernova 11 billions light years distant from us, but in the [Hubble diagram](#) this [supernova](#) is only half as bright as it should be due to its [redshift](#), and therefore apparently further away than assumed. Astronomers and astrophysicists are discussing the thesis whether the expansion of the Universe is accelerating or not since that time. The author has his own opinion concerning this issue. Our Universe is expanding with nearly constant speed since the [Big Bang](#). But the properties of the membrane can change, and therewith physical constants can change too, for example as the skin of a balloon is becoming thinner if it is blown up. The most important change is the increase of the velocity of light due to the increasing tension of the membrane. Indeed, one can find a scenario in which distant supernovae are only half as bright as one expects due to their redshift. In the figure "[Expansion of the Universe](#)" we can see that an object with redshift $z=10$ has emitted its light about at time $T=0.1$ after the Big Bang. Assuming an age of the Universe of about 14 billion years the time $T=0.1$ corresponds to 1.4 billion years.



Expansion of the Universe

The radius of today's Universe has been set here to $R=1$. Time T , the abscissa axis, is the [eigentime](#) (proper time) of a clock moving with the membrane. Time t is the time of a resting outer observer with the time flow of today. The blue curve, $R(t)$, shows the radius of the Universe against eigentime T . Because the first seconds of the eigentime stretched endlessly by reason of the thick and only weakly stretched membrane short after the Big Bang the Universe grew up this time with nearly infinite speed, but only arithmetically. The green curve, $R_z(t)$, shows the real expansion how an outer observer with a clock of the present time would have seen it. But the figure explains also the [Inflation of the Universe](#) which [Alan Guth](#) (*1947) has proposed to explain the flatness problem of the [Cosmic Background Radiation](#). In the context of the Cosmic Membrane Theory this inflation was not an inflation of the radius but an effect of the small speed of light at that time, and of the slow progress of all physical processes in the fat viscous soup of the young membrane.

Some Conclusions

The most important result of the Cosmic Membrane Theory of Gravitation is the derivation of the gravitational law which one gets automatically if one uses a three-dimensional membrane in a four-dimensional hyper space. Furthermore, the membrane model can give us a base for the understanding of the dark matter. The supposed granular structure of the membrane stuff could be a thinkable basis of a quantization of the space, and could become a connecting member between Quantum theory and theory of gravitation. Albert Einstein's results remain unchanged nearly completely. Only some kinds of sight change.

But the membrane model can also push other disciplines of physics and technics. Until now, one has assumed that, e.g., the electrons are moving around the kernels of the atoms without any loss of energy, and this from olden times until now. Now we can calm down. The electrons could refresh also their energy by the ether wind of the expansion, so as flags flutter in the wind. Furthermore, new matter could form permanently, because the slow down of the membrane by the ether wind will set free great amounts of energy. The membrane has, compared with the existing matter, such a vast mass that this slow down has nearly no influence on it.

Ether mills are thinkable which can use the inexhaustible kinetic energy of the membrane for the production of electrical power at some time or other. Ether sails are thinkable which will speed up the spacecrafts of mankind nearly to the speed of light.

One danger one shouldn't hide: The steadily growing balloon, our Universe, could rupture one day, and end not only the mankind but also the whole Universe. If [Bruce Willis](#) can't prevent this debacle then we, nevertheless, can have the hope that there are still many [parallel Universes](#).

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