Physics Recombined

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1 Introduction

The tenets of contemporary physics are no longer comprehensible to most people. On one hand, the so called standard model of physics lacks a convincing conceptual substructure, and on the other hand, every problem that arises is puttied by the invention of another field or mediator particle. For physicists, this approach is somewhat convenient because the interactions between the various fields and particles can be laid out in many different ways. If that is no longer enough, further spatial dimensions are added. Thereby a mathematical jungle has emerged, which is only understood by the ”initiated” scientists and which furthermore no longer allows a comprehensible interpretation across domains. People who have managed to delve into the depths of these mathematical abstractions through a lot of effort are probably not inclined to overturn these theoretical structures, though. Contemporary physics has therefore developed tunnel vision over time and increasingly lost itself in its mathematical models and abstractions. As a result many experts nowadays indeed confuse mathematical formulas with the essence of their described entity. For example, Maxwell's equations of electromagnetism do not explain why an electromagnetic field exists in the first place or what its true nature really is, they describe its behaviour and energy content, which of course is highly valuable knowledge for technical applications. Ultimately though, the secrets of the material world cannot be fully explained through mathematical formulas, but still modern physics is nowadays willingly often used as the quasi religious foundation of a purely materialistic world view with a claim to absoluteness. Moreover, it can be doubted that the standard approach of trying to explain everything by breaking things down into smaller and smaller pieces, also called reductionism in technical jargon, is really expedient. For example, imagine we wanted to research the functioning of engines through crash tests. Every reader is intuitively aware that this approach is only sensible to a limited extent and similarly particle accelerators will not be able to explain our universe to us. Therefore physicists should better pursue a holistic and integrative approach in their theories instead.

Besides, in case you are interested in well founded criticism of contemporary physics let the books and videos of Alexander Unzicker as well as Sabine Hossenfelder be recommended to you here.

2 Used Approach

It cannot be denied that many technological applications and correct experimental predictions were achieved on the grounds of modern physics. Therefore wanting to overthrow all of physics makes no sense. Instead trying to recombine the existing knowledge and to search for overlooked or ignored relationships seems to be more sensible.

In addition, hereinafter some concepts are selected and assumptions are made that allow an alternative physical world view to be built up, which on one hand has a connecting conceptual substructure and on the other hand can be connected to other disciplines, especially philosophy and informatics. The fact that our universe behaves systematically, i.e. there are so called natural constants and the observable forces can be described by mathematical formulas, is remarkable. Our universe could also be a chaotic universe in which natural constants change capriciously and the natural forces would behave unpredictably as a result. Such an universe could not be conceived in terms of information and rules and would ultimately not be able to bring forth life. Conversely, it can be stated that our universe is a universe of systematics and information, which is the basic prerequisite for life. Accordingly, everything living is also always an information processor and the processed information can be recorded quantitatively, for example by numbers and measurements, but also qualitatively, for example through human sensations and concepts. The quantitative classification and grouping is the domain of physics and mathematics, but the qualitative classification and grouping is the realm of the mind and philosophy. In this article the focus lies on the areas of physics and mathematics, but a bridge to the world of philosophy and the mind will also be pointed out. The following concepts, which are in line with what was stated previously, are used repeatedly for that purpose later on:

- Ultimately, all of the physical world can be represented as information onto which rules can be applied.
- The amount of information in any volume of space must be finite in order to be able to acquire its content. Therefore, our universe must be quantized, meaning everything has a smallest element or quantity.
- Our universe is fractal, i.e. it is self similar in its appearance at different levels or scales.
- Our universe is holographic. Its three dimensional information is encoded on a two dimensional surface, i.e. we exist in a kind of film projection.

Furthermore, it makes sense trying to reduce the number of independent constants in physics, since this leads to deeper scientific understandings. Natural constants are sometimes not really constants, but follow from physical relationships, in which case one speaks of emergent constants (note: the values of the used natural constants are listed a separate section at the end of this text). For example, earth's gravitational acceleration with its approximate value of $9.81\,\mathrm{m/s^2}$ was an independent physical constant until Newton's law of universal gravitation could explain it by using the mass of the earth as well as the gravitational constant G. Analogously to this, it is also legit to ask why exactly the speed of light possesses its experimentally measured value and if it might follow from so far unknown or unrecognized relationships. Apparently, however, this question is no longer seriously considered in contemporary physics, where the speed of light is simply defined as a constant reference value.

3 Space Quantization

To describe the position of an object in space typically three numbers are needed, when ignoring the space curvature of Einstein's general theory of relativity for now. But how many decimal places are needed for these numbers to localise an object precisely? If one doesn't make any special assumptions the answer is infinitely many digits, which is somewhat strange. Theoretically, just determining the exact position of a single object would already require an infinite amount of information. The reasonable requirement for the finiteness of this information therefore requires a quantization of space, or generally speaking a grainy space. Subsequently, a smallest possible distance must be assumed and therefore for two dimensions space can be regarded as a squared paper, with each individual square representing a distinct position in space. The position of an object can then be determined by simply counting squares relative to a square which is defined as the origin.
This approach has another important benefit: space quantization defines a fundamental size scale which can be regarded as a ruler. Consequently, on a squared paper an object consisting of one or more squares can easily be copied in identical size to another location. In our universe, space quantization then leads to the fact that a hydrogen atom in our galaxy, the Milky Way, and the Alpha Centauri galaxy really possess the same size. Due to the quantization of space, no additional mathematical tools, such as a so called tangential space, are required for the theoretical proof of this identity.

A concrete candidate for the shortest length in our universe is the so called Planck length $l_l = \sqrt{\hbar/c} \times \sqrt{G/c^2}$, which consists of the following natural constants: the gravitational constant G, light speed c and the reduced Planck constant $\hbar$. Incidentally, the Planck length is really small, even in relation to a single atom. A look at the definition of the Planck length also shows that it contains a G/c^2 term, which is also relevant for black holes. Namely, the radius of a non rotating and electrically neutral black hole, which is also called Schwarzschild black hole, is given by $2M\,G/c^2$ according to Einstein's theory of general relativity, whereby in this case M denotes the black hole's mass. Hence, an evident relation exists between the physical level of the very big and the very small, which constitutes the first concrete evidence for a fractal universe which will be explored further later on. It should also be noted that $c^2/G = 1.3466 \times 10^{27}\,\mathrm{kg/m}$, or the equivalent expression $c^4/G = 1.2103 \times 10^{44}\,\mathrm{J/m}$, represents a kind of maximum energy density in our universe, with respect to the content of a sphere and its radius, which cannot be exceeded even by a black hole.

If one continues the previous argument, it follows that time itself must also be quantized, or grainy. Suppose an object travels a certain distance through a quantized space at constant speed. The duration required for this is given by the formula *time = distance / velocity*. However, this distance can only assume certain values, presumably multiples of the Planck length l_l, and subsequently the time also only can assume certain values. This process can also be thought of as being like a flip book, using this analogy each page turn then corresponds to the smallest possible time interval. Since the speed of light c represents the speed limit in our universe, the smallest possible time interval must consequently be l_l/c, which again is an incredibly small value that is also called the Planck time t_l. Because the Planck length and Planck time are so tiny, we cannot perceive them, even with the most accurate measuring devices, and it therefore appears to us as if time and space are continuous, i.e. without discontinuity.

Taking a smallest distance and a smallest time interval as physically given, the measured value for the speed of light can be explained by employing the additional assumption that each object in our universe can at a maximum only travel one Planck length l_l in one Planck time t_l, and not several Planck lengths during one Planck time interval. In concrete terms, this means that an object can only reach a neighbouring position in the quantized space during a time interval t_l. From this point of view, the speed of light becomes a so called emergent constant because it arises from underlying correlations.

The quantization of space and time allows acquiring all of the physical information that is contained in a volume of spacetime. Subsequently, calculating the temporal evolution of this volume by a computer would also only require a limited amount of time. In case of our universe, however, we don't recognize this information processing because from our point of view it always happens within a Planck time interval, which we can't perceive. Incidentally, comparing our universe with a computer doesn't mean that we are living in a virtual reality in the sense of an artificial reality. The assumption of a virtual reality only shifts the fundamental problem of the mystery of existence as such, because how would the world which simulates our world have come into being? However, by all means presuming that the different levels of our universe are conceptually similar makes sense, which in turn leads us to the concept of fractals.

4 Fractals

Fractals are made up of a similarly repeating pattern, but they can still reach incredible levels of complexity and variety. It is reasonable to presume that our universe also employs this effective mechanism to unfold itself. Typical examples of fractals are displayed in the following three images.

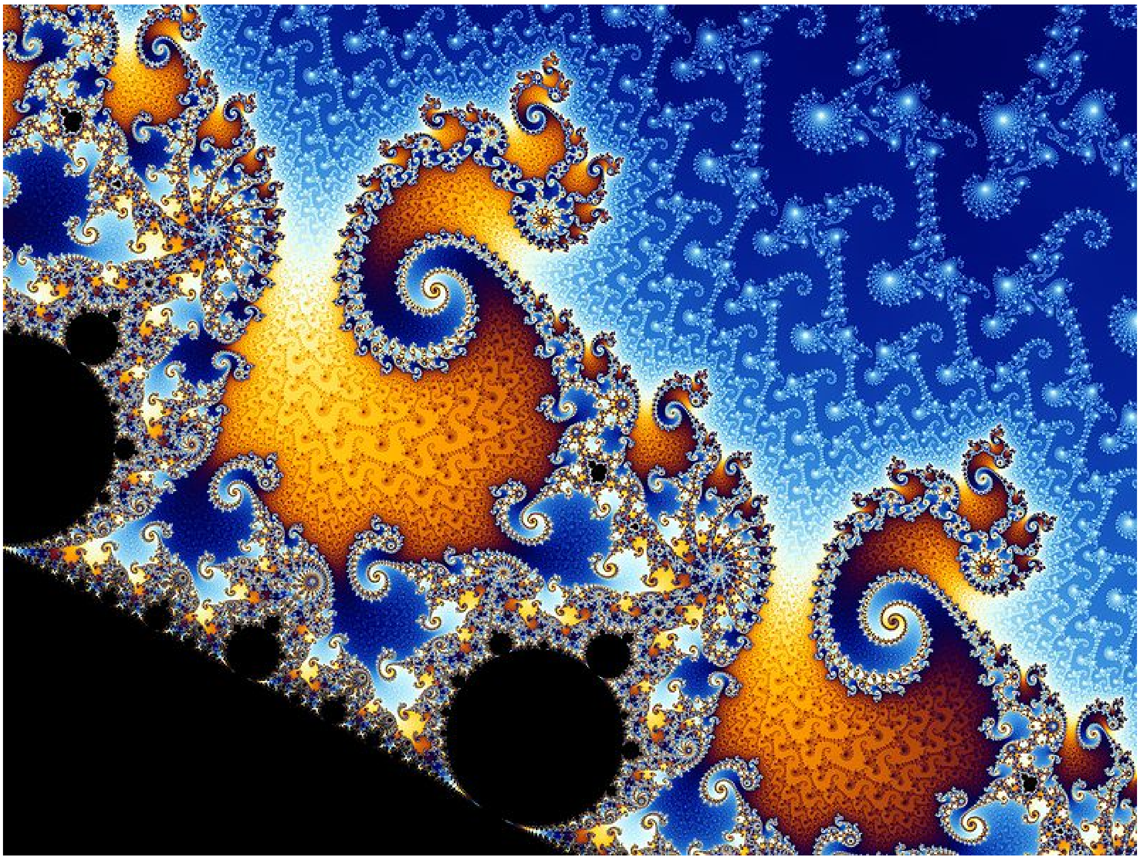

Figure 1: Mandelbrot fractal

Figure 2: Tree silhouette

Figure 3: Matryoshka dolls

Figure 1 shows a graphically impressive representation of the so called Mandelbrot fractal. Remarkably, this complex pattern actually only arises from a simple mathematical rule that is applied repeatedly. Typical for fractals, each section of the Mandelbrot fractal resembles the overall picture. Even trees are ultimately a fractal structure, although they only follow a simple branching rule (see figure 2). Nature also uses this rule in a similar way in humans, in the form of the human lung and our blood vessel system. Another example for a fractal system is a set of matryoshka dolls (see figure 3), which all look alike and can even be stacked into each other. Applied to the human level, one can also say that children are a fractal image of their parents. At the scientific level, planetary systems and atoms are similar to each other, even if this comparison is not really perfect. Thus in the end we're dealing with fractals everywhere, whether we realize it or not.

In case our universe is fundamentally fractal there should be relationships between its characteristic properties at different levels as well as the various natural constants. It turns out that the Planck units are the key to this, in particular the Planck length l_l, Planck mass m_l, Planck charge q_l and Planck time t_l. Most physicists, however, assume that the Planck units have no concrete meaning for the standard model of physics and until now they were only considered to be an interesting way of forming a system of units out of the natural constants. The Planck length and the Planck time are indeed extremely small, which in principle makes them interesting for quantum physics, but the Planck mass with its approximately $21.765\,\mu g$ is comparatively large (note: $1\,\mu g = 0.000\,001\,g$). It takes many protons to even only obtain a single Planck mass and therefore it seemed that there is no meaningful use for the Planck mass in physics. In the following sections, however, it will be shown that the Planck units are definitely suited to gain a novel perspective on all of physics.
It should also be noted that the so called string theory, which tries to explain fundamental physical relations at the smallest of scales through multidimensional vibrating strings and surfaces, also works at the realm of the Planck length. String theory, though, so far has not led to results that are applicable practically and there is also no concrete evidence which suggests that this theory is really leading in the right direction.

5 Fundamental Forces

The electric and magnetic force were already identified by physicists in the 19th century as the two aspects of an unified electromagnetic force. This relationship is also expressed by the fact that the electric field constant ϵ_0 and magnetic field constant μ_0, as well as the speed of light c, are connected with each other via $\epsilon_0\, c^2 = 1/\mu_0$, and consequently one of these constants is actually superfluous since it can be derived from the other two. If one, however, expresses the formulas for the electric force, magnetic force, and also the gravitational force, using the Planck units further relationships become visible because the usually used constants ϵ_0, μ_0 as well as G are replaced with more telling constants and overall a new scheme becomes apparent. In the resulting formulas, for example, the incredibly strong Planck force $F_l = c\hbar/l_l^2$ appears as a common reference force. This force is so strong that it practically can only occur in connection with black holes, but it is massively weakened in the new formulas by other constants, in particular the Planck length l_l, so that the expected calculation results are obtained again.

Force	Classical	In terms of Planck units
Electric	$1/(4\pi\epsilon_0)\ \ q_1 q_2/d^2$	$\alpha F_l\ \ l_l^2/d^2\ \ q_1 q_2/e^2$
Magnetic	$\mu_0/(4\pi)\ \ Iqv/d^2$	$\alpha F_l\ \ l_l^2/d^2\ \ Iqv/(e^2c^2)$
Gravitational	$G\ \ \ \ m_1 m_2/d^2$	$F_l\ \ l_l^2/d^2\ \ m_1 m_2/m_l^2$

Table 1: Fundamental forces

(*Used variables: charges q_1, q_2; masses m_1, m_2; distance d; charge q experiences a Lorentz force as it moves with speed v whereby all vectors are orthogonal; exiting current I of a magnetic field according to the Biot-Savart law for a line element ds*)

Furthermore, it is noticeable that for the electric as well as magnetic force a fundamental connection with the Sommerfeld constant α becomes apparent, which usually appears for the first time in physics when considering the energy levels of hydrogen. The new formulas which utilize the Planck units now also always explicitly exhibit the relevant physical reference quantity, i.e. e, ec and m_l. The quantity e denotes the electric change of the proton and is also called the elementary charge in physics. In case of the magnetic force, the speed of light c in the reference quantity ec indicates that the strength of the magnetic force depends on moving electric charges. The meaning of the reference quantity m_l will be elucidated later on.
It is also interesting that a distance d always has a relation to the Planck length l_l in the new formulas. However, the expression l_l^2/d^2 used here can also be written as $1/[d/l_l]^2$, whereby d/l_l indicates how many of the smallest space elements of length l_l are contained within a certain distance d. Remarkably, the quantization of space is now explicitly present in the equations of the fundamental forces! But, strictly speaking, the fraction d/l_l can only assume integer values, because, for example, a distance d in quantized space cannot amount to 2.5 space elements, only to 2 or 3 space elements.
The conversion of physical formulas into a formulation based on Planck units, as demonstrated here, can, by the way, also be done with further formulas by simply replacing the natural constants μ_0, ϵ_0 and G with equivalent expressions which are based on the Planck units. These expressions can be found in the section containing the natural constant definitions.

For spin ½ particles it is possible to further simplify the equations for the fundamental forces somewhat, since the electrically charged representatives always possess an elementary charge e. In case of the proton and neutron a novel approximation for the strong nuclear force can be defined, which is the force that holds atomic cores together. As a consequence the scheme behind the listed forces, and thereby also their relative strength, becomes even more apparent.

Force	In terms of Planck units
Strong (approx.)	$F_l\ l_l^2/d^2$
Electric	$\alpha F_l\ l_l^2/d^2$
Magnetic (with $I = en/\delta t$)	$\alpha F_l\ l_l^2/d^2\ nv/(c^2\,\delta t)$
Gravitational	$F_l\ l_l^2/d^2\ m_1 m_2/m_l^2$

Table 2: Forces of spin ½ particles

In the case of a proton, the approximation of the strong force is stronger than the gravitational force by a factor of around 10^{38} and stronger than the electric force by a factor of $1/\alpha \cong 137$, which so far agrees with the statements of established physics. However, in reality the strong nuclear force only possesses a very short range, which is not represented correctly by the approximation formula stated here. However, since it is contained in all other equations, and because it is the strongest force, the force $F_l\ l_l^2/d^2$ can rightfully also be regarded as the primordial force or pristine force.

6 Spin ½ Particles

It is no longer that easy to explain what a fundamental particle is supposed to be in modern physics. Allegedly, a particle does not even exist physically until it is observed or measured according to scientific doctrine. Prior to this a particle supposedly only was a probability distribution in space that is described by one of the quantum theories. When a particle gets measured, it then suddenly should consist of subatomic particles in case of the proton, the so called quarks. In the case of the electron, on the other hand, it is claimed that it does not even have a size, or that it is at least extremely small. When a particle moves through free space the probability for its location is given by a so called wave packet, an overlapping of several quantum physical waves, which should actually disintegrate with time into its individual parts as the particle keeps moving. Although these concepts work well for experimental predictions, nobody can really understand them anymore. On top of that, the whole thing should interact with curved space as conceived by the general theory of relativity, for which there is no functioning mechanism so far. More comprehensible models were abandoned because it is allegedly not to possible to develop a useful and comprehensive particle model on the basis of classical ideas on physics. This then even lead to the situation that certain particle properties are said to be purely virtual, i.e. without concrete physical correspondence in three dimensional space. The so called Compton wavelength λ_c , which is relevant for collisions of light quanta, the so called photons, with spin ½ particles (i.e. protons, neutrons, electrons, etc.), is such a property. Contrary to the established doctrine, a simple and understandable particle model can be developed based on rotating spheres according to an idea of Horst Thieme. This model, in which the Compton wavelength λ_c now has a real physical meaning, is based on the following three basic assumptions:

- The shell of a spin ½ particle is approximately described by a sphere.
- The circumference of a spin ½ particle with mass m corresponds to its Compton wavelength $\lambda_c = m/(ch)$. The associated radius is therefore given by $\lambda_c/2\pi$. This radius is referred to as the Compton radius r_c later on.

- All spin ½ particles rotate and thereby move with light speed c at their equator. The resulting rotation frequency is given by c/λ_c and referred to as the Compton frequency f_c later on.

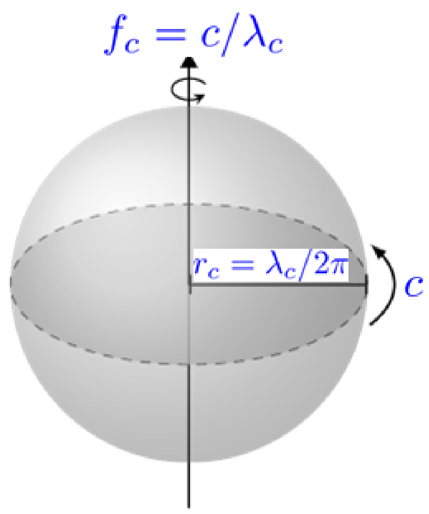

Figure 4: Sphere model of spin ½ particles

In the model presented here, a spin ½ particle presumably consists of the same "something" as space itself and represents a kind of self contained vortex. The speed of light c was chosen as the revolution speed at the equator because it poses a natural boundary in space and thereby also a specific rotation frequency can be defined for each type of particle. At the surface of a spin ½ particle presumably some kind of stall happens because its particle vortex cannot bring the surrounding space up to faster than light speed. With increasing distance from the particle, the surrounding space presumably calms down again.

Interestingly, in this simple model there is a relationship between frequency and wavelength which coincides with the equation for the propagation speed of light, or electromagnetic radiation in the vacuum, namely $c = \lambda_c f_c$. As a result, the energy of a spin ½ particle can be described physically equivalent in terms of its frequency f_c as well as its mass m, i.e. $E = mc^2 = hf_c$. Contemporary physics, however, uses energy expressions composed of Planck's constant h and a frequency f only for calculating the energy content of light quanta, i.e. the photons.

Calculating the Compton radius for the proton results in a particle radius which is smaller by a factor of 4.0 than the $0.842\,\mathrm{fm}$ which were measured with the currently most accurate experiment (note: $1\,\mathrm{fm} = 0.000\,000\,000\,001\,\mathrm{mm}$). The fact that this deviation is an integer factor suggests that the Compton radius is a physically real quantity, because otherwise we would probably be dealing with some "crooked" factor like 4.28479. The assertion of quantum physics that the Compton wavelength is a purely virtual property is therefore hardly tenable. Since spin ½ particles rotate extremely quickly, according to the model presented here, the so called frame dragging should also occur in their immediate vicinity, which denotes a gravitational effect that twists space around a rapidly rotating mass. An experimental measurement of the proton's size by means of a collision should therefore also result in a particle radius which is larger than its Compton radius, because the particle used for the collision experiences a path deflection due to this twisting of space, which in turn makes the proton appear larger.

If one calculates the Compton radius for the electron, the result is a value that is approximately 1836 times larger than the radius of the proton. Professional physicists will probably cry out loud at this point because the electron is extremely small according to doctrine, or maybe does not even possess a physically measurable size. But even this serious deviation may be explainable. First, the electron is probably not a hard ”golf ball”, i.e. one should perhaps imagine it as a jelly or plasma which is simply permeated in high energy collisions. For example, determining the size of a pumpkin using a fired bullet would not work either. Second, spin ½ particles may shrink at high velocities, an idea which will be discussed in more detail in the section on relativistic particle energy.

Contemporary physics classifies all the various spin ½ particles as so called fermions, but because their internal structure differs, according to scientific consensus, they are furthermore divided into baryons (e.g. proton and neutron) and leptons (e.g. electron and positron). However, this distinction is perhaps due to downstream (flow/vortex) effects, which primarily arise due to the different particle sizes. Therefore, for now no attempt is made in the particle model introduced here to explain the subatomic quarks, which the baryons are supposed to consist of.

Unfortunately, the deviations from the so called standard model of physics which were discussed in this section tend to lead to a rigorous rejection of the introduced particle model. However, the following sections will show that there are indications that the concepts which were presented here indeed make sense.

7 Particle Mass

Many people are familiar with Einstein's famous formula $E = mc^2$, which relates an energy E with a mass m and the speed of light c. We usually say that a mass m contains a certain energy E, but here it is argued for the idea that mass is not an independent thing and therefore it is better to write Einstein's famous formula as $m = E/c^2$, because in this form mass can be interpreted as bound, or condensed, energy. Consequently, during an atomic bomb explosion, mass is not converted into energy, but already existing energy is released. Generally speaking, energy can have exactly two forms: the energy of motion, called kinetic energy, or stored energy, called potential energy. Of course, there are many different kinds of energy, but upon closer examination these can always be categorized as kinetic or potential energy. For example, if an object moves with velocity v it has a kinetic energy of $mv^2/2$, at least as long as we neglect very high velocities. A taut mechanical spring with spring constant D and a displacement s possesses a potential energy of $Ds^2/2$, which can be converted back into motion when the spring relaxes. Energy is therefore synonymous with movement, or at least the possibility for movement, and according to this definition energy represents a fundamental mental concept in general that needs no deeper explanation. This also makes energy more fundamental than mass conceptually, for which one cannot as easily define an underlying concept.

But what exactly is particle energy really if mass is not a fundamental property? It probably consists of a combination of different energy components. Electrical and magnetic energy certainly play a role here. Rotational energy probably too. In addition, perhaps potential energy contributions from a possible internal electrical polarization, an internal gravitational potential or a (centripetal) force which holds the particles together. Modern physics has mostly abandoned this explanatory approach, though, because no suitable formulas were found and physics then eventually evolved into a different direction.

According to established physics, protons and neutrons get their mass from subatomic quarks, their associated strong nuclear force and the Higgs boson - but the details are extremely complicated. Electrons, on the other hand, do not possess quarks and therefore also no strong force according to modern physics.
However, as the table below shows, it is quite possible to express the energy of spin ½ particles in various ordinary forms of energy when using the parameters of the previously introduced sphere model. Incidentally, the formulas which are presented in the following table have been adjusted so that they all match with the total particle energy because their respective contribution to the total energy is not to be discussed here as these contributions may differ for each particle type. Moreover, the following table does not claim to be complete, i.e. there may be other forms of energy that contribute particle mass according to $m = E/c^2$.

Energy form	$E = mc^2 = hf_c$
Electric	$= e^2/(4\pi\epsilon_0\alpha r_c)$
Magnetic	$= 2\phi_e e f_c$
Rotational	$= 4\pi L_c f_c$
Gravitational	$= Gm_l^2/r_c$

Table 3: Energy forms of spin ½ particles

A few aspects of the shown formulas deserve to be highlighted briefly. For the electrical (field) energy, it is necessary to insert the Sommerfeld constant $\alpha \cong 1/137$ into the standard formula for electrical potential energy to obtain an energy identical to mc^2. This is the reason why former attempts to explain particle mass exclusively via electrical energy had to fail, because electrical energy alone is far from sufficient for this. It is highly remarkable, though, that the correction factor corresponds exactly to $1/\alpha$. In case of the magnetic (field) energy, the expression ef_c describes the electric current that runs around a spin ½ particle and generates a magnetic field "bundle" $\phi_e = h/2e$. In superconductor experiments it was discovered that $h/2e$ is the smallest possible amount of magnetic flux, and apparently spin ½ particles also produce exactly this magnetic flux. The formula for rotational energy contains the particle spin $L_c = \hbar/2$, which is regarded here as classical angular momentum and not as peculiar quantum physical spin. Interestingly, in the case of gravitational energy, the particle mass m is not to be used here, but the Planck mass m_l instead. This fact is dealt with in more detail in the section on the strong force.
Finally, it should be noted that it is really remarkable that the mass energy of a spin ½ particle can be expressed meaningfully in other forms of energy. This suggests that, the equations which are represented in this section are really physically relevant.

8 Relativistic Energy

If a mass m moves with a high velocity v then its total energy is greater than the sum of its mass energy and kinetic energy, which is given by $mc^2 + mv^2/2$. Einstein introduced the relativistic total energy $E_\gamma = \sqrt{(mc^2)^2 + (\gamma mvc)^2}$ as a correction with his theory of special relativity, whereby $\gamma = 1/\sqrt{1 - v^2/c^2}$ denotes the so called Lorentz factor, that is almost 1 for low velocities but which increases significantly as v approaches the speed of light c. Velocities where the Lorentz factor deviates noticeably from 1 are also called relativistic velocities.
In contemporary physics, however, the frequency aspect has so far been ignored regarding the relativistic total energy which can also be expressed as $E_\gamma = hf_\gamma$ for spin ½

particles by using the novel frequency $f_\gamma = \sqrt{f_c^2 + f_{\gamma dB}^2}$. This frequency will be referred to as the "Lorentz frequency" from now on, because it is only relevant for relativistic scenarios. Incidentally, for low velocities f_γ is almost identical to the immutable Compton frequency f_c , but with increasing velocity the relativistic de Broglie frequency $f_{\gamma dB}$ is playing an increasingly important role. The ordinary de Broglie frequency is defined by mvc/h, but it requires a correction by the Lorentz factor for higher speeds, which is why the relativistic de Broglie frequency is given by $f_{\gamma dB} = \gamma mvc/h$.

In modern physics, however, the de Broglie frequency is rarely mentioned, usually only the de Broglie wavelength is spoken of, whose relativistic variant is given by $\lambda_{\gamma dB} = h/(\gamma mv)$. This wavelength allows matter to also be treated as a quantum physical wave, meaning that a particle is said to not be real until its wave was measured. This twofold existence is also called wave-particle dualism, which is a quantum physical concept that was first used in electromagnetism because light, depending on the experiment, showed up as an electromagnetic wave or as a particle. There are indeed also diffraction experiments in which ordinary particles experience a deflection from their trajectory, which apparently can only be explained through scattering related to the de Broglie wave. The de Broglie wave is therefore sometimes also referred to as a matter wave. However, for stationary particles, i.e. $v = 0\,\mathrm{m/s}$, the de Broglie wavelength is infinitely long, which cannot be interpreted in a physically sensible way. To circumvent this problem, modern physics claims that the de Broglie wavelength is a purely quantum physical property with no real correspondence in three dimensional space. Though, if one uses the associated frequency $f_{\gamma dB} = c/\lambda_{\gamma dB}$ instead of the de Broglie wavelength, a stationary particle simply possesses a frequency of $0\,\mathrm{Hz}$, which is not a physically nonsensical value. It is also often claimed that the de Broglie wavelength is usually so small that it is irrelevant, but thereby it is omitted, though, that a particular speed v can always be found at which this wavelength should be physically relevant. Therefore, it seems to make sense to consider the de Broglie frequency as the physically relevant particle property, instead of the de Broglie wavelength, which together with the Compton frequency makes up the physically real Lorentz frequency.

In the sphere model for spin ½ particles, the relationship between the Compton radius r_c and the Compton frequency f_c is given by $r_c = c/(2\pi f_c)$. It seems sensible to presume that there is also a relativistic radius for high velocities that uses the Lorentz frequency f_γ instead of the Compton frequency f_c and which is therefore given by $r_\gamma = c/(2\pi f_\gamma)$. This equation states that a particle shrinks with increasing rate of motion because r_γ decreases when the Lorentz frequency f_γ increases with rising velocity. This phenomenon is also known from Einstein's special theory of relativity under the name of length contraction. However, there is one crucial difference: according to the approach used here, a particle should shrink uniformly and remain a sphere, while according to the special theory of relativity it is compressed in the direction of movement. Unfortunately, I do not know whether this different behavior can be distinguished experimentally, but the relativistic radius r_γ could explain why electrons appear vanishingly small in experiments with very high motion speeds.

The time dilation for moving objects, which is also predicted by the special theory of relativity, is possibly related to the Lorentz frequency f_γ too. Due to this frequency, every spin ½ particle possesses its own internal clock in the view presented here, which could influence a particle's interactions. It seems that the internal time course of a spin ½ particle changes by a factor of $f_c/f_\gamma = 1/\gamma$ compared to a stationary clock.

It should also be noted that the concepts which were laid out in this section indicate that the relativistic energy of a spin ½ particle is stored in its rotational energy. However, this statement does not quite fit well with the common interpretation of special relativity, in which the kinetic energy of an object ultimately depends on an observer and the relative velocity to him. However, with regard to the total energy contained in our universe, this property of the special theory of relativity does not really seem to make sense, because for the total energy balance it makes a big difference whether a spaceship is moving with a speed of $c/2$ relative to a stationary universe or if the rest of the universe moves with $c/2$ relative to a stationary spaceship. These two perspectives are not equivalent.

9 Particle Spin

A moment of inertia J describes how difficult it is to change the rotational speed of an object, the angular momentum L stands for the sway that a rotating object possesses. These two quantities are related to each other via $L = J \times 2\pi f$, whereby f denotes the object's rotations per second. All spin ½ particles possess an angular momentum of $L_c = 1/2\,\hbar$, which can be calculated the ordinary way in the sphere model by using a suitable moment of inertia - but this should not be possible according to contemporary physics. However, there is a peculiarity that has to be considered here, instead of a sphere's moment of inertia, which is given by $2mr^2/5$, the moment of inertia of a thin disc must be used, which is given by $J_d = mr^2/2$. Due to the connection between the mass m of a spin ½ particle and its Compton frequency f_c, the moment of inertia J_d can also be written as $\hbar/(4\pi f_c)$. Then, as expected, the same angular momentum results for each type of spin ½ particle, namely $L_c = J_d \times 2\pi f_c = 1/2\,\hbar$, because the frequency f_c simply cancels out.

But why is a thin disc's moment of inertia used here? The spherical model obviously needs to be expanded somewhat. A particle with spin ½ is apparently not a static body, such as a golf ball, but presumably more like a dynamic body, such as Neptune. The flow patterns in the upper and lower half of the spherical shell presumably run in such a way that all vertical flow components cancel each other out and only horizontal flow components, which are aligned in parallel to the equatorial disk, remain. The following sketch of a particle surface with two overlapping ring shaped flows (in green and purple) shall help to clarify this concept.

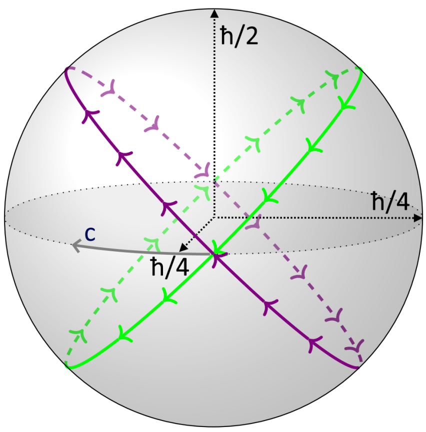

Figure 5: Symmetric flow components

How these flow patterns could actually look like in reality is thematized in the section about hydrogen. Finally, it shall also be noted here that the analogy to Neptune fits nicely into the overall idea of a fractal universe.

In the concept presented here, particle spin is caused by the angular momentum of a particle around its rotational axis. For the rotation around an axis there are naturally only two directions of motion, which coincides with the so called quantization of the particle spin. This property denotes the experimental observation that, in the presence of a surrounding magnetic field, the spin of an electron can only point in two specific directions which are dependent on that magnetic field. But allegedly, this effect cannot simply be explained by an electrically charged rotating particle, which is why particle spin is said to be a virtual property of quantum physics for which there is no real equivalent in three dimensional space. This argument is only valid, though, as long as a spin ½ particle is considered to be a rotating "golf ball", which has no (orthogonal) angular momentum components in addition to the angular momentum about its axis of rotation. However, a rotating object with internal dynamics, as shown in figure 5, has two more (orthogonal) space axes in its equatorial plane, each with an angular momentum of $\hbar/4$. With these additional angular momenta, experiments that determine particle spin can then be explained again without quantum physics.

Incidentally, the magnetic moment of spin ½ particles also seems to be related to the concepts presented in this section. In case of the electron this is particularly obvious because its magnetic moment is given by the simple formula $ef_c\pi r_c^2$. The expression πr_c^2 thereby describes the area of the equatorial disk of a free electron (see also figure 4), i.e. of an electron which is not bound in an atom, and the expression ef_c describes an electric current which runs around that equatorial disc, which in turn consists of a ring shaped distribution of a charge e that moves with light speed c. As with particle spin, the calculation of the magnetic moment can apparently be reduced again to a simple two dimensional case due to symmetry considerations.

At the latest it should be clear now that the sphere model for spin ½ particles has some merit, even if it is simplistic, because the relationships presented so far cannot simply all be coincidence.

10 Mass Symmetry

Expressing the mass of black holes and spin ½ particles in relation to the Planck mass m_l reveals a remarkable mathematical symmetry in the corresponding formulas. As a reference, a rotating black hole is used here which moves with light speed c at its equator and is electrically neutral overall. A black hole with these properties is also referred to by physicists as most extreme Kerr hole. In reality, however, Kerr holes cannot fully reach this rotational speed. Since a most extreme Kerr hole is also assumed to be almost spherical and to, at least, nearly rotate with the speed of light, it possesses a certain similarity to spin ½ particles as conceived by the sphere model - it quasi is a gigantic neutron, when disregarding the different density. This similarity is presumably the deeper cause for the symmetry in the formulas for the mass of these objects.

	Mass
Most extreme Kerr hole	$r_k/l_l \times m_l$
Spin ½ particle (proton, neutron, electron)	$l_l/r_c \times m_l$

Table 4: Mass symmetry

Remarkably, only the fraction r/l_l is used in a reverse fashion in both mass equations (with radius r_k or r_c for r). This mathematical symmetry, which was originally discovered by Nassim Harmein, shows that black holes are in a way the mirror images of spin ½ particles, which indeed makes sense for the most important objects in a fractal universe. The fact that this symmetry only becomes evident through the use of the Planck units also indicates that a quantum theory of gravity needs the Planck units as a central element, because they are apparently relevant at the level of the very large and the very small. Furthermore, the expression r_k/l_l suggests that space is quantized because it denotes how many Planck lengths a given radius r_k contains. The expression l_l/r_c uses the same information, only in the form of the reciprocal, i.e. $1/[r_c/l_l]$. Additionally, it is also interesting that the mass in both equations depends on the radius and not the surface or the volume, although one would naively expect the latter.

When entering the two presented mass formulas into a graphic, another remarkable relation becomes apparent.

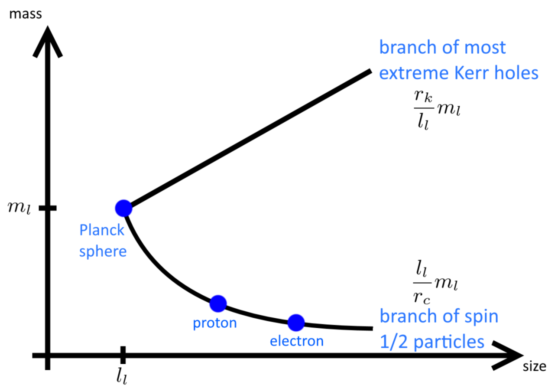

Figure 6: Characteristic lines for masses

The characteristic lines of both mass formulas meet at an intersection point with radius l_l and mass m_l. Earlier on the idea was already put forward that space itself must consist of smallest elements, the so called quanta of space. This statement in turn begs the question which properties do these quanta of space exactly possess? The intersection point of the characteristic lines for most extreme Kerr holes and spin ½ particles may provide us with these properties. Therefore the presumption is made here that the quanta of space, which are from now on are also referred to as Planck spheres or PSUs (Planck Spherical Units), have a radius of one Planck length and possess one Planck mass. Please note that the Planck spheres have a special status in our universe, because they are both a black hole and a spin ½ particle all at once. Interestingly, the energy of a single space quantum is significantly greater than the energy of a proton or electron in model presented here. In one of the following sections, the thesis is put forward that the mass of a particle is also reflected in its surface temperature. This suggests that spin ½ particles were created from Planck spheres that expanded after the Big Bang and cooled down because their internal energy was distributed over a larger volume.
Furthermore, the presumption is made here that all PSUs have a designated electrical charge, which can be a positive or negative Planck charge q_l with a value of $\pm e/\sqrt{\alpha}$. Since there should be an equal number of positively and negatively charged PSUs in our universe, empty space still appears to be electrically neutral. It is even possible to redefine electromagnetism itself using these assumptions, which will be discussed in a later section.

11 Hydrogen

A proton and an electron can combine to form a hydrogen atom, whereby, according to the sphere model used here, the proton gets completely enclosed by the larger electron. Because the magnetic fields of both particles should align in parallel, the proton probably enters via one of the electron's geographic poles, which may possess some kind of opening. However, the electron undergoes two changes during this process. It grows by a factor of $1/\alpha \cong 137.04$ from its Compton radius r_e to the so called Bohr radius $a_0 = r_e/\alpha$ and at the same time its equatorial velocity decreases by a factor of $\alpha \cong 0.007\,297$ from the speed of light c to the speed αc. Because a rotational frequency is generally proportional to revolution velocity and inversely proportional to radius, the rotational frequency of an electron bound in the hydrogen atom is lower than that of a free electron by a factor of $\alpha^2 \cong 0.000\,053\,25$. This lower frequency is also reflected by the presence of α^2 in the so called Rydberg constant $R_\infty = \alpha^2/(4\pi r_e)$, which is used to calculate the energy levels of hydrogen. The physical reason for the stated changes in the electron is apparently that the properties of the bound electron are determined by the electric attraction between the proton and the electron, whereas the properties of the free electron are only limited by the speed of light.
The relationships presented here are alien to contemporary physics, though, because the ideas about the nature of the electron are completely different. It should also be noted in this regard that the relationship $r_e/\alpha = a_0$ between the Bohr radius a_0 and the electron's Compton radius r_e indicates that a free electron (at standstill) really possesses the radius $r_e = 3.86 \times 10^{-13}\,\mathrm{m}$. The Bohr radius $a_0 = 5.29 \times 10^{-11}\,\mathrm{m}$ is undisputedly the experimentally measured radius of the hydrogen atom and its direct relation to the Compton radius of the free electron, via the Sommerfeld constant α, is impossibly just coincidence.

According to current scientific consensus, the supposedly point like electron does not have a predictable path in the hydrogen atom, but its whereabouts only follows a probability distribution that can be determined from the wave equations of quantum physics. In this view, a probability only becomes a fact when it comes to a measurement. However, the sphere model offers an alternative that is capable of precise results, and that without quantum physics, only on the basis of the classical electromagnetism equations according to James Clerk Maxwell. This is possible because there is a mathematical relation between the probability calculations of quantum physics and electric currents on the surface of a sphere. The following figure illustrates this relationship for various energy levels of hydrogen with different quantum number n. On the right probability clouds are depicted for the electron's location in the hydrogen atom and on the left side the corresponding patterns of electric current density are shown for the surface of a sphere, which lead to similar calculation results. The correspondences are from the inside to the outside, with respect to the vertical dividing line in the graph. The direction vectors of the electric currents, as well as the overall rotation of the electron, are not shown on the left side of the illustration (these terms have no meaning on the right side).

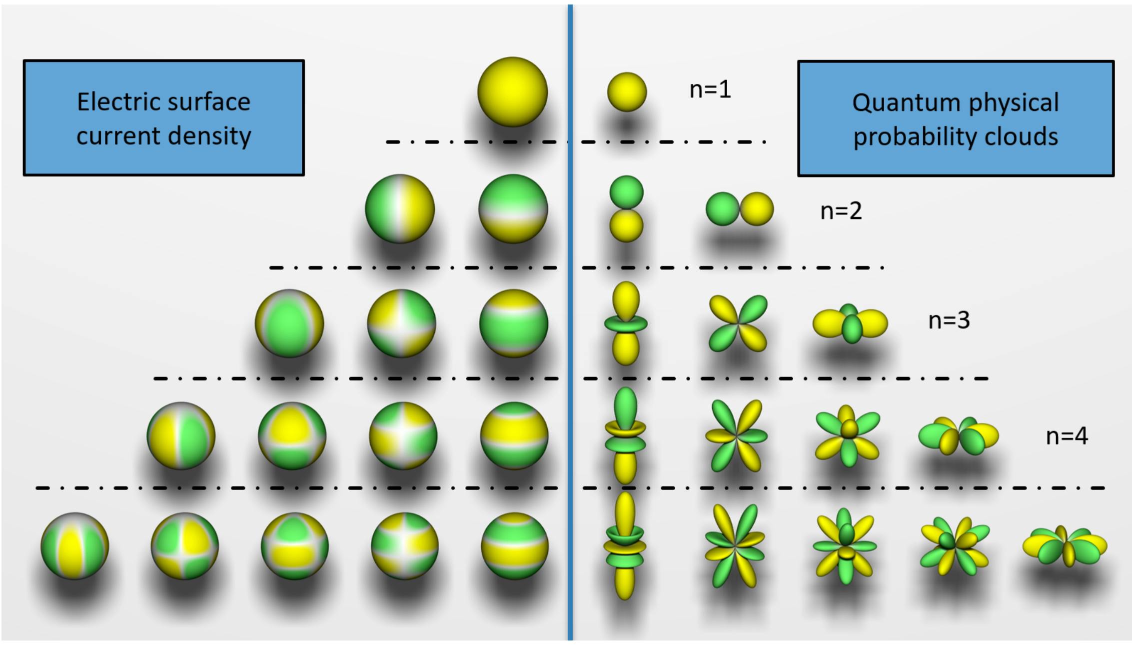

Figure 7: Surface current density vs probability clouds

The spheres on the left side can be imagined as being similar to the gas planet Neptune, in the sense of the idea of a fractal universe, with a rotation speed of αc at their equator, a proton as the hard core and atmospheric vortex systems which here are electrical in nature. The vortex systems on the lower and upper half-shell are always symmetric, as also with the free electron. With this model, all individual energy levels of hydrogen can indeed be calculated, and extended for more complex atoms even the binding energies in molecules, the latter, however, with much less computational effort than by means of established quantum physics.

The sphere model based interpretation of the hydrogen atom also leads to a special, and long unknown, form of hydrogen, the so called hydrino, which is a hydrogen atom whose electron is below the so called ground state. States below the ground state were not predicted by quantum physics and are probably rare on Earth because it takes a catalytic process to lower an electron below the ground state. The existence of hydrinos (not to be confused with neutrinos) has been vehemently denied by the scientific establishment so far, but the company Brilliant Light Power of Randell Mills, the discoverer of the hydrino, is well on the way to using hydrinos in small reactors as a clean and environmentally friendly source of energy. The reactor developed for this purpose is also called sun cell because an incredibly bright light is generated inside of it which is mostly located in the extreme ultraviolet spectrum. The prototype shown in figure 8 is said to already deliver power in the range of around 250 kW. The amount of energy that the sun cell can generate from one liter of hydrogen corresponds to the fuel value of approximately 0.13t of coal, an energy density that is far superior to most other systems. The sun cell should therefore be able to produce electricity for only 0.1 USD/kWh. The mass production of these devices would quickly end the ravaging global energy crisis and our dependency on oil and gas.

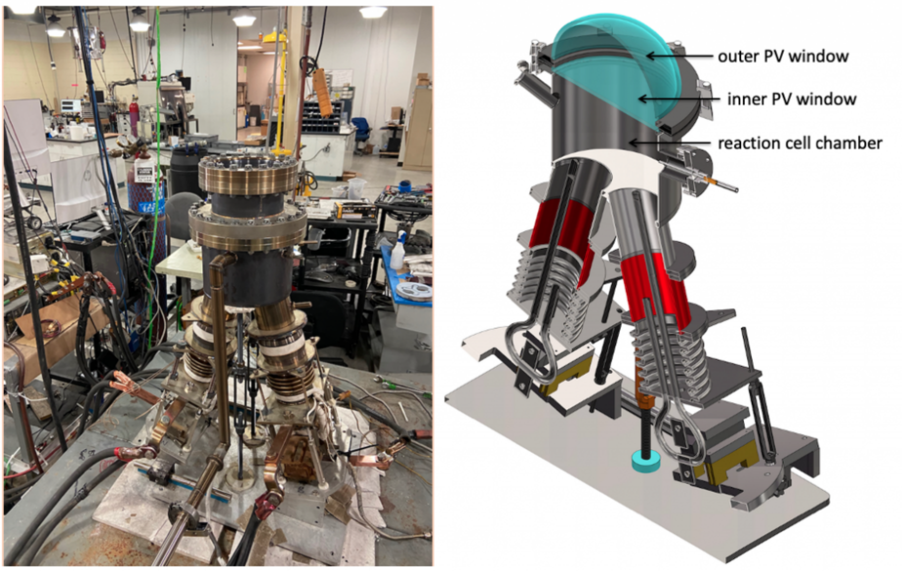

Figure 8: The suncell (public material from Brilliant Light Power)

One of the great mysteries in cosmology is the ”invisible” dark matter, because there should actually be much more mass in our universe than is seen in order to be able to explain certain astronomical observations. Hydrinos, though, may solve this mystery. There is a lot of hydrogen in our universe and consequently there could also be lots of hydrinos if there were and are circumstances in the development of our universe that promote their production. However, since hydrinos do not emit light so easily, and hydrino gas is chemically inactive like noble gas, hydrinos generally appear to us as being ”invisible”. According to Randell Mills, chemical reactions of hydrinos could also be responsible for the as of yet unexplained high temperature in our sun’s corona.

12 Schrödinger Equation

The first differential equation in quantum physics was found by Erwin Schrödinger in connection with research on the hydrogen atom and later on that equation was also named after him. If we take a closer look at the Schrödinger equation in its original context, we will recognize that it is primarily an electromagnetic equation. The time independent variant of the Schrödinger equation can be written as $d^2\psi/dx^2 + 2m/\hbar^2\,[E_{tot} - E_{pot}(x)]\psi = 0$, where $d^2\psi/dx^2$ is the second derivative of a wave function ψ, E_{tot} denotes the total energy of a hydrogen system, E_{pot} its potential energy and m is the mass of an electron. Time independent means that only the location variable x is used, but no time variable t, which is sufficient for our considerations because here we are primarily concerned with the expression $2m/\hbar^2$. That term is very strange since it contains the reduced Planck constant $\hbar$ in squared form and there is no meaningful physical interpretation for this, which suggests that the expression $2m/\hbar^2$ should be formulated differently. Recognizing that m denotes the mass of a spin ½ particle here, and utilizing the hydrogen radius a_0, it is possible to rewrite $2m/\hbar^2$ after several transformations as $(4\pi\epsilon_0/e^2)(2/a_0)$, whereby ϵ_0 denotes the electric field constant. The expression $e^2/(4\pi\epsilon_0)$, which has emerged now, is characteristic for the electric force of a particle system with two elementary charges e, as it is the case in the hydrogen atom. This shows that the time independent Schrödinger equation primarily describes an electric relationship and explains why this equation cannot be applied without changes to other atoms since these usually contain a larger number of elementary charges.

Considering these findings, together with the relationships presented in the section on hydrogen and relativistic energy, it is questionable whether it was justified to establish the idea of a quantum field in physics because of the Schrödinger equation. The physical meaning of a quantum field based on wave functions is not really clear until today, in particular why the mathematical function $|\psi^2|$ should describe a probability of location in space and why a measurement process leads to the collapse of a wave function ψ, whereby only then a definitive reality is supposedly created. Incidentally, the collapse of a wave function must happen simultaneously in the whole space that it occupies, because otherwise it would theoretically be possible to duplicate a particle by doing two simultaneous measurements of a wave function at two different locations. However, this instantaneous collapse contradicts the special theory of relativity, which claims that no change can propagate faster than light. It is also still unclear why a measurement has such a special role in quantum physics and what in particular actually defines such a measurement. Phenomena such as entanglement, diffraction, tunnelling and superposition, which were only discovered through the Schrödinger equation, shall not be denied here, but these effects can also have a different physical cause than the wave properties of a quantum field.

13 The Role of c^2

The significance of the speed of light c as the upper speed limit in our universe was firmly established by Einstein's special theory of relativity. Einstein built this theory upon the findings of James Clark Maxwell, who discovered a connection between the electric field constant ϵ_0 , the magnetic field constant μ_0 and the speed of light c, namely $c = 1/\sqrt{\epsilon_0\,\mu_0}$, which then led Maxwell to the correct conclusion that light is an electromagnetic wave with a propagation speed of c. Alternatively, this relationship can also be written as $1/c^2 = \epsilon_0\,\mu_0$, but then the question arises what $1/c^2$ stands for? An explanation for this question can be found if one defines the electric and magnetic field constants in terms of the Planck force F_l and discovers that the magnetic field constant then contains the expression $1/(e^2\,c^2)$ (see the natural constants section). The speed of light c is to be interpreted here as the upper speed limit for carriers of an elementary charge e, more precisely for two elementary charge carriers, which is why both e and c are squared. Except for $1/c^2$, everything then simply cancels out when ϵ_0 is multiplied by μ_0.

Interestingly, the gravitational constant G can also be defined in terms of c^2, which gives it the form $G = c^2\,l_l/m_l$. The Planck length l_l and Planck mass m_l are functioning here as necessary normalization quantities, because the SI system of units is not calibrated to these quantities. Incidentally, in this new definition, the gravitational constant is no longer a fundamental constant, since it emerges from other constants of nature when the concepts presented beforehand are really taken seriously. The gravitational potential of our sun, with its mass $M_\odot$, can then be written as $V_\odot = -c^2\,(M_\odot/m_l)\,/\,(d/l_l)$ instead of $V_\odot = -GM_\odot/d$, whereby d denotes the distance to our sun. Using these formulas it is possible to calculate how much kinetic energy a second mass would gain due to the gravitation of our sun when approaching it. In the new notation, however, the role of the gravitational constant G is taken over by c^2 and both the solar mass $M_\odot$ and the distance d are expressed as a multiple of their respective base quantity, in the form of $M_\odot/m_l$ and d/l_l. This way of describing a gravitational potential seems very natural and also elucidates previously hidden relations to the presumed properties of the quantized spacetime. That reformulation is possible because the units usually used for a gravitational potential, i.e. $\mathrm{J/kg}$, match with those of the squared speed of light, i.e. $\mathrm{m^2/\,s^2}$, after decomposition and cancellation. This connection was originally recognized by Erwin Schrödinger but did not receive much attention in science. Ultimately, $-c^2 = -9.0 \times 10^{16}\,\mathrm{J/kg}$ presumably delineates the limit for any gravitational potential in our universe, since a gravitational potential of $-c^2/\,2$ already matches the gravitational potential of a non rotating black hole, a so called Schwarzschild hole. The minus sign that appears again and again in connection with the gravitational potential is incidentally just a common convention among physicists which is not particularly relevant here.

It is noteworthy that c^2 also appears as a factor in Einstein's most famous formula $E = mc^2$ which allows to convert a mass m into an energy E. It seems natural to suspect that the conversion factor c^2 is also related here to the gravitational potential of black holes, and thus to the general limit for gravitational potentials. The energy E namely also approximately corresponds to the kinetic energy which a mass m would acquire when falling into a most extreme Kerr black hole.

In conclusion, it can be stated that the expression c^2 is apparently as important in physics as c itself.

14 Holographic Principle

Most physicists believe that information can never be lost. However, when an object falls into a black hole, it is trapped in it and we can no longer observe this object directly. Consequentially, the information about it seems to have been lost. The physicist Jacob Bekenstein examined this connection more closely and found that the information content of a black hole must be related to its surface area. This is an extremely remarkable result since one would expect the information content of a black hole to depend on its volume. Furthermore, any volume of space could turn into a black hole if enough mass accumulates in it, which is why Bekenstein's result must also possess a certain generality. This led Gerard 't Hooft to the idea that all information about any spatial volume must also be encoded on its surface, or boundary area. What comes closest to this idea are holograms, which convey a three dimensional impression even though all of their information is contained on a two dimensional object. Because of this analogy, 't Hooft's idea is commonly referred to as the Holographic Principle. This principle indicates that boundary areas are of fundamental physical importance, which is something that is also reflected in the realm of biology in the form of cell membranes and egg shells. Boundary surfaces will also play an important role later on in the section on thermal gravity. How the concrete encoding on a holographic boundary surface could look like is still a mystery, though.

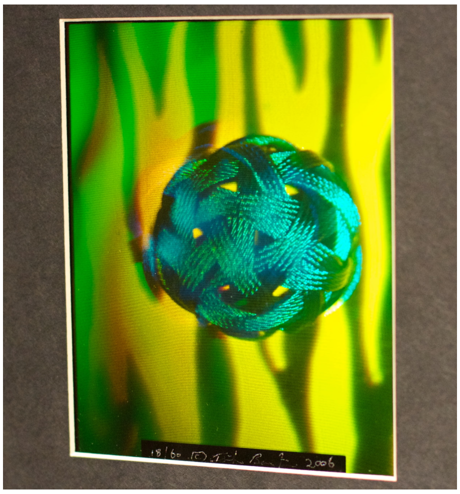

Figure 9: Hologram card

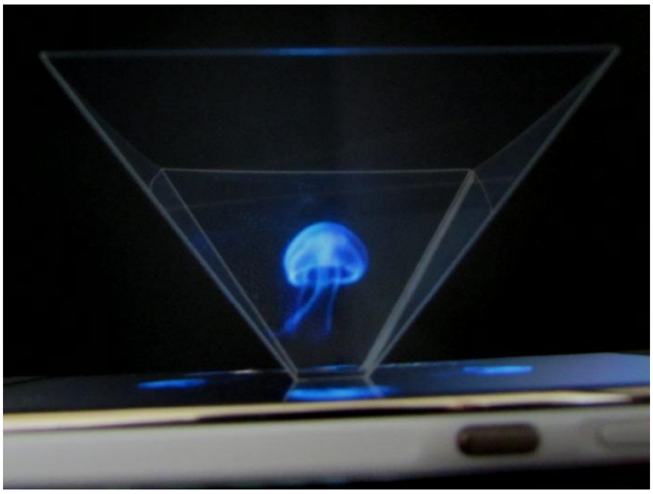

Figure 10: Hologram projector

In physics, the term entropy is used when it comes to the information in a system. More precisely, the physical term entropy describes the information about a system that is unknown to us. If the energy in a system increases, its entropy also increases because the processes in the system become more chaotic. Entropy is also often referred to as the disorder of a system, but this is a rather inappropriate analogy that leads to misconceptions. For a good understanding of the concept of entropy the books of Arieh Ben-Naim are recommended here. In his books Ben-Naim explains that the physical entropy is a special case of the entropy concept of information theory, whereby the latter is also called Shannon entropy. Furthermore, Ben-Naim argues that entropy is not responsible for the forward passage of time, as it is sometimes claimed.

Bekenstein and Hawking were also able to calculate the concrete entropy of a non rotating Schwarzschild hole. This entropy is given by $S_S = k_b\, A/(4l_l^2)$, and also called Bekenstein-Hawking entropy due to its discoverers, whereby k_b denotes the Boltzmann constant and A the surface area of a black hole. Incidentally, according to current research, this relation seems to hold for rotating black holes as well, which gives us an universal upper limit for entropy, since no volume can contain more energy, or information, than a most extreme Kerr hole. This finding should furthermore also hold true for black holes which are not electrically neutral, since these are not fundamentally different in their geometry from neutral black holes. Another remarkable thing about the Bekenstein-Hawking entropy is that it divides the surface A by Planck squares with an area of l_l^2 and therefore the entropy of a black hole depends on its surface, as was indicated before. The Bekenstein-Hawking entropy does not contain a logarithm function, though, which is quite unusual for an entropy formula.

15 Hubble Sphere

According to astronomical observations, our universe is expanding in all directions simultaneously, like a rising yeast dough. Therefore, galaxies, by and large, move away from us faster the larger their distance from us. This has the consequence that there is a limit up to which we can see at all, because beyond this limit everything moves away from us with superluminal speed, which is possible because it is the space itself which expands. The boundary of the visible universe therefore has, due to symmetry, the form of a sphere in whose center we are located. This sphere is also called the Hubble sphere, in honor of the astronomer Edwin Hubble. In space itself, however, the speed of light c is and remains the upper limit for any movement. The expansion rate of space is characterized by the so called Hubble constant H_0, with the help of which the radius of the Hubble sphere can be estimated to $r_H = c/H_0$, as well as the recession velocity $v_e = (d/r_H) \times c = H_0\, d$ of a galaxy, depending on its distance d to us. For comparison, the radius of the Hubble sphere is about $3\,000\,000\,000$ times the distance to our neighbor galaxy Alpha Centauri.

Since observations indicate that our universe is largely flat, i.e. without any significant space curvature, its density is approximately $3H_0^2/(8\pi G) = 1.0 \times 10^{26}\,\mathrm{kg/m^3}$ according to current studies. This density is also called the "critical density" ρ_c which includes contributions of the so called dark matter and dark energy. The mass of our visible universe can consequently be estimated by using standard Euclidean geometry, given the flatness of space. By multiplying the Hubble sphere's volume $4\pi r_H^3/3$ by the critical density ρ_c, the mass m_H of our Hubble sphere then evaluates to approximately $c^2\, r_H/(2G) = 8.4 \times 10^{52}\,\mathrm{kg}$. Remarkably, that result matches with the mass of a Schwarzschild black hole of the same size. This surprising finding actually makes sense because the mass of a non rotating black hole is the theoretical upper limit for the energy contained within our Hubble Sphere, which implies that our universe is apparently fully maxing out its limits. This relationship also allows to approximately define the gravitational constant G in terms of the properties of our Hubble sphere, i.e. $G \cong c^2/2\; r_H/m_H$. It can even be argued that the gravitational constant G is a consequence of the mass and size of our Hubble sphere. However, compared to the definition using the Planck units, i.e. $G = c^2\, l_l/m_l$, an additional factor of $1/2$ is required and therefore the definition using the Planck units seems to be more fundamental. In any case, these relations again highlights the fractal nature of our universe because there is another similarity between the very big and the very small.

A clear conflict is emerging, though: why is the mass of our Hubble sphere close, or even identical, to that of a black hole and yet we do not observe any significant space curvature? Incidentally, locally confined curvatures, e.g. gravitational lenses caused by galaxies, do not affect this assertion because they are comparatively confined. Allegedly, the center of every black hole possesses a so called singularity in which the curvature of space even becomes infinitely strong, which is definitely not the case in our cosmological vicinity. Hence, it is possible that the use of the gravitational constant G is only appropriate in calculations when it comes to masses that are negligibly small compared to the Hubble mass, or the curvature of space is generally just a mathematical accessory of the general theory of relativity and does not exist in reality. In this regard, reference is also made here to the section on thermal gravitation.

16 Strong Force

The strong force is about a factor of 10^{38} stronger than gravity, but the strong force has a very limited range and therefore only works in the region of an atomic nucleus. However, there is a relation that casts doubt on this generally accepted viewpoint: dividing the gravitational force of two Planck masses m_l by the gravitational force of two proton masses m_p results in the same factor, i.e. $(Gm_l m_l/d^2)\,/\,(Gm_p m_p/d^2) = m_l^2/m_p^2 = 1.69 \times 10^{38}$. This result leads to two suppositions, the strong force, on the one hand, is the short range effect of gravity, like suggested by Nassim Haramein, and on the other hand, each spin ½ particle possesses an internal energy of one Planck mass. Consequently, the gravitational force would not be comparatively weak, like generally assumed as of yet. It only seems to decrease quickly in the close range of atoms, which could be because the actual internal mass of a spin ½ particle is somehow shielded. This would also explain the energy relation $Gm_l^2/r_c = mc^2$ from table 3, which strangely uses m_l as the mass relevant for gravitational self energy instead of the actual particle mass m. The underlying cause might be the so called frame dragging effect, which states that space twists around a rapidly rotating object and which is also not taken into account by Newton's law of universal gravitation. Moreover, an internal energy of one Planck mass also fits with the previously stated supposition that many spin ½ particles originally emerged from Planck spheres through an expansion.

The strong force was called the primordial force in a previous section and stated in relation to the Planck force F_l as $F_l\, l_l^2/d^2$, a formulation that yields identical results to the formula Gm_l^2/d^2 which was used here. Furthermore, the strong force can also be reduced to the formula $c\hbar/d^2$, which is a remarkable expression since it is impossible to define a force more simply or fundamentally. Therefore, it is quite justified to call the strong force the primordial force. Moreover it should be noted, that the supposed electric force of a Planck sphere coincides with the primordial force too, i.e. $q_l^2/(4\pi\epsilon_0\, d^2) = Gm_l^2/d^2 = c\hbar/d^2$.

Interestingly, if the mass m_{kp} of a hypothetical most extreme Kerr hole with the size of a proton is divided by the mass m_p of a proton, the result is again a factor of $m_{kp}/m_p = 1.69 \times 10^{38}$. The same result is obtained if the gravitational potential of a most extreme Kerr hole, of $-c^2$, is divided by the gravitational potential $-Gm_p/r_p$ of a proton, whereby r_p denotes the Compton radius of the proton. These results, and the conjectured twisting of space, lead to the idea that protons and neutrons appear as most extreme Kerr holes at close range. This makes perfect sense if the surface of a spin ½ particle is viewed as a rapidly rotating event horizon, but the density of a spin ½ particle is too low even if the Planck mass m_l is assumed to be its real mass. Moreover, the results shown in this paragraph can be explained by the mathematical relationships between the Planck mass, spin ½ particles and most extreme Kerr holes, as provided in the section about mass symmetry. Consequently, spin ½ particles do probably not qualify as black holes, despite their similarities.

17 Structure of Space

Space should consist of smallest elements, the so called space quanta, in order to possess a finite amount of information. These space quanta are presumably Planck spheres which do not only have a position and volume in space, they are space! An important distinction. However, space should have a structure and the Bekenstein-Hawking entropy gives us a first indication of how this structure could look like. It suggests that two dimensional surfaces should be made up from a lattice of squares. Furthermore, the Planck spheres should fill space completely, so that there are no gaps left, which is why the Planck spheres ultimately have to overlap. These demands can all be taken into account by dividing a surface into squares and surrounding each square with a circle, as shown in figure 11, whereby each circle in turn corresponds to the cross section of a Planck sphere.

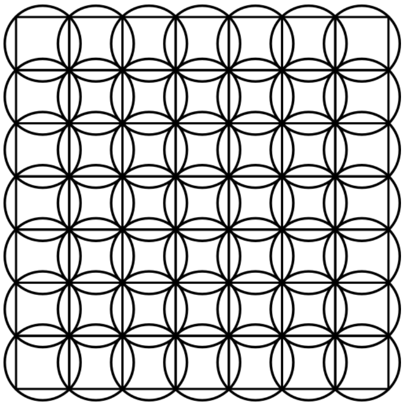

Figure 11: Quantized surface

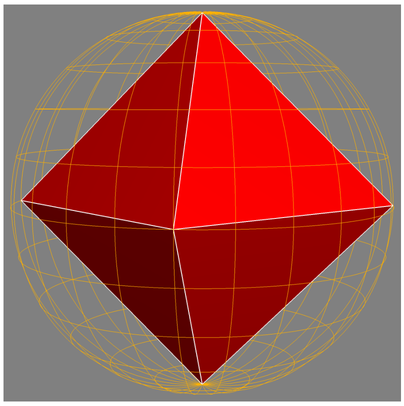

Figure 12: Space quantum

In three dimensional space each of these encircled squares corresponds to an octahedron that is surrounded by a sphere, as shown in figure 12. Interestingly, an octahedron is the simplest geometric form that represents three dimensional space because an octahedron consists of three squares plugged into one another at right angles and thus each octahedron represents a three dimensional coordinate system. Since a single Planck sphere has a radius of one Planck length l_l each of these squares possesses an edge length of $\sqrt{2}\,l_l$ and an area of two Planck squares, i.e. $2l_l^2$. The number of Planck spheres on the surface of a sphere with radius r can therefore be calculated by $\eta_{sq} = 2\pi r^2/l_l^2$, or in relation to the Bekenstein-Hawking entropy S_S by $\eta_{sq} = 2\,S_S/k_b$, as long as this sphere is significantly larger than a single Planck sphere.

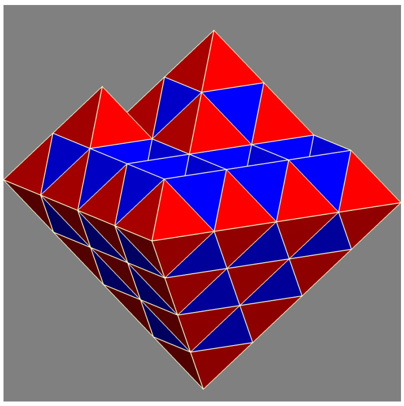

Figure 13: Fractal space structure

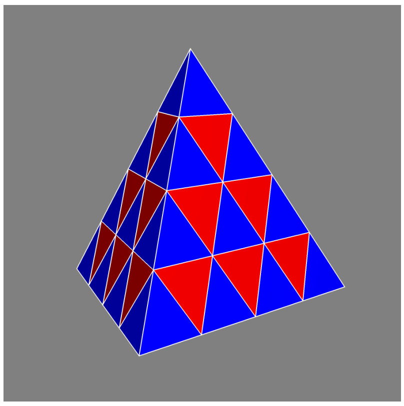

Figure 14: Fractal tetrahedron

Tetrahedrons (see figure 14) are needed in three dimensional space as auxiliary objects to calculate the number of Planck spheres in a given volume, because an arrangement of octahedrons alone cannot completely fill a space. How tetrahedrons and octahedrons can be arranged to fill space completely is shown in figure 13. Interestingly, this is a fractal geometry, i.e. through combination additional octahedrons and tetrahedrons of different sizes can be created, with a crystalline structure like it is also promoted by Nassim Haramein. Incidentally, the colors used here for the octahedrons and tetrahedrons have nothing to do with electrical charge. As before, each red octahedron represents a Planck sphere that encloses it. The number of Planck spheres within a larger sphere of radius r is given by $R_{oct} = \frac{2}{3}\pi\,r^3/l_l^3$, as long as this sphere is significantly larger than a single Planck sphere. Interestingly, the energy density of this spatial structure also agrees with that of the vacuum energy, which is also called zero point energy, as predicted by quantum physics and amounts to $m_l c^2/(2l_l^3) = 2.3166 \times 10^{113}\,\mathrm{J/m^3}$. Since this gigantic energy is bound in the Planck spheres, though, it probably cannot be considered as an explanation for the so called dark energy. According to currently prevailing cosmological model, about 68.3% of our universe consists of "invisible" dark energy, because otherwise our universe's ongoing expansion cannot be explained. However, it is possible that the space structure presented here has something to do with the dark energy. It might be fluctuations in the space structure, which do not appear as electromagnetic waves or gravitational waves. Neutrinos, "ghostly" particles which normally hardly interact with matter, are possibly a moving fluctuation in space, and not really a particle. Interestingly, there are now graphene-coated foils that seem to be able to convert these fluctuations in space into electric current. Hopefully, this technology will give us more understanding of what is really going on in the smallest structures of space.

To put it simply, space itself can be imagined as a computer monitor whose pixels are arranged in three dimensions instead of just two dimensions. A spin ½ particle should therefore not be imagined as a smooth sphere, but as a sphere made of smaller spheres as shown in figure 15. The relation of the quantized radius r/l_l of such a sphere to the Planck spheres on its surface, i.e. η_{sq}, and in its volume, i.e. R_{oct}, is given by $3\,R_{oct}/\eta_{sq} = r/l_l$, whereby r/l_l simply indicates how many Planck lengths are contained in its radius r. This relation is very similar to the usual relation between the Volume V and surface area A of a sphere, which is given by $3V/A = r$, since it is a quantized version of it. For better visibility, the Planck spheres in figure 15 are incidentally depicted massively enlarged.

Figure 15: Sphere of spheres

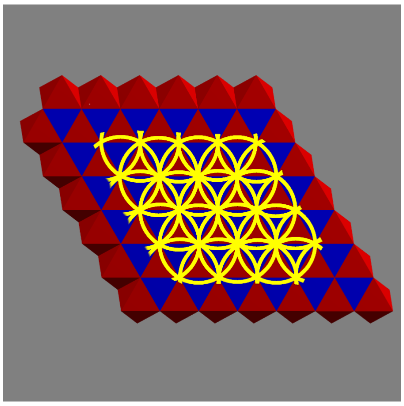

Figure 16: Flower of life pattern

To the liking of readers with a more mystical worldview, the flower of life pattern is also contained in the spatial structure presented here. It "hides" in the geometric pattern of the side faces of a fractal octahedron, as shown in figure 16.

18 Thermal Gravitation

Among other achievements, the physicist Steven Hawking has succeeded in determining the surface temperature of a Schwarzschild hole. However, this temperature, which is also named after him, is usually very low. For a Schwarzschild hole with the mass of our sun, the Hawking temperature is just $0.06\,\mu\mathrm{K}$, which is only slightly above the lowest possible temperature of $0\,\mathrm{K}$ (Kelvin scale: $0\,\mathrm{K} = -459.67\,°$F $= -273.15\,°\mathrm{C}$, $\Delta 1\,\mathrm{K} = \Delta 1\,°\mathrm{C} = \Delta 1.8\,°$F, $1\,\mu\mathrm{K} = 0.000\,001\,\mathrm{K}$). Unfortunately, it has therefore not been possible to verify the Hawking temperature through observation by now.

Interestingly, the temperature of a black hole decreases as it increases in mass. In case a black hole doubles in mass, its radius doubles and its surface area A quadruples, according to the formulas of Einstein's general theory of relativity, but its surface temperature should halve according to the Hawking temperature $T_S = c^3\hbar/(8\pi k_b GM)$. Since radiated power P (= energy per time), under ideal circumstances, varies with the surface and with the fourth power of the temperature, i.e. $P \propto AT^4$, these effects do not balance out and the radiated power of a black hole should decrease as its mass increases. At the extreme, if a black hole doubled in mass, its radiated power would drop to just $1/4$th of its previous power. If this relation holds true, then our universe should be slowly cooling due to the growth of black holes, which raises the question whether gravity is a thermodynamic phenomenon?

Remarkably, Erik Verlinde has succeeded in deriving Newton's law of universal gravitation from the Hawking temperature for a mass m that is located on the horizon of a black hole. To achieve this, the equipartition theorem $E = NTk_b/2$ from thermodynamics must be used, which establishes a connection between the average energy E of a system, its degrees of freedom N and the temperature T of the system. Here, the energy E is simply the mass M of the black hole multiplied by c^2, according to Einstein's well known formula $E = Mc^2$. Verlinde estimated the number of degrees of freedom N by dividing the surface $A = 4\pi r^2$ of a black hole with radius r by Planck squares with area l_l^2, much like the Bekenstein-Hawking entropy does. Verlinde assumed that each Planck square represents one bit of information and corresponds to an independent degree of freedom. Instead of the Hawking temperature, however, the so called Unruh temperature $a\hbar/(2\pi ck_b)$ shall be used here, because it contains a variable a for acceleration. This exchange is possible because the, so far actually unproven, Unruh temperature, that an object with constant acceleration a should experience in vacuum, is identical to the Hawking temperature at the surface of a Schwarzschild hole since there the acceleration $a = F_g/m$ corresponds to the classical gravitational acceleration GM/r^2. If you now replace the terms in the equipartition theorem equation and rearrange further, you end up with Newton's universal law of gravitation $F_g = GMm/r^2$, which in turn demonstrates a concrete connection between gravity, information, black holes and thermodynamics.

Verlinde's result can be generalized by defining a general gravitational temperature $T_g = 2E/(k_b\,A/l_l^2)$ which is applicable to black holes as well as spin ½ particles and whereby E denotes the energy of the object and A its surface. Using this temperature and the previously presented quantized spatial structure, it should ultimately be possible to construct a theory of quantum gravity, which physicists have not been able to do so far. However, the temperatures resulting from T_g are extremely low for spin ½ particles. According to the formula, the surface temperature of a proton is only $1.0 \times 10^{-26}\,\mathrm{K}$ and that of an electron is $6.6 \times 10^{-36}\,\mathrm{K}$. These temperatures are even far below the values for black holes, but it must be considered that the gravitational temperature T_g presumably relates to the states of the space quanta for spin ½ particles. Temperatures, like we perceive them with our body, relate to the states of molecules, or atoms, in gases, liquids or solids. So we are dealing with physically different relationships.

The gravitational temperature T_g also adheres to the second law of thermodynamics, together with the Bekenstein-Hawking entropy S_S , which underpins the plausibility of the theses made here. The associated formula $\Delta E = \pm T_g\ \Delta S_S$ simply states that a small change in the entropy ΔS_S of an object is related to the change in its energy ΔE via its temperature T_g. However, there is a peculiarity here, for spin ½ particles $-T$ is relevant, which is remarkable because entropy and energy are generally always related via $+T$. For example, if a stationary black hole gains energy, its entropy also increases and the entropy of the rest of the universe decreases accordingly, but with spin ½ particles it seems to be the opposite: if a stationary proton gains energy, its entropy seemingly decreases and the entropy of the rest of the universe increases. This negative entropic relationship also reflects in larger spin ½ particle types having smaller mass. For example, the neutron is smaller than the proton, but the neutron has a greater mass. In this context it is also noteworthy that a single quantum of space should have the smallest possible entropy, namely only $k_b/2$.

The concepts presented in this section are unacceptable to most physicists, though, because they regard curved space, as described by the theory of general relativity, as the cause of gravity. However, they overlook that there may not be a fundamental contradiction here at all, we could merely be dealing with two sides of the same coin. Water waves, for example, are curved surfaces on the one hand, but a closer look reveals that they consist of a large number of individual H_2O water molecules. So in physics, it can definitely depend on the way you look at something.

19 Electromagnetism

Electromagnetism will be reinterpreted in this section under the assumption that the electric charge of a space quanta only have two manifestations, a positive or negative Planck charge q_l. The electric charge of the space quanta is thus a fundamental manifestation of the principle of duality, i.e. the principle of opposites, which is also known as yin & yang in the Asian region. From the point of view of information science we are dealing here with binary information as it is also used to store data in computers. The latter perspective is particularly suitable for interpreting the electromagnetic phenomenon as pure information, the processing of which follows a given set of rules or a programming. Electromagnetism thus represents a remarkable synthesis of physics, information science and philosophy, which makes perfect sense from the perspective of a fractal world view.

If there are only two different electric charges at the level of the space quanta, though, how do other charges come about then? This can be explained most clearly using liquids. Let's assume there are two electrically charged liquids which each consist of identical charge carriers, with one liquid only containing positive charge carriers and the other one only negative ones. Ideally, these charge carriers should be very small and have a rather high electrical charge. By mixing these two liquids in a container, almost any electrical charge can be produced. If, for example, the two liquids are mixed in equal proportions an electrically neutral liquid is created in which the different charge carriers are evenly distributed. One can presumably imagine the empty vacuum with its electrically charged space quanta in a similar way (see figure 17). On the other hand, the spherical surface of a charged spin ½ particle, e.g. the proton, should exhibit a mixing ratio which in total leads to the experimentally measured elementary charge e.

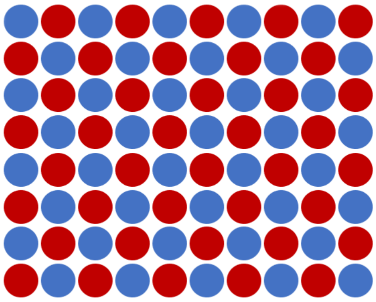

Figure 17: Neutral vacuum

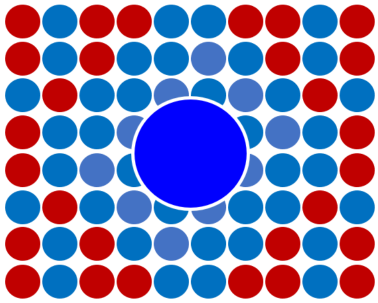

Figure 18: Polarized vacuum

Electrically charged elementary particles, such as the electron or proton, presumably polarize the space around them according to their own charge type, i.e. in the vicinity of a negatively charged electron there are more negative than positively charged space quanta (see figure 18). As the distance increases, the different charges are getting distributed more evenly again. However, changes in the arrangement of the space quanta can only take place with a limited speed, because an electric field can also only propagate with the speed of light at a maximum. Strictly speaking, the electric field incidentally no longer exists as an independent physical entity, or one that is separate from the phenomenon of electric charge, in the model presented here! This model only knows differing arrangements of the two fundamental electrical charge types in space and the electrical field in this view ultimately only a mathematical abstraction of the charge density that is present in space. Consequently, it also makes sense to define the electric field constant ϵ_0 in relation to the Planck charge q_l, i.e. as $\epsilon_0 = q_l^2/(2ch)$, because the electric field constant, according to the perspective described here, only is an effect of the properties of the quantized spacetime. The electrical force then simply is the strive of space to achieve an overall charge density that is as neutral as possible, which in turn ultimately manifests itself as the attraction or repulsion of electrically charged elementary particles.

Modern physics claims that the magnetism which is caused by a current carrying conductor is only an effect of the special theory of relativity, because due to the relativistic length contraction, from the point of view of a charge carrier flying past a stationary conductor, the density of the positive and negative charge carriers in this conductor would be different. The magnetic effect on the flying charge carrier would then in reality be an electrical effect because the conductor possesses a positive or negative excess charge from the point of view of the charge carrier flying past. However, this appears physically questionable because the number of charge carriers in a conductor segment should not change, no matter what frame of reference the situation is viewed from. In addition, the question arises as to what is supposed to change its length here? Space itself? Unlikely, because there are said to be two different changes in charge density. There is an experiment, however, that could be done to test the relativistic point of view. Instead of measuring the magnetic force using two parallel current carrying wires, two rotating disks that are not electrically neutral at their outside could be used. As they rotate, these disks generate an electric current mechanically, rather than through an electrical voltage, and as a result, there are no longer any speed differences in the current carrying layer. If, depending on the direction of rotation, attractive and repulsive magnetic effects arise between the two rotating disks, which correspond to the classic formulas of magnetism, then the relativistic argumentation cannot be correct. Incidentally, one of the two discs could also be replaced with a magnetic field measuring device without destroying the meaningfulness of the experiment. The idea that a magnetic field is only a relativistic effect is also not consistent with the concept of electromagnetic radiation, since it, according to scientific doctrine, always possesses an oscillating magnetic field which is detached from any charge carriers.

What exactly constitutes magnetism at the level of quantized space is not easy to guess if we assume that it is not a relativistic effect. In any case, an impulse is somehow transferred through space by a magnetic field, which can then deflect charged elementary particles from their trajectory. There are at least two explanations for this: either magnetism has something to do with a rotation of the charged Planck spheres or the electric field of a charged spin ½ particle has filaments. In the first case, there may be friction effects, in the latter case these filaments may interact with each other like gears. In any case, the magnetic field constant μ_0 should probably also better be defined in terms of the Planck charge q_l, i.e. as $\mu_0 = 2h/(q_l^2 c)$, analogous to electric field constant.

In the mid 19th century, Michael Faraday discovered that light is an electromagnetic phenomenon. To this day, however, the so called particle-wave duality poses a mystery to science. It states that, depending on the experiment, light appears as a wave or particle, whereby the particles of light are also called photons in technical jargon. Nowadays, modern science seems to have come to terms with this strange fact and does not even try to explain it any further. However, if one considers the photons as small electric ring coils, the wave-particle duality can perhaps be explained intuitively. The geometric structure of a photon presumably corresponds to that of a torus, or donut, which has a kind of alternating current on its surface in order to be able to account for the varying electric and magnetic fields of electromagnetic radiation. The details are still unclear here, however. The torus shape was chosen because the spin of a photon, considering a suspected flow symmetry, presumably correlates with the moment of inertia of a thin ring, i.e. Er^2/c^2. Subsequentially, the spin of a photon can be explained easily by an angular momentum of $1\hbar$. If such a donut shaped photon with energy E collides with a detector, it exhibits a classic particle character, according to the model proposed here, and subsequently an expected momentum of E/c. Moreover, these donuts are expected to polarize the space around them, because they should exhibit aggregations of electric charge on their surface. Electromagnetic radiation, in this model, then consists of a large number of these donuts which presumably can join together in elastic formations due to their magnetic dipole moment, similar to permanent magnets, provided that those photons have a halfway identical frequency. This coupling effect should be responsible for the wave character of the electromagnetic radiation and, for example, explain the diffraction effect of light at edges.

20 Numerical "Coincidences"

As can be assumed for a fractal universe, the most important parameters in our universe appear to be related to each other in a hitherto inexplicable way: the Compton radius r_p of the proton, the Compton radius r_e of the electron, the Planck length l_l and the radius r_H of our Hubble sphere are related to each other by the ratio $r_H/(2r_e) \cong r_p^2/l_l^2$. This relationship is astonishingly accurate, with a deviation of less than 2.5%, given the gigantically large and extremely small numbers which are used here, which in turn suggests that this relation is likely not coincidental. However, there is some uncertainty in the measurement of the Hubble constant H_0, which is why the error could be larger. Curiously, we are also dealing here with the factor $r_p^2/l_l^2 = 1.69 \times 10^{38}$ again, which has already been identified before as the relative strength of the gravitational force and the strong force, or primordial force.

The most important objects in our universe also exhibit a conspicuousness in the ratios of their masses when mathematical logarithm functions are used, as Hartmut Müller noticed. The calculation results are always very close to an integer, or at least almost exactly halfway between two integers, i.e. with 0.5 in the decimal part, as shown in the following examples for the proton mass m_p, the electron mass m_e, the Planck mass m_l and the mass m_H of our Hubble sphere: $\ln m_p/m_e = 7.5$, $\ln m_l/m_p = 44.0$, $\ln m_H/m_e = 191.0$, $\ln m_H/m_p = 183.5$. These results are likely not just coincidental and they also fit well with the idea of a fractal universe. Hartmut Müller suspects that standing gravitational waves are the physical cause of this logarithmic phenomenon.

As already mentioned, around 68.3% of our universe consists of the so called dark energy. Interestingly, the octahedron, which was used for calculating the spatial structure of space, fills approximately 31.8% of the volume of its surrounding Planck sphere, and thus around 68.2% are remaining, which in turn corresponds surprisingly well with the proportion of dark energy. This strange coincidences was brought to my awareness by Jörg Geisbauer. The exact equation for the excess volume is given by $1 - 1/\pi \cong 0.6817$.

21 Final Remarks

The concepts which were presented here have the advantage that all physical phenomena are much more intertwined than in contemporary physics. In particular, to this end the quantized spatial structure, which presumably consists of the Planck spheres, plays a central role. According to the perspective presented here every form of matter arises from this structure, which makes sense because there are physical processes in which the various elementary particles, as well as the photons, transform into one another, such as in beta decay and pair annihilation. These transmutations essentially require that all involved objects ultimately consist of the same "something" and only change their structure and dynamics. Thereby space serves as a kind of information storage, that presumably is cyclically updated, and all basic physical forces apparently function, in one way or another, directly on the basis of this quantized space structure. The presented concepts therefore no longer employ any "magic" fields, because these are presumed to ultimately only be mathematical abstractions. Interestingly, the strong nuclear force appears to be an effect of gravity, which in turn appears to be a thermodynamic phenomenon at the quantum level based on the quanta of space, which offers a way out of the seeming incompatibility of general relativity with quantum physics. In general, it also seems to be a mistake to regard mass as a fundamental physical property, it makes more sense to regard matter as bound energy, whereby energy ultimately always means movement, or the potential for movement, within the spatial structure of space. For example, matter is thus not converted into energy during nuclear fission, instead it actually releases a part of its (internal kinetic) energy.

An essential feature of our universe are energy relationships of the form $E = hf$, whereby here the frequency f can stand for the frequency of a photon (of light), respectively an electromagnetic wave, but also for the rotation frequency of a spherical spin ½ particle. In addition to that, another previously unknown relationship of this kind appears for the electrical potential energy $e^2/(4\pi\epsilon_0 d)$ when the distance d between two electrically charged spin ½ particles is converted into a frequency $f_d = c/(2\pi d)$. This results in the remarkable relationship $e^2/(4\pi\epsilon_0 d) = \alpha h f_d$ where, as in table 2, the Sommerfeld constant α appears as a characteristic feature of electromagnetism. In particular, there are further noteworthy congruences for the Planck spheres, for them the potential energy for electrical and gravitational force, as well as the primordial force, is identical to the hf form, i.e. $q_l^2/(4\pi\epsilon_0 d) = Gm_l^2/d = F_l\, l_l^2/d = hf_d$. Our universe apparently uses similar patterns again and again, even if these are not immediately obvious.

The only constant in Einstein's general theory of relativity is $8\pi G/c^4$. The factor c^4 results from the fact that this theory uses energy instead of mass for its calculations, since Newton's gravitational formula possesses a similar constant when expressed in terms a mass's energy using $E = mc^2$, i.e. $F_g = G/c^4\, E_1 E_2/d^2$. However, it is not considered in modern physics that c^4/G equals the primordial force F_l. Therefore, Newton's gravitational formula can also be written as $F_g = 1/F_l\;\; E_1 E_2/d^2$ and for the general theory of relativity $8\pi G/c^4 = 8\pi/F_l$ applies. An interesting interpretation can also be found for the 8π term, because of $F_l = c\hbar/l_l^2$ it follows that $8\pi/F_l = 4\pi l_l^2\, 2/c\hbar$, whereby $4\pi l_l^2$ corresponds to the surface of a Planck sphere. Thus, even Einstein's general theory of relativity contains hidden references to the Planck spheres.

As has been shown the Planck units are relevant for many fundamental areas of physics and only through their use do deeper, and previously undiscovered, relationships become apparent, in particular the symmetry between the formulas for the mass of most extreme Kerr holes and spin ½ particles. This symmetry in turn leads to the presumed properties of the quanta of space, whose characteristics are also defined by the Planck units. If the quanta of space really have these properties, then the gravitational constant G, the electric field constant ϵ_0 and the magnetic field constant μ_0 are no longer fundamental natural constants, because they can be defined through the properties of the space quanta and therefore must be considered as being emergent constants. Even the speed of light c is no longer a fundamental natural constant in case there exists a time quantum t_l, since $c = l_l/t_l$ does apply.

In conclusion it can be said that it indeed makes sense to think about fundamental physical questions again, because numerous relations have been overlooked or ignored after all. The concepts presented here may be incomplete and only partly right, but they definitely open up a different perspective on physics, which will hopefully be helpful for a better understanding of our universe.

Appendix A Natural Constants

A.1 Classical

Light speed	$c = 2.9979 \times 10^8\,\mathrm{m/s}$
Planck constant	$h = 2\pi\hbar = 6.6261 \times 10^8\,\mathrm{J/Hz}$
Gravitational constant	$G = 6.6743\,\mathrm{m^3/(s^2\,kg)}$
Electric field constant	$\epsilon_0 = 8.8542 \times 10^{-12}\,\mathrm{F/m}$
Magnetic field constant	$\mu_0 = 1.2567 \times 10^{-6}\,\mathrm{mT\,/A}$
Fundamental charge	$e = 1.6022 \times 10^{-19}\,\mathrm{C}$
Sommerfeld constant	$\alpha = e^2/(2ch\epsilon_0) \cong 1/137$
Magnetic flux quantum	$\phi_e = h/2e$
Planck length	$l_l = \sqrt{\hbar/c} \times \sqrt{G/c^2} = \sqrt{\hbar G/c^3} = 1.6162 \times 10^{-35}\,\mathrm{m}$
Planck mass	$m_l = \sqrt{\hbar/c} \times \sqrt{c^2/G} = \sqrt{\hbar c/G} = 21.765\,\mathrm{\mu g}$
Planck time	$t_l = \sqrt{\hbar/c} \times \sqrt{G/c^2} \times \sqrt{1/c^2} = \sqrt{\hbar G/c^5} = l_l/c = 5.3912 \times 10^{-44}\,\mathrm{s}$
Planck charge	$\pm q_l = \pm e/\sqrt{\alpha} = \pm 1.876 \times 10^{-18}\,\mathrm{C}$
Planck force	$F_l = c^4/\,G = 1.21 \times 10^{44}\,\mathrm{N}$

A.2 In Planck Force

Gravitational constant	$G = F_l\,l_l^2/m_l^2$
Electric field constant	$\epsilon_0 = F_l/(4\pi\alpha)\,e^2/l_l^2 = F_l/4\pi\,q_l^2/l_l^2$
Magnetic field constant	$\mu_0 = 4\pi\alpha/F_l\,l_l^2/(e^2c^2) = 4\pi/F_l\,l_l^2/(q_l^2c^2)$

A.3 Emergent

A.3.1 In Base Units (of quantized spacetime)

Light speed	$c = l_l/t_l$
Gravitational constant	$G = c^2\,l_l/m_l$
Sommerfeld constant	$\alpha = e^2/q_l^2$
Electric field constant	$\epsilon_0 = e^2/(2\alpha ch) = q_l^2/(2ch)$
Magnetic field constant	$\mu_0 = 2\alpha h/(e^2c) = 2h/(q_l^2c)$
Planck force	$F_l = c\hbar/l_l^2$

A.3.2 Cosmological

Hubble constant	$H_0 \cong 74.3\,\mathrm{km/s/Mpc}$
Hubble radius	$r_H = c/H_0 \cong 1.25 \times 10^{26}\,\mathrm{m}$
Hubble mass	$m_H \cong 8.4 \times 10^{52}\,\mathrm{kg}$
Gravitational constant	$G \cong (c^2/2)\,r_H/m_H$
Planck length	$l_l \cong \sqrt{\hbar/c} \times \sqrt{r_H/(2m_H)}$
Planck mass	$m_l \cong \sqrt{\hbar/c} \times \sqrt{(2m_H)/r_H}$
Planck time	$t_l \cong \sqrt{\hbar/c} \times \sqrt{r_H/(2m_H)} \times \sqrt{1/c^2}$

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