Alternative Gravity Approach: Quantum Theory. Dark Matter and Dark Energy. Black Holes. Inertia. Weak Interactions. Climate

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Abstract. *The work presents AGA, i.e., an Alternative — compared to general relativity — Gravity Approach. The obtained theory is quantum-mechanical, consistent with Lorentz transformations, and it satisfies Mach's principle. As the main result we offer a strikingly simple solution to the problem of dark matter. It is at odds with general relativity, but is in line with the approximate version of AGA, i.e., Newtonian gravity. The problem of dark energy has been clarified as well. We show that the experiments that confirm Einstein's theory do the same for AGA. In particular, our approach predicts gravitational time dilation, but does it via quantum probabilities instead of concepts straight from classical physics. A time-related fundamental contradiction of general relativity has been found. Black holes without singularities have been introduced. The long-sought origin of inertia is revealed. Our results are possible thanks to the powerful engine of AGA, which is termed info mechanics and is a new branch of quantum mechanics. We show that using it instead of perturbation theory you will be able to build a logically consistent quantum field theory that not only contains gravity, but in which gravity is a model for other fields. A new understanding of the nature of weak interactions is proposed. The existence of new particles (e.g., the seventh quark instead of, no longer needed, the Higgs boson) is predicted. The mystery of the positron excess in cosmic rays has been unraveled. For climatologists, we put forward the scientific cause of global warming. Finally, we demonstrate that the method of info-bearing particles is also able to rationally explain quantum phenomena unrelated to interactions, such as quantum entanglement.*

1 Introduction

The work has been created from the author's belief that general relativity [1] — despite many merits — is now obsolete and should be sent into retirement. For this reason, we dare to present a theory that could take its place. Our proposal is briefly termed AGA (Alternative Gravity Approach) and it is compatible with GUN (Grand Unification of Nature) [2].

In our opinion, the main source of the problems is that general relativity is

- ‼ firmly embedded in classical physics,
- ‼ inextricably linked to singularities,
- ‼ incompatible with certain particles,
- ‼ inconsistent with Mach's principle.

The first item does not need to be discussed in details that can be found in the literature [3-8]. The most important interaction surely deserves a quantum formulation that should show how gravity acts on the smallest trajectoryless objects of Nature. If it were unnecessary, so many humans would not be looking for it [9-23]. We agree with the opinion of [8] that "most experts expect Einstein's theory to fall short someday, because the universe ultimately appears bumpy, not smooth", but, unlike them, we think that this has already happened.

In general relativity singularities occur in two situations, inside event horizons and at the Big Bang. Physicists hoped [24] that the infinities would be able to be removed after introducing cosmological models more realistic than given in [25], but the hopes had proven to be in vain. Hawking and Penrose showed in [26] that singularities were permanently incorporated into Einstein's equations.

In classical theories point-like singularities are not very harmful because an improper force integral may exist, and due to this the energy can be finite. On the other hand, in quantum physics the derivatives termed forces are not defined, so a singularity implies, in general, infinite energy. This is unacceptable, especially that — as we believe — at the lowest level Nature is quantum. Thus Einstein's theory cannot describe the reality correctly. On the other hand, you shall see that in AGA the singularities have been avoided at each event of space-time (the one at our Big Bang was eliminated already in [2]), including the centers of black holes.

The third disadvantage is related to, inter alia, the extremely difficult problem of dark matter. Most physicists have thought that the troubles are caused by particles compatible with Einstein's theory, but — despite extensive searches — they have not been detected for several decades.

In medicine, if long-term pharmacological treatment of the patient does not bring positive results, the doctors usually decide to perform surgery. In the paper we suggest doing something similar. If compatible particles do not work, just take incompatible ones. And you shall see that our patient (i.e., science, not general relativity that is only one of many theories, more or less consistent with experience) will feel very well, which proves the correctness of this treatment.

In Section 2. we recover gravitational mass for physics and all science. It was identified with inertial mass after the famous Eötvös experiments. Nevertheless, we show that they have been overinterpreted. The elimination of gravity mass may be compared to a rash resignation from one degree of freedom. It was a significant facilitation (like reducing the number of dimensions), but — of all the people on this Earth — physicists should know what it can lead to.

In Section 3. we slightly modify the signal encapsulation principle Ⓢ known from [27]. It was enough to remove contradictions from our experiments, but did not help very much in building theories. In this work the problem is connected with the fact that in general relativity an inflation (not solving everything) of space-time was needed [28]. Thus in AGA we assume that gravitation can be propagated with a superluminal speed, which naturally and fully solves the horizon problem (that of flatness was already resolved in [2]). Owing to the elaborate signal encapsulation principle Ⓔ the velocity becomes infinite without contradictions, which greatly simplifies the theory.

Section 4. brings the foundations of info-mechanics, that is, the concept of info-bearing particles. We show that, from a purely theoretical point of view, they only fill a certain gap (related to the wave-particle duality). Nonetheless, the importance of info mechanics for quantum physics is difficult to overestimate. Just quote [24]: "…we should mention the numerous attempts to 'quantize' the gravitational field, i.e. to build a microscopic theory of gravitational interactions, by analogy with quantum electrodynamics. It seems that this problem has not been solved yet and that it is one of the most difficult problems of theoretical physics." It is our hope that after reading the paper you will admit that this problem has been resolved.

Earlier, in Section 5. and [29], we clarify why this issue was not correctly solved even in the case of interactions different from gravity. The point is that quantum field theory attempts to do it via virtual particles and perturbation theory. If someone draws diagrams eagerly, they may have difficulty in discovering that in order for the particle to send an appropriate virtual boson to another, the former ought to receive information about the latter and its properties (e.g., color). Furthermore, it has been forgotten that matter is in constant motion.

Fortunately, we not only point out mistakes, but also show the way to correct them. If you replace virtual particles by info-bearing ones (they are real) and perturbation theory by info-mechanics, you will be able to solve — without a lot of work and tedious calculations — all the problems touched by quantum field theory, and much more.

Our microscopic theory of gravitational interactions is possible owing to the assumption that one of info particles is graviton. This hypothesis is justified by a few important facts. Firstly, despite long searches, no graviton has ever been detected [30, 7, 31]. Secondly, without our gravitons, nobody was able to present a satisfactory quantum gravity theory. Thirdly, there is a reason — last but not least — given in the conclusion of Section 17.

Because info mechanics is a branch of quantum mechanics, we have to consider waves that consist of info bosons. In the paper the most important are the hexagonal graviton waves defined in Section 6. We should note that each info wave contains a fixed number of particles, dependent on the type of the wave.

In Section 7. we create a framework that allows us to state that AGA satisfies the so-called Mach's principle. To avoid misunderstandings, this is achieved by the direct interpretation of Mach's words [32]. In connection with this, in Section 30. — using binary info waves — we resolve the next immensely difficult problems of theoretical physics, i.e., we explain where the origin of inertia comes from. Let us recall that Einstein thought long about these issues, but he came up with nothing.

Info mechanics is not only info particles and their waves, but it also needs specific rules. In the work we present the ten most basic rules. The three first ones have been formulated in Section 8.

Although the theory is quantum, we do not forget about the large group of macroscopic users. That is why in Section 9. we give approximate formulas with forces instead of discrete alterations to momentum.

Nevertheless, in that section they are still very general because AGA enjoys an unusual feature. Normally, if you find a mismatch between a formula and the experimental data, you tell the authors that you regret but their theory seems to be wrong. On the other hand, in the present case you may replace any formula by another, and AGA will remain a quantum theory consistent with Lorentz transformations and Mach's principle. For example, if — despite everything — it turns out that weak equivalence holds, AGA will adopt it with ease.

Therefore, the theory cannot be, in practice, refuted, but this does not mean that it is already completely accurate. In Section 10. we formulate the first proposal for a quantum change in momentum under the influence of gravity. You will be able to test their compliance with experience and suggest any corrections if needed. Nonetheless, the info-mechanical core of AGA will remain unaltered.

At this point, it is worth saying that the acronym AGA may have an expansion different than the one given earlier. If it is written in italic or small caps, it should be expanded to *Additional Gravitational Amendment*. This expresses the fact that, in our formulas, *AGA* and AGA provide amendments to Newtonian gravity (which is an approximate version of our theory). They ensure basic consistency with special and general relativity. For instance, in Section 13. we prove that the experimental verification of the latter during the 1919 total solar eclipse corroborates AGA equally well, and in the next section we do the same with the gravitational redshift.

It is important to emphasize that in AGA the effects of gravitation are not seeming. In particular, they are not caused by the space-time curvature or Einstein's gravitational time dilation.

Nonetheless, experiments are still being performed that confirm a certain gravitational time dilation. We come out with the assumption that since those experiments are quantum, the explanation should be provided on the basis of quantum physics. Without info mechanics this intention is perhaps difficult to implement, whereas in Section 15. we simply formulate the next info-mechanical rule. According to it, quantum gravity can by analogy change quantum probabilities in a similar manner as it changes the momentum of particles. We calculate that our approach, based on the gravitational randomization, gives results consistent with experiments already performed, and for some future ones it yields gravitational time dilation even greater than that predicted by general relativity.

Moreover, in the final part of Section 15. you will encounter the description of a fundamental contradiction of general relativity. This means that it must already be treated as a false theory, no experiments are needed. This fact is related to the fourth disadvantage mentioned above and indicates that the omission of Mach's principle cannot remain without consequences. It is connected with time as well; simply put, *curved space-time does not exist because time does not curve*.

If you are waiting for our discussion of black holes, you will find it in Sections 17. and 18. The novelty (compared to Einstein's theory) is that we define gravitational holes using probabilities (bearing in mind Hawking radiation) and solely with the help of light (the phrase 'even light' is replaced by 'light'). Only later we prove that matter (at least regular, i.e., without antimatter) cannot escape from black holes either. This way is more difficult, but we have to use it because we want to take into account the option in which gravitational interaction between regular matter and antimatter is repulsive. As a result, we have light horizons instead of event ones.

However, if Nature has not chosen this option, we obtain usual event horizons (albeit still without singularities). And, in any case, black holes — when observed from a great distance — look the same according to AGA as well as general relativity.

Since in our approach we introduce gravitational waves that move at infinite velocities, we must respond to waves that travel at the speed of light. They have been long sought after and were detected by one of the groups a few years ago. In Section 19. we show that the discovery violates Einstein's equivalence. This does not exclude their existence, but you should be aware that it confirms some other theory, unknown so far.

We have already listed certain tough problems that are solved in the paper. They, however, belong to theoretical physics, while in Section 21. we deal with one that greatly absorbs experimenters as well. That is why we treat its resolution as the main result of this work.

Obviously, we think of dark matter mentioned at the outset. Physicists have known for a long time that neutrinos are a good candidate for it. Nonetheless, they have believed that neutrinos have a number of flaws, the most important of which is too little mass. Thus they have been searching for other particles intensively and fruitlessly.

We show that neutrinos enjoy sufficient mass and have no disadvantages. They can form the so-called cold dark matter, and the fact that they are fermions does not limit their potential density in any part of the universe (our explanation is related to the phenomenon of neutrino oscillation). Hence, all dark matter is able to be composed of them.

To accept this composition of dark matter, you should just admit that neutrinos can be incompatible with general relativity. No new particles, interactions, reactions, sources of enormous energy (about five times larger than baryonic one), etc., are needed. That is why we believe that our solution is strikingly simple.

In Section 22. we present two options for solving the problem of dark energy. This issue is less important and remains, to some extent, open. If antimatter 'antigravitates', dark energy is formed by antineutrinos and the intercosmic inertia of [2], and otherwise the resolution of [2] should be enough for all of it. It is worth adding that both the dark matter and the dark energy of AGA are compatible with the original Newtonian approximation of gravity.

In Section 23. we discuss the recent experiment that has revealed an excess of positrons in cosmic radiation. This result begs to be explained by assuming that positrons behave differently in the Earth's gravitational field than electrons. Of course, we understand that this is at odds with general relativity, but at present we already have a gravity theory that takes into account such a possibility.

The presentation method used in Section 24. is rather unheard of in scientific papers, but the author has decided that in this case it may be best. Aiming to reduce the number of interactions, we interpret weak nuclear forces as a special case of gravitation. This is genuine gravity, not some 'gravitoweak' interaction. Naturally, such things are possible only in AGA.

Since we have already removed the artificial electroweak interactions, no Higgs boson is needed. Thus the question arises as to what is the particle that was hailed (by people having mixed their dreams with reality) as such a boson a few years ago. Well, in Section 25. we answer that it contains the seventh quark that is knocking on the door of this world. And our analysis shows that the probability of the latter case is greater than that of the former.

The troubles of general relativity with energy conservation are well known. In AGA they do not occur because our theory uses the info-mechanical principle formulated in Section 26. It allows energy to be obtained from gravity in violation of the special relativity principle, just like the latter based on the Einstein formula enables you to obtain useful energy from mass in violation of the classical law.

In Section 27. we use the enormous flexibility of AGA and introduce a self-correction to our formulae. It is termed the positive *Eve* whose special cases include the quadratic or cubic *AGA*. This option (especially the quadratic one) seems to be very likely, but — as always — the experimental verification will be needed. If this is successful, humanity will gain a new, hugely powerful and very safe energy source.

In the next section we apply the positive *Eve* to give a scientific cause of the climate change on the planet. This factor runs continuously increasing or decreasing the temperature. We show that it affects the polar regions two to three times more strongly than the rest of Earth, which exactly matches the experience. In our opinion, for climatology it will also be better if this agent is definitively confirmed.

Section 29. can be very important for scientists who deal with strong and electromagnetic fields because we reveal the existence of other info particles called pherons. They are intermediate bosons of all interactions (including inertia) different from gravity.

On the other hand, both (colored) gravitons and pherons are used by Nature in a phenomenon known as quantum entanglement. In Section 31. we depict that of spin, and we outline the way to describe the entanglement of other physical properties.

Concluding the introduction, let us quote again [8]: "Gravity was the first fundamental force that humanity recognized, yet it remains the least understood. Physicists can predict the influence of gravity on bowling balls, stars and planets with exquisite accuracy, but no one knows how the force interacts with minute particles, or quanta. The nearly century-long search for a theory of quantum gravity — a description of how the force works for the universe's smallest pieces — is driven by the simple expectation that one gravitational rulebook should govern all galaxies, quarks and everything in between." We think that the work contains such a rulebook and gives the answers to these questions, and even more.

2 Gravitational mass

Einstein's equivalence principle, which is the cornerstone of general relativity created in 1916, implies that gravitational and inertial masses are the same. The main impulse for assuming this postulate was probably provided by the result of the Eötvös experiment completed in 1909 [33]. The researcher and his team tried very hard; they confirmed the equality of these masses for such materials as brass, glass, cork, wood, copper, water and the most expensive platinum. Later, these experiments were repeated with increasing accuracy by other researchers, e.g., Dicke [34].

We must claim bluntly that the selection of those materials was of little importance. They are composed of Up and Down quarks and electrons, and in this case TIM (Tinion Internal Model, a counterpart of the Standard Model, so far unpublished and announced in [35]) states that both of these masses can be identified. The crux of the problem is located somewhere else. For instance, do you know what neutrinos are made of?

Certainly not of gold and the materials used in those experiments (no one has tested the gravitational mass of neutrinos[1]), so you should not jump to conclusions from them.

Therefore, in AGA we assume carefully that each particle enjoys two masses: *inertial*, called also *rest* (in the case of massive particles), and *gravitational*. The former has to be, at least in the case of real particles, nonnegative, whereas the latter can be even — surprisingly enough — complex (with nonvanishing imaginary part). However, the gravity mass of massive particles is always real.

Two masses of bodies were already introduced by Newton who also performed the first experiments to establish their equality. Despite their positive results, although the founder of the first gravity theory did not know anything about neutrinos, he chose not to formally identify the masses. Thanks to this, we may say that AGA — like Einstein's theory — is a generalization of Newtonian gravity, but while Einstein eliminated gravitational mass, we nurture and develop this concept.

The notion can be regarded as the charge of gravity. This is important for quantum physics because it eliminates trajectories but appreciates charges (general relativity does the opposite). The question further arises as to whether the quantity can be negative in the case of massive particles, which in turn leads us to antimatter (no Dirac sea is needed). We note, first of all, that AGA will work even if

$$m(q) = m(\bar{q}), \tag{1}$$

where $m(q)$ is the gravitational mass of q, holds for each particle. Nonetheless, in the paper we assume, in general, that for massive particles one has

$$m(q) = -m(\bar{q}), \tag{2}$$

because this case is more difficult, and Nature is more varied. (And that's what tigers like best.)

(2) enables us to resolve certain problems, such as that of the excess of positrons in cosmic radiation. At the same time, the experiment with AMS-02 [36-38] can be regarded — in our opinion — as the first confirmation of gravitational repulsion between regular matter and antimatter in the face of known difficulties with the direct observation of gravitational forces at the particle level, especially with the participation of antimatter [39-42].

Since AGA admits negative gravitational masses and repulsion caused by gravity, some things should be clarified immediately. In the formula $E = mc^2$ one has a rest mass m, so energy cannot be negative, and its conservation is not violated. (For instance, positrons enjoy positive inertial mass and negative gravitational one.) On the other hand, gravity charge is not — in general — preserved, which enables, inter alia, annihilation and creation. Furthermore, you shall see that photons are always attracted by regular matter as well as antimatter.

Decoupling the mass means, obviously, that the ratio

$$\frac{m(q)}{m_0(q)}, \tag{3}$$

where m_0 denotes the rest mass, is not constant because otherwise one could simply change the units. Nevertheless, you may be surprised to find out that (3) is not constant — albeit still remains positive — even for fundamental particles q that belong to regular matter. This fact is the basis of our solution to the problem of dark matter.

[1] Not so long ago, physicists even thought that neutrinos were massless.

Twelve years after the emergence of general relativity Dirac gave his famous equation. It was compatible with Einstein's theory because it contained only one mass. It turns out that a similar tool exists for AGA, but in this case the temporal order has been reversed. Already in [43] Kowitt decoupled gravitational mass from inertial one in the Dirac equation, and he even considered the possibility of gravitational repulsion between regular matter and antimatter. Other approaches to this issue can be found in [44-48].

It is worth emphasizing that AGA does not require dividing the gravitational mass into passive and active [24]. The cause is not an attempt to maintain in force the third law of dynamics, which is not fulfilled in relativistic theories anyway. The rules of info mechanics determine the field generated by a particle with a given mass as well as its behavior in the field.

The gravitational mass m of a massless particle with energy E is sometimes informally defined by $m = E/c^2$, but this is not the best choice because it can give the same result for very different particles. Thus in AGA we require m to be a complex number that satisfies

$$\mathrm{Im}(m) = \frac{E}{c^2}, \tag{4}$$

As a result we obtain

$$|m| \geq \frac{E}{c^2}. \tag{5}$$

In addition, we assume that when a photon is created, its gravitational mass is imaginary (a particle with this property is termed *fresh*, and otherwise *tired* unless it is massive), that is

$$|m| = \frac{E}{c^2}. \tag{6}$$

The gravity mass of massless particles actually works somewhat differently than that of massive ones. Its complex value is no problem because you will see that in this case the gravitational change of momentum and the generated gravity field depend on $|m|$ and $\mathrm{Im}(m)$ respectively.

Let us note that from (4) it follows that (2) cannot be fulfilled for massless particles, so (1) ought to hold for them whenever they enjoy antiparticles. An example is provided by gluons.

To simplify notation we introduce the following functions of complex variable

$$\mathrm{Sgr}(m) = \mathrm{sgn}\big(\mathrm{Re}(m)\big),$$

$$\mathrm{Sgi}(m) = \mathrm{sgn}\big(\mathrm{Im}(m)\big),$$

$$\mathrm{Sir}(m) = \big(1 - \mathrm{Sgi}(m)\big)\mathrm{Sgr}(m),$$

$$\gamma(v, m) = \frac{1}{\sqrt{1 - \frac{v^2 \mathrm{Sir}^2(m)}{c^2}}},$$

where v may be a scalar or vector. It is useful because $\gamma(c, 0) = 1$, so m may be any inertial mass without contradictions. If the second argument is omitted, it is set to 1, which gives the usual γ. Due to Sgi in Sir (this important function will be frequently used below) the last formula goes for a nonzero gravity mass m as well. Note also that γ with two variables could be defined by $\gamma(v, m) = \gamma\big(v\mathrm{Sir}(m)\big)$.

3 Elaborate signal encapsulation principle

The signal encapsulation principle Ⓢ of [27] protected us from contradictions, but it was gold-plating. In the work we need a bit milder version [cf. the comments in Section 8. of 27]. A signal (as in [27], we do not strictly define this concept) is termed *elaborate* if the sender can determine the transmitted value by local experiments, with any degree of accuracy, before the start of the transmission. This definition covers the case when the sender knows this value because reaching for any medium — including memory in the brain — is an experiment as well. The word 'local' should ensure that this property is relativistically invariant.

We use it in the following

Ⓔ (ELABORATE SIGNAL ENCAPSULATION.) *A signal transmitted by one observer will be received with positive probability by another if and only if its speed measured by the latter would be either nonnegative and finite or infinite whenever the signal is elaborate.*

One sees that Ⓔ admits exactly (not only almost) immediate propagation of signals. The question arises whether it still fulfills its security role. We believe that this follows from the signal elaboration. Obviously, we cannot prove it strictly, but we may consider a representative example.

Suppose that two computers A and B send instantaneous zero-one signals to each other. The former always duplicates the value received, while the latter works exactly the opposite. Now, if A starts a transmission by sending e.g., 1, it receives 0 at the same time, so it should send the latter value, a contradiction. However, it is easy to see that the signals sent by B are not elaborate (you must not assume that the observers agreed in advance that A would transmit 1 because there is non-zero probability that A would break the agreement). Thus our principle eliminates them (the signal of B cannot be received by A).

We think that this will hold in any similar case. Those contradictions arise because at least one interlocutor responds immediately without processing the question. Nevertheless, if their signals are elaborate, this is impossible.

The rest of the section is not used in subsequent sections and is intended for inquisitive readers. They may ask whether the above *and only if* clause is justified, i.e., the signal elaboration is necessary for the transmission of instantaneous signals. The following considerations are again not entirely rigorous.

Suppose that an observer sends a signal from $(\boldsymbol{a}, t)$ to $(\boldsymbol{b}, t)$, and the signal is not elaborate. This implies that it is not constant, i.e., two distinct values, say x and y, can be transmitted. By symmetry, we may assume that an analogous signal is transmitted by someone else from $(\boldsymbol{b}, t)$ to $(\boldsymbol{a}, t)$. The senders may determine the value they transmit based on their state (e.g., the result of a quantum experiment), but they may also decide that they will repeat the value of their partner (for this is an experiment of a similar type). Although it only exists at the time t, the original states of the interlocutors are also decisive only at this time (and at least two possibilities must remain), since both of these signals are not elaborate.

If the senders do nothing else, everything is fine. Nevertheless, one of them might make a slight modification to the computer program and send y instead of x and vice versa, which gives a contradiction. Moreover, many other paradoxes and anomalies can be found here.

The situation could change if we were able to stipulate that no signal can be transmitted from $(\boldsymbol{b}, t)$. However, this is impossible because signals can also be sent using bosons, and one can imagine that they behave exactly like those created using fermions. Thus we should assume that the transmission of instantaneous signals that are not elaborate leads to contradictions.

Of course, Ⓔ and Ⓢ cannot be satisfied at the same time. We assume that the former is exact, where the latter is approximate (in many cases it is sufficient). In this fashion, instead of Corollaries 8.1. and 8.2. of [27], we obtain

COROLLARY 3.1. No observer can send any signal with infinite or negative speed unless in the former case the signal is elaborate. ■

COROLLARY 3.2. If a signal sent by O from $(\boldsymbol{a}, s)$ to another event $(\boldsymbol{b}, t)$ is received by O' with positive probability, then $s' < t'$ or $s' = t'$ and the signal is elaborate. ■

Therefore, we think that we have found (see also [27]) the necessary and sufficient conditions for superluminal transmission. Einstein could have formulated the conditions instead of prohibiting the sending of superluminal signals. However, to this end, he should have studied probability instead of non-Euclidean geometry.

4 Info-bearing particles

In the section we introduce a new type of particles called *info-bearing* or briefly *info* ones. Their mass (at least inertial), energy, and momentum are equal to zero, whence they fulfill the equations

$$\left.\begin{aligned} E &= m\gamma(v)c^2 \\ p &= m\gamma(v)v \end{aligned}\right\} \qquad (7)$$

unless their speed v equals c (but they always meet (7) whenever $\gamma(v)$ is replaced by $\gamma(v, c - v)$). This implies that they can easily move at superluminal velocities including ∞ (then p of (7) is undefined, but info particles fulfill $p = E/c$ by $E^2 = p^2c^2 + m^2c^4$ true for all particles[2]). On the other hand, they do not satisfy the equations

$$\left.\begin{aligned} E &= hf \\ p &= h/\lambda \end{aligned}\right\} \qquad (8)$$

because the frequency and the wavelength of info particles have to be nonzero and finite (in the work they satisfy the equality $\lambda f = c$ regardless of their propagation speed).

Certain problems cannot be solved without info bosons. Therefore, in physics it is necessary to consider three basic classes of particles: massive, massless, and info[3]. (The last term seems better than 'energyless'.) Note that there is a symmetry here: massive

[2] Moreover, for both speeds, undefined values can be assumed to be 0 by virtue of convergence.

[3] Similarly, in mathematics we have the earliest discovered positive numbers, negative ones with positive absolute values (energies), and zero. Even the suffix 'tive' corresponds to the prefix 'mass'.

particles meet all the four equations, massless ones satisfy only (8)[4], and info-bearing ones fill the gap and — again due to the wave-particle duality — fulfill only (7).

At this point, you may be surprised and ask: If these new particles have neither energy nor momentum, what do they actually have? Well, they arise naturally on the basis of the so-called tinion hypothesis [35]. According to it, all fundamental particles consist of tinions (the term and its pronunciation comes from 'tiny', not from 'tin'), whence info-bearing ones have tinion compositions as well. Although certain tinions do not carry energy either, all they are fermions, and we think that in quantum physics we may treat spin and momentum on a par. After all, the spin of point-like particles was already pretty weird, but we had to accept it.

5 Action at a distance

Since Newton's time, physics has faced an eternal problem: How is it possible that distant particles interact with each other? Newton himself was intuitively aware of the shortcomings of his theory, when writing in a letter [49]: "It is inconceivable that inanimate brute matter should, without the mediation of something else which is not material, operate upon and affect other matter without mutual contact."

Quantum field theory was to explain this mystery (for interactions different from gravity) by using the exchange of virtual bosons between particles, but we have shown in [29] that it has provided a quasi-response that only moves the problem elsewhere. For to send suitable virtual particles, an electron or quark should have information where an electrically charged or colored particle is located and what are its relevant properties (e.g., color).

Honestly speaking, even this information cannot help much. Indeed, suppose that two electrons e and e_1 are close to events $(\boldsymbol{r}, t)$ and $(\boldsymbol{r}_1, t)$ correspondingly. Let the distance between $\boldsymbol{r}$ and $\boldsymbol{r}_1$ equal 1,000 light-years. As electromagnetism is a long-distance interaction, e_1 sends a virtual photon in the direction of e. After happily avoiding many obstacles, the boson gets close to the event

$$(\boldsymbol{r}, t + 1{,}000 \text{ years}).$$

Unfortunately, it turns out, with at least 99,99% probability, that e is no longer within the radius of 1,000 km from $\boldsymbol{r}$. And now there is a question for you: Why did this poor photon fly there for a thousand years?

If you would like to correct it by assuming that the photon keeps up with e, you should answer the question: What interactions make the photon change its direction? Or maybe Nature attempts to predict where the electron will be in 1,000 years time? Even in classical physics it would be highly unreliable. (In quantum physics, this would require at least the knowledge of the initial velocity of e, which is at odds with the uncertainty principle.)

You could still suggest that each particle should send intermediate photons to every space-time event distant by ct, but that would require the existence of infinite energy, inexplicable even with the help of the uncertainty principle. One could try to reduce the energy using the mathematical tricks mentioned in [29], but this would be immensely intricate and non-physical.

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[4] Even if it is assumed (incorrectly) that $0 \cdot \infty = E/c^2$, photons will not usually satisfy (7) because in the presence of matter their group velocity is lower than c.

You see that quantum field theory practically does not work. The exchange of virtual bosons is a fiction. Nature does not use this because, in most cases, there would be no interaction between particles.

Info-bearing particles solve this problem very effectively and safely, for an energetic particle is able to send info bosons to each space-time event (with a suitable time) without difficulty. Indeed, their total energy remains equal to zero, and lots of info particles can pass through a single event at any speed. If there is no right recipient at the destination, the intermediate info boson simply ceases to exist. Otherwise, it can transfer energy and momentum to the target particle.

Here you may exclaim: How can this info boson transmit some energy and momentum when it has nothing like that?! Well, the answer to this question can be interesting because it gives a new paradigm of our quantum gravity theory and other theories of this type.

Suppose that the target particle and info boson are at the same event. As the latter satisfies (7), it should be subject to the uncertainty principle. If its time and location is known, its energy and momentum cannot be precisely determined, i.e., equal to zero. You will see that a portion of momentum created this way gives the correct interaction. And if we consider the interaction between, e.g., two electrons, nothing needs to be added up; a single info boson suffices at a time of one energy particle.

This is where we can make a comparison between the classes of info-bearing and virtual particles. They both use the principle of uncertainty, but in different situations. The latter need it to the creation, whereas the former are always real and — thanks to this principle — can be detected at specific events.

It is worth emphasizing that info particles are normal particles, although they are not material (cf. the above quote from Newton). For example, they can enjoy nonzero spin and have all possible colors of quarks and gluons. On the other hand, they do not carry electric charge. Their behavior is described by info-mechanics which is a new branch of quantum mechanics.

6 Gravitons

In the paper we deal mainly with two black info-bearing particles called *gravitons* (they are slightly different in tinion structure). One of them enjoys a spin ± 2, and the other 0. The latter (the smallest fundamental particle, comparable to a hydrogen atom) travels exclusively at superluminal speeds, whereas the former can be also subluminal.

We assume that each superluminal graviton is trajectoryless and exists only at two events: initial and final. They are uniquely determined because such gravitons occur solely with partners; the particles of the same wave have the same initial event and distinct final ones.

From the relativistic composition law for velocities it follows that a superluminal graviton has to move with infinite velocity under an observer. We take for granted that in this case it has a specific form. First of all, its wave consists of six gravitons that have all events with the same time t (called the *time* of the wave) equal to the time of the source (denoted below by $\boldsymbol{r}_1$). As the wave is three-dimensional, Fig. 1 shows its two views: side and front.

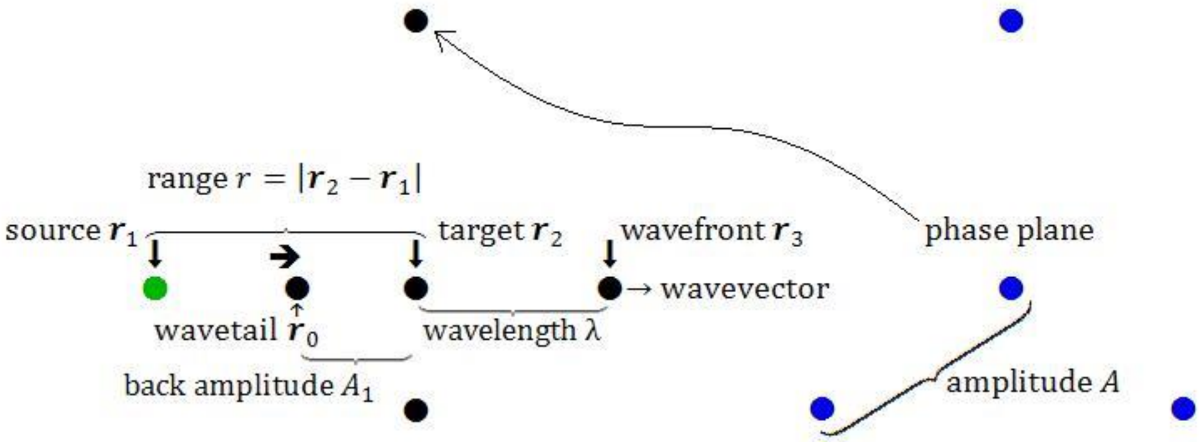

Fig. 1. Gravitational (hexagonal) wave with infinite speed.

Three location vectors of the gravitons lie on the same line that determines the direction of the *wavevector*, whereas four location vectors lie on the same plane called the *phase plane* of the wave. The line and plane are perpendicular, and at their intersection there is situated a common graviton, termed the *target* of the wave, with its location denoted by $\boldsymbol{r}_2$.

The non-phase graviton located farthest (at $\boldsymbol{r}_3$) from the source is said to be the *wavefront*, whereas the one closest (at $\boldsymbol{r}_0$) is called the *wavetail*. By the *length* λ of the wave we mean $|\boldsymbol{r}_3 - \boldsymbol{r}_2|$. The quotient c/λ is called, naturally, the *frequency* f of the wave.

All distances between the target and other phase vectors are identical and equal to the so-called *amplitude* A. The magnitude of the *wavevector* $\boldsymbol{k}$ is defined as A/c, that is,

$$\boldsymbol{k} = \frac{A(\boldsymbol{r}_2 - \boldsymbol{r}_1)^\wedge}{c}. \tag{9}$$

The *waveversor* $\boldsymbol{k}^\wedge$ is frequently denoted by $\boldsymbol{e}$.

The magnitude r of $\boldsymbol{r}_2 - \boldsymbol{r}_1$ is termed the *range* of the wave. The distance between the wavetail and the target is said to be the *back amplitude* and is denoted by A_1. We have also the concepts of *pinnacle* and *pinnacle-1*

$$P = \frac{A}{\lambda}, \tag{10}$$

$$P_1 = \frac{A_1}{\lambda},$$

which are of particular importance, and they can be any positive numbers. Instead of 'pinnacle', the shortcut 'pin' may be used.

In the case of certain info waves one may assume that they are compact, i.e., their length and amplitudes are less than, e.g., the Planck length. However, sometimes the wavelength cannot be arbitrarily small (cf. Section 9.), which causes the pins of a compact wave not to enjoy any positive values. Fortunately, we never use this property.

7 Mach's principle

This term was coined by Einstein, whereas Mach wrote [32] only that to describe "accelerated and inertial motions" the "investigator must feel the need of... knowledge of the immediate connections, say, of the masses of the universe." In our work, by Mach's principle we will understand the very formulation above.

Since it says about 'masses of the universe', we infer that any motion should be considered in relation to something like the average mass distribution in our universe. Let us suppose, therefore, that a point-like massive particle floats in the cosmos. Its position and time are not measured in any way, so we are entitled to speak of its momentum and energy. Thus we may assume that its mass is negligible compared to that of the entire universe, and it can happen that its speed with respect to the mass center (or another exemplification of the masses) of the cosmos vanishes.

One sees that Mach's principle implies the existence of an observer, termed *Mach's frame* below, such that any motion can be considered with respect to them. This is not only consistent with quantum mechanics, but also with special relativity. Indeed, observers that move with a constant velocity with respect to Mach's frame are inertial (they feel no fictitious forces, since their accelerations vanish), and one may assume that without gravity the speed of light in vacuum equals c under each of them. This leads to Lorentz transformations that imply that acceleration varies with respect to different inertial frames. Thus we must have a unique observer with respect to which inertia originates, and this is exactly Mach's frame.

In [32] Mach rightly criticized Newton's idea of absolute space. In fact, we could not construct Mach's frame in empty space, and if it contains only the space-borne particle, no motion and inertia will occur. Nevertheless, we would like to present the frame in a more definite form. Einstein thought that it was associated with distant stars, but this was useless, and he failed to base his gravitation theory on Mach's principle.

If you approach a distant star, you will see that apparent forces play at their best there (and the Milky Way shall be a distant star), so in this fashion you will not get Mach's frame. Instead, let us recall that according to GUN of [2] there are normal (most likely regular) transformations from our $U2$ to our $U1$. We have the following basic

THEOREM 7.1. *Among pairs of normal observers in a universe and its certain subworld there is at most one pair with an inertial external observer whenever frames immobile to each other are identified.*

Proof. Suppose first that normal O' and O'_1 observe the subworld. If they are both inertial, there is a Lorentz transformation between them. One has

$$x_1 = \gamma(x - Vt).$$

For both of them the subcosmos should be contained within a bounded area, regardless of the time of observation. By virtue of the time fullness of normal transformations, this is possible only when V vanishes.

Now suppose that two internal observers O and O_1 move relative to each other. Denote by (σ, τ) the normal transformation from O to O', and by (σ_1, τ_1) from O_1 to O. Every movement consists in the fact that something changes its position. As event renumbering, even dependent on time, does not count, there are $\boldsymbol{r}$, s and t such that

$$\sigma_1(\boldsymbol{r}, s) \nparallel \sigma_1(\boldsymbol{r}, t).$$

As (σ, τ) is motionless, we get for any x and y

$$\sigma(\sigma_1(\boldsymbol{r}, s), x) \nparallel \sigma(\sigma_1(\boldsymbol{r}, t), y),$$

and, in particular,

$$\sigma(\sigma_1(\boldsymbol{r}, s), \tau_1(\boldsymbol{r}, s)) \nparallel \sigma(\sigma_1(\boldsymbol{r}, t), \tau_1(\boldsymbol{r}, t)).$$

This implies that the composition of (σ_1, τ_1) and (σ, τ) is not normal. ■

In the theorem the strict definition of an inertial observer has not been necessary, but it can be useful. In the case of $U0$ the matter is easy; we may assume that a frame is *inertial* if it is the simplest possible, i.e., in it all massive objects move along straight lines. As in $U0$ there are no working interactions, we take for granted that inertial observers exist.

The next natural step would be to assume that internal normal observers associated with external inertial ones are inertial as well. This is possible, but from Theorem 7.1. it follows that they are uniquely determined. Thus they are special inertial observers, and we should take this opportunity to introduce those sought Mach's frames.

Therefore, we extend Subworld Formula of [2] to

- (INERTIAL SUBWORLD FORMULA.) *If U is a proper subuniverse of U', then there is a normal transformation from the finite-dimensional Mach's frame O_0 in U to an inertial observer in U'.*

Mach's frame is also called *observer zero*. Note that the postulate of [2] remains true, but it does not guarantee the uniqueness. On the other hand, Theorem 7.1. ensures here that the transformation is uniquely determined, and we have explicitly specified Mach's frames in Bang-initiated universes. This yields also all inertial observers because they arise from Mach's frames by using Lorentz transformations. On the other hand, there is no such frame in the mother world $U0$; all its inertial observers are equivalent. Thus the relativity principle holds but, naturally, at the highest level of Nature.

Since the hierarchical structure of universes was introduced in [2] using quantum interactions, we propose to call this rule the *quantum relativity principle*, in contrast to the classical principle concerning our universe. And by demanding that the velocities of massive objects have a finite upper bound independent of the observer, we arrive at the Lorentz transformation.

In the first part of the proof of Theorem 7.1. we have assumed that t can arbitrarily large. From a theoretical standpoint, this is fine, but in practice the subworld is observed over a finite time interval T, and this is not sufficient to unambiguously determine the inertial external observer. Thus we suggest using the following self-evident criterion: the sizes of $\sigma(\mathbf{E}^n, T)$ should be minimal.

This practical approach has a disadvantage: Mach's frame can be changed after prolonged observation. However, in the most important case of regular transformations (or at least synchronic, which is very common) T can be of any nonzero length. Indeed, in the proof, time fullness is unnecessary because if x does not depend on time, x_1 does depend on it (as t cannot be constant by virtue of Corollary 3.1. of [2]) unless $V = 0$. Consequently, Mach's frame remains unchanged.

In this manner we have finally found the observer with respect to which inertia effects are created. Note that O_0 is, without a doubt, the most important observer of our world, so it would be very strange if O_0 did not fulfill this role.

Since in AGA Mach's frame is related to our Big Bang rather than to distant stars (the exemplification of masses consists of those that must have been at time zero [2]; Mach was not talking about all masses), we may assume that O_0 coincides (at least with high accuracy) with the frame of the cosmic microwave background radiation (i.e., a frame in which the radiation is isotropic). Consequently, we can rewrite a known anecdote [50]:

> You are standing in a field observing the Cosmic Background Radiation (CBR). Your arms are resting freely at your side, and you see that CBR does not flicker, i.e. it has a fixed reddish color. Now start spinning. CBR begins to flicker, i.e., it is once more red and once less, and your arms are pulled away from your body. Why should your arms be pulled away when CBR flickers? Why should they be dangling freely when CBR is flicker-free?

It is possible that in the future the exact examination of CBR will be able to accurately determine the motion of the Solar System with respect to Mach's frame O_0. Nonetheless, we do not think that CBR (just like distant stars) is a cause of inertia because the latter occurs even in a tightly closed container. The answers to questions similar to the above ones will be given in Section 30.

Although we think that Einstein's equivalence principle is, in general, false, we admit that it can hold for some particles unless the gravity is very strong, i.e., under certain conditions the inertia and gravitation effects are locally indistinguishable. Since the former arise with respect to Mach's frame, observer zero begs for taking a central place also in the theory of gravity. This strategy has been adopted in the next section and all the work.

8 Fundamentals of graviton info-mechanics

Below are presented the first three rules of info-mechanics. By the spin of a hexagonal wave we mean that of its target.

✱ (i) (*Emission of gravitons.*) Under O_0, each particle with nonzero gravitational mass m (or its last position during its lifetime) generates, at time intervals equal to $1/f$, gravitational waves with infinite speed and spin $2\mathrm{Sir}(m)$ taking off from its current location $\boldsymbol{r}_1$ to any target $\boldsymbol{r}_2$, whereby, with infinitesimal delay, one has

$$P = \textsc{gen}(|\mathrm{Sir}(m)\boldsymbol{v}|, m, P_1 = |\boldsymbol{r}_2 - \boldsymbol{r}_1|), \tag{11}$$

where GEN is a positive mapping dependent on experience, and $\boldsymbol{v}$ is the group speed of the particle.

✱ (ii) (*Absorption of gravitons.*) If a particle with nonzero gravitational mass m is at the target (with accuracy less than, e.g., the Planck length and time) of a gravitational wave with infinite speed and spin s, then its momentum is increased, (on average and provided that this is possible without changing $|m|$) by a portion of the momentum of the wave, i.e.,

$$\Delta\boldsymbol{p} = \textsc{aim}(\boldsymbol{k}, \boldsymbol{v}, m, s),$$

where AIM is a — dependent on experience — vector mapping homogeneous of degree 1 with respect to the first variable, $\boldsymbol{k}$ is the info wavevector, and $\boldsymbol{v}$ is the group speed of the particle, whereby for massless particles $|m|$ remains unaltered, and the absorption is possible only at the target.

✱ (iii) (*Remainder of gravitons.*) If a particle has absorbed a spin-2 graviton, the former immediately emits a stable subluminal graviton with the same spin.

We check whether these rules are compatible with quantum mechanics and Lorentz transformations. As (i) does not refer to time, we may consider the energy E of the particle. On the other hand, its position $\boldsymbol{r}_1$ is important there, so its momentum should be undefined. Note that we do not use it; $|\boldsymbol{v}|$ can be determined from E if the particle is massive, and otherwise it does not matter.

(ii) refers to neither time nor location. Does this mean that we may talk about energy and momentum of the particles? This would be the case if there was only one particle, but here we have two and assume they are at the same (albeit unknown) event. Therefore, the energy and momentum of one of them have to be indeterminate. More specifically, we assume that the event of the energy particle is undefined, but then the event of the info boson is already known (with a possible negligible shift suggested in (ii)). Hence the energy and momentum of the energetic particle is defined, while the momentum of the graviton has to be indeterminate, that is, it can take arbitrary (or at least enormously huge) vector values, and we may assume that its portion, equal on average to $\Delta\boldsymbol{p}$, is transferred to our energy particle.

A careful reader may ask whether we should not do the opposite, i.e. assume that the event of the info boson is undefined, which could imply that the event of the energy particle becomes known. Well, there is a certain asymmetry between energy and info particles. Only the former can determine the position and time on their own. The latter can only do this using other particles and the uncertainty principle, so in order to avoid logical looping we must assume as above. And for the same reason, no energy is created by the presence of two info bosons at the same event.

This reasoning is entirely consistent with the uncertainty principle. The situation when particles are at $(\boldsymbol{r}, t)$ must be distinguished from that when they are at an unknown event, and in the latter case their number is relevant.

Note that in (i) the gravitons also have to have a non-zero momentum and a non-vanishing amount of energy at $\boldsymbol{r}_1$. Nevertheless, it does not matter by virtue of the last clause of (ii). It states that the energy created by the uncertainty principle can be detected only at the target of an info wave with infinite speed (at other positions the detectable portion vanishes). Similarly, an energy particle belonging to a probability wave can be recorded at different locations, but cannot be detected at distinct positions at the same time.

In general relativity [1] Einstein assumed that gravity was caused by space-time curvature. You see that in AGA the reason is quite different; gravity is caused by uncertainty. What's more, we think that the paradigm can be used to describe other fundamental fields as well. Some details are given in Section 29.

In (i) we have assumed that the wave is generated under O_0, while in (ii) no observer has been mentioned. However, the absorption can happen only under observer zero, which eliminates logical contradictions. Indeed, consider an observer that moves at the nonzero velocity $\boldsymbol{V}$ with respect to O_0. From Lorentz transformations it follows that if $\boldsymbol{V}$ is not perpendicular to the direction of the wave, the times of the target and the wave front are distinct. Otherwise, this involves phase gravitons, i.e., the wave does not fulfill the conditions of Section 6. (its portion does not move with the infinite velocity).

It seems that frames such as the Earth, the Solar System or the Milky Way move quite slowly with respect to observer zero, so all formulas of the work are approximately true. In other cases, it may be necessary to use formulas for a relativistic momentum transformation.

Because in (i) and (ii) we take into consideration merely waves with infinite velocity, $\Delta\boldsymbol{p}$ defines the gravitational dependence between two particles at the same time. We infer from this that on a particle at a given moment another one — which travels at speeds not exceeding c — acts gravitationally just once. Obviously, another solution would make no sense.

As we have said, the immediate action does not lead to contradictions. However, for Ⓔ to work, the pinnacle has to be set, according to (i), with infinitesimal delay. This means that if the gravitational mass or energy of a particle changes by leaps and bounds, gravitons with new values of P are sent only after the alteration. You will see that this excludes the possibility that two particles mutually increase their energy at a time, and thus it grows to infinity. Sometimes, this causes that P is undefined, and then gravitons are not sent. For example, in the early universe gravitons took off only after time zero [2]. In the case of an electron and positron annihilation the spin-0 gravitons are generated only after this event.

In (i), the clause with 'last position' may look weird, but it can be necessary in the case of a quantum particle q without a trajectory. If q is at $(\boldsymbol{r}, t)$ and $(\boldsymbol{r}_1, t_1)$, where

$$t_1 - t > 1/f,$$

and q does not exist within (t, t_1), Nature (more precisely, the yellow info boson of Section 31.) sends black gravitons from $\boldsymbol{r}$ during the interval. One might assume equivalently that q is still at $\boldsymbol{r}$ over this time period.

The clause 'provided' of (ii) does not apply to massive particles, for their gravitational mass is in no way linked to their momentum and energy. Nonetheless, you will see in Section 21. that neutrinos can change the gravity charge on their own (and this entails their oscillations). On the other hand, the case of massless ones is discussed in Section 14.

Gravity generated by a system of many particles is, of course, the sum of interactions generated by the components because each of them sends gravitons. However, there is a small problem related to binding energy [51]. In the simplest solution, a particle that belongs to such a quantum system of many particles enjoys a proportional change in its gravitational mass.

This can be okay for atoms or nuclei, but you may wonder what sends out gravitons, a hadron, or the quarks and gluons contained within it. The answer is: all. Since the hadron is a universe [2], the particles contained within it cannot send anything further than infinity. Therefore, we have to assume (this is how (i) should be understood in this case) that in our universe gravitons are sent from the hadron's center of gravity mass (taking into account the binding energy and to distances beyond the hadron). On the other hand, gravitons sent from outside the hadron enter it and, along with gravitons from within, affect the particles inside it. This must be the case, as the center of mass is an abstract event.

Similar remarks apply to our $U2$ moving inside our $U1$ [2]. Therefore, the question arises whether it is possible to detect the influence of gravitons from our $U1$ on the objects contained in our $U2$. Note that such an effect does not follow from (ii) that encompasses solely gravitons from our $U2$ (e.g., info bosons whose sources are outside our $U2$ have an unknown speed in our universe). Thus you don't have to deal with them; their influence on all our particles may be the same or almost the same (as large distances in our $U2$, e.g., between its energy ends, are very small in our $U1$). Nonetheless, if gravitational anomalies are ever detected in the motion of some objects in our universe, you may remind yourself of this matter.

Let us add that all objects outside our $U1$ do not interact with those in our $U2$ or even $U1$. Indeed, $U1s$ have zero gravitational mass (see Section 11.), and the others cannot send anything over a distance greater than infinity.

Because GEN has to be positive, the sign of gravitational mass is transmitted by spin. You might ask why its absolute value is equal to 2, since 1 would be sufficient (albeit not quite, as you will see). Well, this is not connected with gravitation and will be clarified in the full version of [35]. Remember that info-bearing bosons are given to us like, e.g., photons and gluons. Nature uses them constantly.

Note that during a particle-graviton collision some conservation principles are seemingly violated, since, e.g., $\Delta\boldsymbol{p}$ does not disappear together with the graviton. Those of energy and momentum will be restored later, but that of spin must be repaired here. As the number of gravitons in a wave is even, we may assume that the sum of their spins equals zero. However, if the spin-2 target is absorbed, something with the same spin should be emitted. That's what's done in (iii).

The gravitons of (iii) move at speeds lower than c, so they do not disturb the gravitational field. Nonetheless, their existence can be of great importance for learning about the past because they document all events in the universe. Their waves will be able to be registered again with the help of the uncertainty principle, but at present I do not know precise rules of info mechanics in this scope. Additional important tips will be given when my works — starting with [27] submitted in 2007 to *Annalen der Physik*, where it got stuck — begin to be published.

I would like to emphasize that this is not about my private interest, but about the good of science, because the lack of discussion kills science. I can give you the following example. Nobel Prize winner Roger Penrose said not long ago that space-time inflation did not suit him and that we should have considered sending superluminal signals. He is right, but he's wasting time because he doesn't know (apparently he has not done a survey on the internet) that this problem has already been solved. In my opinion, all physicists should have the opportunity to discuss signal encapsulation and elaboration freely, even if they were untrue.

9 Gravity between massive particles

In the section we examine how the quantum approach from the previous section looks in a classical approximation. Suppose that under O_0 there are two massive particles q_1 and q_2 that have gravitational masses m_1 and m_2, are located at events $(\boldsymbol{r}_1, t)$ and $(\boldsymbol{r}_2, t)$, and move with velocities $\boldsymbol{v}_1$ and $\boldsymbol{v}_2$ correspondingly. Each of them can receive the wave generated by the other. According to (i) this happens at time intervals Δt equal to λ/c. If it is small, $\Delta\boldsymbol{p}/\Delta t$ approximates the derivative of momentum, that is, force.

Therefore, we may assume that the force $\boldsymbol{F}_{21}$ that acts on q_2 satisfies

$$\boldsymbol{F}_{21} \cong \frac{\mathrm{AIM}\big(\boldsymbol{k}, \boldsymbol{v}_2, m_2, 2\mathrm{sgn}(m_1)\big)c}{\lambda}.$$

Although the length of gravitational waves can be — in general — an arbitrarily small value, some should be selected. For example, the condition

$$\lambda \leq \frac{l_P t_P}{1 + t}, \tag{12}$$

where l_P and t_P are the Planck length and time respectively, and t is the wave time, should ensure very high accuracy in virtually all experiments. (Note that t is — owing to the infinitesimal delay — positive and usually very large.)

On the other hand, we require that, for instance,

$$\lambda \geq \frac{l_P t_P}{(1+t)^2},$$

is fulfilled. This type of security is necessary to prevent reaching infinite energy in finite time. Obviously, Nature may use different inequalities. (The last two right-hand sides can be replaced by positive functions f and g correspondingly, where $f(t) \geq g(t)$, and g is continuous.)

Note that the homogeneity of (ii) and (9) imply

$$\text{AIM}(\boldsymbol{k}, \boldsymbol{v}, m, s) = \frac{\text{AIM}(\boldsymbol{e}, \boldsymbol{v}, m, s)A}{c}.$$

Using this, (10) and (11) we are able to eliminate the wave and obtain

$$\boldsymbol{F}_{21} = \text{AIM}\big(\boldsymbol{r}^{\wedge}, \boldsymbol{v}_2, m_2, 2\text{sgn}(m_1)\big)\text{GEN}(|\boldsymbol{v}_1|, m_1, |\boldsymbol{r}|), \tag{13}$$

where $\boldsymbol{r} = \boldsymbol{r}_2 - \boldsymbol{r}_1$. Of course, the force $\boldsymbol{F}_{12}$ that acts on q_1 is derived analogously.

As we have said, (13) holds under observer zero and, approximately, under observers that move at low relative speeds. For others you should apply relativistic force transformations.

10 The suggested form of gravitational field

It is high time to present the author's suggestions for the GEN and AIM mappings. They contain, in particular, the *AGA* (*Additional Gravitational Amendment*) parameters that show how gravity depends on particles' velocities. They can be scalar or vector (denoted by AGA and **AGA** correspondingly), and give additional amendments to Newton's theory. They should be determined by experimental means, but it's good to start with something.

In the case of GEN, which depicts the generated gravitational field, there is not much choice, also for quantum reasons. We include the gravitational constant Γ in the formula below because there is more space in it than in that for AIM. Therefore, we suggest that

$$\text{GEN}(v, m, r) = \Gamma \underbrace{\gamma(v)}_{\text{AGA}} [\![m]\!] \rho(r), \tag{14}$$

where the so-called *primary* mass $[\![m]\!]$ is defined by

$$[\![m]\!] = \text{Re}(m)\text{Sir}(m) + \text{Im}(m), \tag{15}$$

$\rho: \mathbb{R}^+ \to \mathbb{R}^+$ is continuous, nonzero for nonzero arguments, and

$$\rho(r) \cong \frac{1}{r^2}, \tag{16}$$

whenever $r \gg 0$. For example, you may put

$$\rho(r) = \frac{1}{(r+a)^2},$$

where a is positive and very small (e.g., less than the Planck length, which ensures that the right side of (16) can be assumed in virtually all experiments). Note that $\rho(r)$ cannot be exactly equal to $1/r^2$, which protects us against contradictions. What's more, asymptotic freedom (ρ vanishes at zero) is possible if you define, e.g.,

$$\rho(r) = \frac{r}{(r+a)^3}.$$

In (15) Sir distributes roles because we get

$$[\![m]\!] = |m|,$$

whenever m is real, and otherwise by (4)

$$[\![m]\!] = \frac{E}{c^2}, \tag{17}$$

where E is the energy of the massless particle. One sees that the gravitational field generated by a particle depends on its gravitational mass if it is massive and on its energy otherwise.

There are more options for the AIM function that describes the particle response to the gravitational field. Note that it is a vector mapping because we allow that the gravitational force between two particles is not central. Due to homogeneity, it suffices to define AIM with the first argument equal to $\boldsymbol{e}$, e.g.,

$$\text{AIM}(\boldsymbol{e}, \boldsymbol{v}, m, s) = \text{SNS}(m, s)\underbrace{\gamma(v, m)}_{\text{AGA}}|m|(\boldsymbol{e} + \textbf{AGA}(\boldsymbol{e}, \boldsymbol{v})), \tag{18}$$

where the vector amendment is equal to

$$\textbf{AGA}(\boldsymbol{e}, \boldsymbol{v}) = \frac{\boldsymbol{v} \times (\boldsymbol{e} \times \boldsymbol{v})}{c^2} = \frac{v^2\boldsymbol{e} - (\boldsymbol{e}\boldsymbol{v})\boldsymbol{v}}{c^2},$$

whereas the integer-valued function

$$\text{SNS}(m, s) = -\text{sgn}(\text{Sir}(m)s + 1)$$

determines the sense of the interaction. It is equal to -1 unless $\text{Sir}(m)s$ is different from 0. This condition implies that m is real and $|s| = 2$, so we get that

$$\text{SNS}(m, s) = -\text{sgn}(ms),$$

and from (13) we obtain for massive particles

$$\boldsymbol{F}_{21} = -\Gamma m_1 m_2 \gamma(v_1)\gamma(v_2)\rho(|\boldsymbol{r}|)(\boldsymbol{r}^\wedge + \textbf{AGA}(\boldsymbol{r}^\wedge, \boldsymbol{v}_2)), \tag{19}$$

where $\boldsymbol{r} = \boldsymbol{r}_2 - \boldsymbol{r}_1$.

The occurrence of **AGA** in (19) causes that the force does not have to be collinear with $\boldsymbol{r}$. That is why we say that the interaction is attractive if

$$\boldsymbol{F}_{21}\boldsymbol{r} \leq 0, \tag{20}$$

and repulsive otherwise. Note that

$$\big(\boldsymbol{v} \times (\boldsymbol{e} \times \boldsymbol{v})\big)\boldsymbol{e} = v^2 - (\boldsymbol{e}\boldsymbol{v})^2 \geq 0,$$

$$\textbf{AGA}(\boldsymbol{e}, \boldsymbol{v})\boldsymbol{e} \geq 0, \tag{21}$$

whence we infer that **AGA** does not matter to (20). Therefore, if the signs of the gravitational masses are identical or one of them is zero, the force is attractive, and otherwise it is repulsive. Let us add that if $\boldsymbol{v}_2$ and $\boldsymbol{r}$ are collinear, we get

$$F_{21} = -\Gamma m_1 m_2 \gamma(v_1)\gamma(v_2)\rho(|\boldsymbol{r}|)\boldsymbol{r}^{\wedge}. \quad (22)$$

This implies that gravitational repulsion between two massive particles that move along the line that connects them holds if and only if the product of their gravitational masses is negative.

Concluding the section, we would like to note that this theory is flexible enough to explain, in principle, any experimental data (without Einstein's equivalence that leads to non-existent curved space-time). If necessary, the structure of gravitational waves and info-mechanical rules may be modified (e.g., by adding back amplitudes, cf. Section 31.). You could eliminate gravitational repulsion by taking for granted that gravitational masses of massive particles are always positive. Assuming that gravitational and inertial masses are identical, you might even obtain a quantum gravity theory consistent with weak equivalence, Lorentz transformations and Mach's principle (Einstein's equivalence is at odds with most of the formulations of the latter). Nevertheless, we do not recommend it because the results should be in line with experience.

11 Gravity generated by massless particles

Suppose that a particle q_2 satisfies the conditions of Section 9., and a massless particle q_1 has a gravitational mass m_1. Analogously, we obtain that a force $\boldsymbol{F}_{21}$ acts on q_2; the only difference is that now it is always attractive. Indeed, as $s = 0$, we get instead of (19), using (17),

$$\boldsymbol{F}_{21} = \frac{-\Gamma E|m_2|\gamma(v_2)\rho(|\boldsymbol{r}|)(\boldsymbol{r}^{\wedge} + \mathrm{AGA}(\boldsymbol{r}^{\wedge}, \boldsymbol{v}_2))}{c^2}, \quad (23)$$

where E is the energy of q_1. You see that gravitational field consists, in essence, of two distinct fields that enjoy different quanta. The one with spin-0 gravitons has solely an attractive effect, and that with spin-2 ones can act attractively as well as repulsively. The former is of particular importance for the theory of [2].

Let us recall that according to GUN the objects contained in our universe are usually monochromatic, while those of our supercosmos are electrically neutral. And — although in [2] we could not say it clearly — $U1s$ (which belong to the mother world $U0$) should enjoy zero gravitational masses.

In $U0$ there are also gravitons that form residual gravity. This implies difficulty (whenever (2) holds) because if, e.g., our $U1$ would like to fall apart into two objects with nonvanishing gravitational masses m and $-m$, spin-2 gravitons would help it in this by acting repulsively. Fortunately, as we have said in [2], in $U0$ the only admissible values of constants are 0, 1, and ∞. Thus the free gravitons of the cosmos have to have the zero spin, whence the gravity between its objects — if they had non-zero gravitational masses — would be attractive. (And now you can see that the graviton spin of 2 instead of 1 plays a role.)

The function ρ can be defined differently in distinct universes. In the mother world the infinite values are acceptable, whence ρ does not need to be continuous. All indicates that in $U0$ it is defined by

$$\rho(r) = \frac{r}{1 - \mathrm{sgn}(r)}.$$

Thanks to this, those decays are excluded, even as a result of arbitrarily far quantum leaps. The asymptotic freedom ensures that during collisions the free gravitons do nothing either. On the other hand, gravitational quanta with nonzero spin which work inside $U1s$ protect them from annihilation.

In Section 21. of [2] we have said that residual gravity is somewhat similar to magnetism, but no field is felt by the objects of $U0$. We can now explain why this is true. Well, unlike photons, gravitons do not carry energy, and consequently no 'gravity-magnetic' force has ever been discovered (however, cf. Section 24.).

In Section 25. of [2] we have also claimed that there are no bombardments in $U0$. This is correct, but only from the standpoint of the internal observer. Indeed, if a free graviton of $U0$ gets in a $U1$ at a time t, the external one can record an increase of energy by virtue of the uncertainty principle. On the other hand, the internal one does not know the time, so in this case the intercosmic communication is actually impossible.

12 Gravity felt by massless particles

Let us denote by $\boldsymbol{p}_{ij}(t)$ an approximation of the momentum obtained at time t by the particle q_i under the gravitational influence of the particle q_j. As in Section 9., we may assume that $\boldsymbol{p}_{ij}$ is differentiable, and $\Delta\boldsymbol{p}/\Delta t$ approximates its derivative $\dot{\boldsymbol{p}}_{ij}$. As before, we postulate that it fulfills our definitions of GEN and AIM. By (14) and (18) we get

$$\dot{\boldsymbol{p}}_{21} = \mathrm{AIM}(\boldsymbol{r}^\wedge, \boldsymbol{v}_2, m_2, 2S\mathrm{ir}(m_1))\mathrm{GEN}(|\mathrm{Sir}(m_1)\boldsymbol{v}_1|, m_1, |\boldsymbol{r}|),$$

where $\boldsymbol{r}$ is the difference of location vectors of q_2 and q_1, and

$$\dot{\boldsymbol{p}}_{21} = \Gamma\mathrm{SNS}(m_2, 2S\mathrm{ir}(m_1))|m_2|\gamma(v_2, m_2)[\![m_1]\!]\gamma(v_1, m_1)\rho(r)(\boldsymbol{r}^\wedge + \mathrm{AGA}(\boldsymbol{r}^\wedge, \boldsymbol{v}_2)). \quad (24)$$

The particle q_2 may be at any event, since the field generated by q_1 acts everywhere. If q_2 is massless, we obtain

$$\dot{\boldsymbol{p}}_{21} = -\Gamma|m_2|[\![m_1]\!]\gamma(v_1, m_1)\rho(r)(\boldsymbol{r}^\wedge + \mathrm{AGA}(\boldsymbol{r}^\wedge, \boldsymbol{v}_2)). \quad (25)$$

Of course, it is no force in this case. By (21), as the primary mass is positive, one gets

$$\dot{\boldsymbol{p}}_{21}\boldsymbol{r} < 0. \quad (26)$$

i.e., the interaction is always attractive. Summarizing this thread, gravity between two particles is repulsive if and only if their gravitational masses have different nonzero signs. This also justifies, inter alia, why we have assumed that the gravity masses of massless particles are complex numbers; they do not have signs.

13 Gravitational deflection of particles

In the section we study the deflection of a particle q with gravity mass m and inertial mass m_0 in the relatively weak gravitational field generated by a massive q_1 with positive gravitational mass m_1. The former comes in from infinity, passes q_1 at the minimum distance b, and again recedes towards infinity [52]. Our goal is to determine the deflection angle α between the final directions in the presence and absence of the field (and any other forces in both cases).

We assume that b is sufficiently large, which implies that the magnitude of the velocity $\boldsymbol{v}$ of q (denoted below by v) is constant, and its direction changes slightly. Note that $\mathrm{AGA}(\boldsymbol{e}, \boldsymbol{v})$ is a combination of $\boldsymbol{e}$ and $\boldsymbol{v}$, whence we may assume that an approximate trajectory of q lies in a plane. We use this in Fig. 2., where q moves along the x-axis, and the effect of the deflection is presented on the y-axis. Fig. 2 does not show time, but we apply the relationships

$$x = v_x t,$$
$$y = b + v_y t.$$

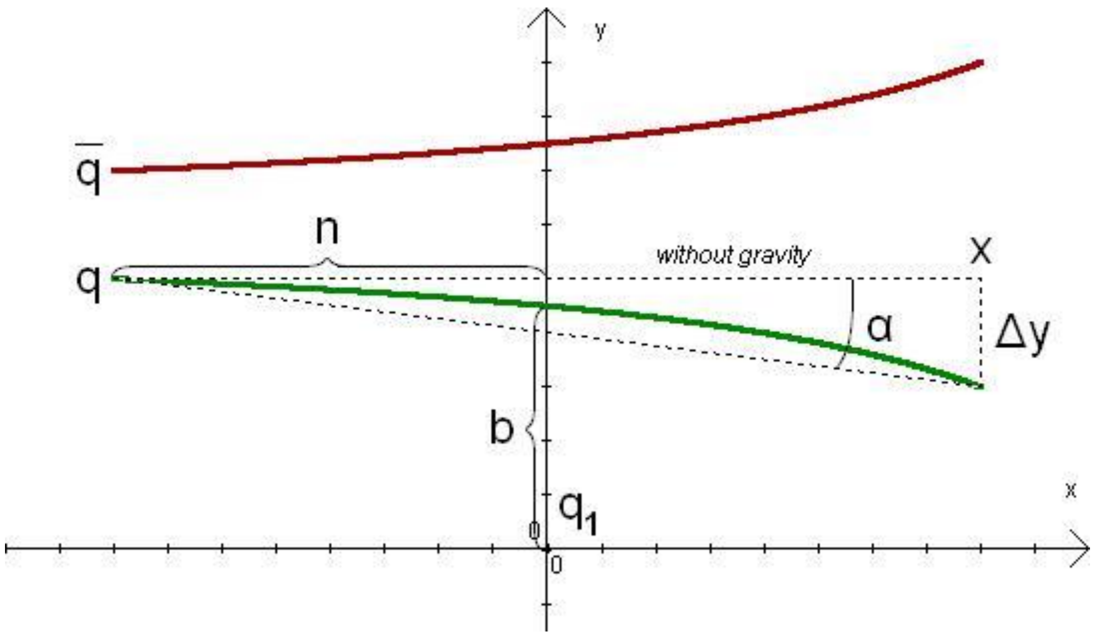

Fig. 2. Gravitational deflection of particles.

As b is great, the deflection is tiny, i.e., $\alpha \cong \mathrm{tg}\alpha$, and — of course — the same holds for all smaller angles. This implies that in Fig. 2. we have

$$\alpha \cong \frac{\Delta y}{x+n},$$

that is, for the actual α whenever $0 \ll n \ll x$ (n can be fixed),

$$\alpha \cong \frac{\Delta y}{x} = \frac{\Delta v_y}{v_x} = \frac{\widehat{m}\gamma(v,m)\Delta v_y}{\widehat{m}\gamma(v,m)v_x}, \tag{27}$$

where

$$\widehat{m} = m_0 + \frac{c^2 \mathrm{Im}(m)}{v^2}.$$

As one has

$$E = pv \tag{28}$$

whenever q is massless, it is easy to check that the momentum of q equals $\widehat{m}\gamma(v,m)\boldsymbol{v}$. Hence, (27) yields [cf. 52], for the momentum components of q and sufficiently large x, the crucial dependence

$$\alpha \cong \frac{\Delta p_y}{p_x}. \tag{29}$$

Since b is big, p_x remains essentially unchanged, and

$$p_x \cong \widehat{m}\gamma(v,m)v. \tag{30}$$

As q_1 is massive, we may assume that its velocity vanishes. Thus from (24) and (16) we get

$$\frac{\Delta \boldsymbol{p}}{\Delta t} \cong \frac{\Gamma \mathrm{SNS}(m,2)m_1|m|\gamma(v,m)(\boldsymbol{r}\hat{} + \mathrm{AGA}(\boldsymbol{r}\hat{},\boldsymbol{v}))}{r^2},$$

$$\frac{\Delta \boldsymbol{p}}{\Delta t} \cong \frac{-\Gamma \mathrm{sgn}(2S\mathrm{ir}(m)+1)m_1|m|\gamma(v,m)\left(\boldsymbol{r}\hat{} + \dfrac{\boldsymbol{v}\times(\boldsymbol{r}\hat{}\times\boldsymbol{v})}{c^2}\right)}{r^2},$$

Because p_z is also unchanged, $\Delta p_y/\Delta t$ satisfies the same formula with the vectors replaced by scalars. Since the gravitational field is weak, we assume — as in [52] — that $r_y \cong b$ throughout the whole process. Thus we get

$$\Delta p_y \cong \int_{t=-\infty}^{t=\infty} \frac{\Delta p_y}{\Delta t}dt \ \propto \ \int_{t=-\infty}^{t=\infty} \frac{\dfrac{b}{\sqrt{b^2+v^2t^2}} + \dfrac{bv^2}{c^2\sqrt{b^2+v^2t^2}}}{b^2+v^2t^2}dt.$$

The integral is equal to

$$b\int_{t=-\infty}^{t=\infty} \frac{c^2+v^2}{c^2(b^2+v^2t^2)^{3/2}}dt = \frac{2\left(1+\dfrac{v^2}{c^2}\right)}{bv},$$

so we obtain

$$\Delta p_y \cong \frac{-2\Gamma \mathrm{sgn}(2\mathrm{Sir}(m)+1)m_1|m|\gamma(v,m)\left(1+\dfrac{v^2}{c^2}\right)}{bv},$$

and using (29) and (30)

$$\alpha \cong \frac{-2\Gamma \mathrm{sgn}(2\mathrm{Sir}(m)+1)m_1|m|\left(1+\dfrac{v^2}{c^2}\right)}{\widehat{m}bv^2}.$$

The minus sign indicates that the deflection is directed along the negative y-axis (i.e., the interaction is attractive) unless q is massive and $m_1 m < 0$.

As the field is weak, the energy of q remains unaltered, i.e., $\mathrm{Re}(m)$ vanishes if the particle is massless (it is fresh, since we do not consider fields generated by other particles). Hence we obtain

$$\alpha \cong \frac{-2\Gamma m_1(\mathrm{Re}(m)+\mathrm{Im}(m))\left(1+\dfrac{v^2}{c^2}\right)}{\widehat{m}bv^2}.$$

Now suppose that we have an object of gravitational mass M that is the sum of masses of particles similar to q_1. If the minimum distance b between it and q is sufficiently large, its shape does not matter. It can even rotate provided that the speeds of its particles are small. We may assume that the total interaction between the object and q is the sum of elementary interactions. Thus we get

$$\alpha \cong \frac{-2\Gamma M(\mathrm{Re}(m)+\mathrm{Im}(m))\left(1+\dfrac{v^2}{c^2}\right)}{\widehat{m}bv^2}. \tag{31}$$

This is a generalization of the formula obtained in Einstein's theory. Indeed, if

$$\mathrm{Re}(m) + \mathrm{Im}(m) = \widehat{m},$$

(i.e., the inertial mass of q either equals its gravitational mass or vanishes with $v = c$) the deflection is always directed towards the object, so we are only interested in its absolute value and we may skip the minus sign. Then one has

$$|\alpha| \cong \frac{2\Gamma M\left(1+\frac{v^2}{c^2}\right)}{bv^2}.$$

In the case of $v = c$ we get a value twice greater than the amount expected from Newtonian gravity, i.e.,

$$|\alpha| \cong \frac{4\Gamma M}{bc^2},$$

which coincides with one of the key predictions of general relativity [1]. Thus the spectacular experimental verification of this effect during the 1919 total solar eclipse [53] confirms AGA as well.

The checking of (31) for massive particles may not be easy. However, we will expect it with peace of mind because **AGA** can be arbitrarily modified if necessary. For instance,

$$\mathrm{AGA}(\boldsymbol{e}, \boldsymbol{v}, m) = \frac{\boldsymbol{v} \times (\boldsymbol{e} \times \boldsymbol{v})}{\gamma(v, m)c^2}$$

ensures that the deflection of matter is close to the values predicted by Newton's theory. Note also that by putting $\mathrm{AGA}(\boldsymbol{e}, \boldsymbol{v}) = \boldsymbol{0}$ you could remove the multiplier in brackets from (31), and then compliance with Newton would be full.

14 Gravitational frequency shift

Consider a massless particle q with gravitational mass m in the gravitational field generated by q_1 with vanishing speed and gravitational mass m_1. q has been created in a vicinity of q_1 and recedes from the latter along a straight line with the speed v. If the travel time T is short, $\rho(r)$ remains nearly constant. The same goes for m_1 and, by virtue of the clause 'whereby' in (ii), $|m|$. Using (25) we obtain that the change $\Delta\boldsymbol{p}$ of the momentum $\boldsymbol{p}$ of q satisfies

$$\frac{\Delta \boldsymbol{p}}{\Delta t} \cong -\Gamma\rho(r)|m_1 m|.$$

Since this is approximately constant, the change during the whole travel equals

$$\Delta\boldsymbol{p} \cong -\Gamma\rho(r)|m_1 m|T.$$

The momentum of q is reduced because, according to (26), the interaction is attractive.

As in the previous section, we may replace m_1 by the gravitational mass M of a large object. If it is Earth, $\Gamma\rho(r)M$ can be replaced by the gravitational acceleration g, which gives

$$\Delta\boldsymbol{p} \cong -g|m|T.$$

Using (28) and (6), we get

$$\Delta E \cong -g|m|Tv = -g|m|l = \frac{-gEl}{c^2} = \frac{-g\omega\hbar l}{c^2}, \tag{32}$$

where l is the distance traveled by q, and E and ω are its initial parameters. In this fashion, we obtain the gravitational redshift confirmed experimentally in [54, 55].

The question arises regarding gravitational blueshift. Well, the situation is not symmetrical. The energy of a photon can be always reduced preserving $|m|$ and (4) because it suffices to increase $\mathrm{Re}^2(m)$. However, the reverse action cannot be carried out if $\mathrm{Re}(m)$ vanishes. Thus a fresh photon does not change its frequency (the clause 'provided' of (ii) works) when it moves in line with a gravitational field. On the other hand, if it is tired after overcoming the field, its energy can be recovered. After it has been turned back without colliding (e.g. when trying to escape from a black hole, cf. Section 17.), the gravitational blueshift should be observed. Let us add that if the blueshift of a fresh particle was possible, (ii) could be easily modified (that clause would be omitted, and 'unaltered' would be replaced by 'undiminished').

In this context, it is worth quoting from [56]: "The classical phenomenon of the redshift of light in a static gravitational potential, usually called the gravitational redshift, is described in the literature essentially in two ways: On the one hand, the phenomenon is explained through the behavior of clocks which run faster the higher they are located in the potential, whereas the energy and frequency of the propagating photon do not change with height. The light thus appears to be redshifted relative to the frequency of the clock. On the other hand, the phenomenon is alternatively discussed (even in some authoritative texts) in terms of an energy loss of a photon as it overcomes the gravitational attraction of the massive body. This second approach operates with notions such as the 'gravitational mass' or the 'potential energy' of a photon and we assert that it is misleading."

To clarify this, note that general relativity does not contain any mechanisms that enable to directly change the frequency of photons under the influence of gravity. Instead, as such a change is being detected in experiments, they say that it just seems to us, and we are urged to look for clocks. However, probably no one will deny that clocks can, along various paths, move in the potential, so their delays are able to become different. Consequently, the association of a photon with two clocks may not be unambiguous, and the same experimenter can have many distinct frequency shifts of the same photon. Thus the clock interpretation is not the simplest possible, and experienced researchers are entitled to have doubts. To be formally fine, they mention general relativity, and then they refer to Newton's theory.

Nevertheless, the latter does not contain such mechanisms either (and in this aspect the authors of [56] are right). Potential energy is defined via work, the latter via force, and the last concept makes no sense when applied to massless particles. Thus the gravitational redshift oversteps the bounds of Newtonian mechanics.

In AGA everything is logically correct and completely consistent with experience. Using the notion of gravitational mass is not an ad hoc action; we have said in Section 2. that all particles have the gravitational charge (sometimes equal to zero if they are not fundamental and (2) holds). In particular, gravitons transmit momentum to photons exactly as they do it to massive particles. Thus the gravitational change of energy is real, and no clocks are needed. Note that in the derivation of (32) we have not used those concepts of classical physics. And the experiments of Pound, Rebka, and Snider have been confirming (32), since time was not compared.

15 Quantum gravity changes quantum probabilities

At this point you might say: It is true that they did not measure time, but a number of successful experiments have been conducted to confirm gravitational time dilation. Well, we know that, but the problem is that those results can be explained in a different (and more correct) way. To demonstrate this, we introduce the next rule of info-mechanics.

✱ (iv) (*Probabilities.*) If a massive particle q with gravitational mass m is at the target of a gravitational wave G with infinite speed, spin s, pinnacle P, and range r, and without gravity the probability of a reaction that spontaneously reduces the energy of q is equal to p, then after taking into account G the current probability is increased by

$$\Delta p = \text{PRO}(m, s, P, r, p),$$

where PRO is a real function, whereby after taking into account all gravitons the sum should be, if necessary, reduced to 1 (immediate reaction) or increased to 0 (no reaction).

Gravitons are entitled to alter the probability because the reaction may change the distribution of energy related (via inertial mass) to gravitational charge. As p is always the probability without gravity, the resultant one does not depend on the graviton sequence.

As the first approximation of PRO, we suggest to multiply its parameters or their signs (of two first). More precisely, we put

$$\text{PRO}(m, s, P, r, p) = \frac{-\text{sgn}(ms)Prp}{c^2}. \tag{33}$$

This is very simple and seems to be in line with experience.

Consider two massive particles q and q_1 that move at small relative velocities. From (14) it follows that under the influence of the latter (other particles are neglected) the probability of the spontaneous reaction of the former equals approximately

$$p\left(1 - \frac{\text{sgn}(m)m_1\Gamma\rho(r)r}{c^2}\right).$$

If their gravitational masses have the same sign, we get

$$p\left(1 - \frac{\Gamma m_1\rho(r)r}{c^2}\right) \quad (34),$$

i.e., the probability decreases.

Now suppose that we have a particle q_0 in the laboratory on the surface of Earth, and similar q_1 on a plane that flies at height h. From (34) and (iv) it follows that in Earth's gravitational field their probabilities are equal to, correspondingly,

$$p_0 = p\left(1 - \frac{\Gamma\sum_{q\epsilon\text{Earth}} m_q\rho(r_q)\,r_q}{c^2}\right),$$

$$p_1 \cong p\left(1 - \frac{\Gamma\sum_{q\epsilon\text{Earth}} m_q\rho(r_q + h)\,(r_q + h)}{c^2}\right),$$

where m_q is the gravitational mass of q, and r_q is the distance between q and q_0. Hence we get

$$\Delta p \cong p_1 - p_0 = \frac{p\Gamma \sum_{q\epsilon \text{Earth}} m_q \rho(r_q) r_q - m_q \rho(r_q + h)\,(r_q + h)}{c^2}.$$

Using (16) we may assume that $\rho(r_q) = 1/r_q^2$ for $r_q > \varepsilon$, which gives

$$\Delta p \cong \frac{p\Gamma}{c^2} \sum_{q\epsilon \text{Earth}, r_q > \varepsilon} \frac{m_q h}{r_q (r_q + h)}.$$

Because, in general, $h \ll r_q$, we obtain

$$\Delta p \cong \frac{ph\Gamma}{c^2} \sum_{q\epsilon \text{Earth}, r_q > \varepsilon} \frac{m_q}{r_q^2}.$$

$$\Delta p \cong \frac{phg}{c^2},$$

where g is gravitational acceleration. You see that $p_1 > p_0$.

If time is measured with clocks that use particles similar to q_0 and q_1, the earthly clock will show a number T_0 of 'ticks' less than T_1 shown by its flying twin after returning or sending a radio signal. We have to have

$$\frac{T_0}{T_1} \cong \frac{p_0}{p_1}. \tag{35}$$

This implies

$$T_1 p_0 \cong T_0 \left(p_0 + \frac{pgh}{c^2}\right),$$

$$T_1 \cong T_0 \left(1 + \frac{pgh}{p_0 c^2}\right). \tag{36}$$

As $p > p_0$, the earthly clock will be lagged behind by at least

$$\Delta T = \left(\frac{gh}{c^2}\right) T_0.$$

Because Earth's gravitational field is relatively weak, we may assume that $p \cong p_1$ (the equality of p and p_0 would be too far-reaching, as it would imply the same for p_1 and p_0), which, by (36) and (35), gives

$$T_1 \cong T_0 \left(1 + \frac{T_1 gh}{T_0 c^2}\right),$$

$$T_1 \cong T_0 + \frac{T_1 gh}{c^2},$$

$$T_1 \cong \frac{T_0}{1 - \frac{gh}{c^2}}.$$

As $gh \ll c^2$, we get

$$T_1 \cong T_0 \left(1 + \frac{gh}{c^2}\right),$$

which yields the delay ΔT. It was corroborated (after eliminating various background effects) by the experiments of [57-59].

It is important that those experiments have been performed with the help of atomic clocks that work on the basis of quantum physics. Hence, they should be interpreted in the framework of a quantum theory. On the other hand, in general relativity gravitational time dilation is sometimes considered to be a difference in the passage of proper time at distinct events. However, proper time does not exist in fact because quantum particles (included in these clocks) do not enjoy trajectories. Thus quantum physicists should rather talk about probabilities (or time measured by specific, perhaps imperfect, clocks) in this context (cf. Fig. 3.).

Physics	*Most important quantities*			*Picture of*		*Transformations*
	number	*vector*	*common*	*matter*	*radiation*	
classical	time	force	energy	trajectory	wave	Galileo, Lorentz
quantum	probability	momentum	energy	wave of probabilities		Lorentz, intercosmic

Fig. 3. Fundamental quantization of physical theories.

It is worth noting that (iv) works even if the probabilities are equal to 0 or 1. Consider an ideal optical clock with "a single, motionless atom, unperturbed by any interactions with other atoms or the environment" [60]. If there is no gravity, the clock is ticking with 100% accuracy. Strictly speaking, there is a constant T such that if a tick was at T_0 of coordinate time, the probability of a tick during $(T_0, T_0 + T)$ is equal to 0, and starting from $T_0 + T$ it becomes equal to 1. With gravity generated by regular matter the zero probabilities remain unchanged, whereas those equal to 1 become slightly smaller. As a result, the clock is late. On the other hand, if the atom belongs to antimatter, by virtue of (33) the zero probabilities become somewhat larger, while the ones equal to 1 remain the same. Consequently, the clock is fast.

It is possible to replace (33) by

$$\text{PRO}(m, s, P, r, p) = \frac{-Prp}{c^2}.$$

In this case the anti-atomic clock would also be late. The formula is more in line with general relativity, but we prefer (33) because it 'sees' antimatter and due to this it can lead to fascinating applications. For we predict that in several decades' time (after launching super large colliders) antimatter will be available on Earth much more widely than it is today. Then we will be able to construct a *binary clock* that consists of two parts of which one is made of regular matter and the other of antimatter. After averaging, it will give (maybe almost) exact time (e.g., consistent with time in Houston) everywhere. In the era of widespread spaceflights this may be vitally important.

Now we would like to consider the issue of the 'age' of the Earth center [61, 62]. The authors of [62] confirm everything we have written about. They admit that this is a quantum problem because "fewer radioactive decays of a particular specimen have taken place in the Earth center than on its surface." Then they write "arguments based on symmetry will convince (…) that there is no gravitational force at the Earth center. Consequently, such an effect cannot be due to the force itself…" At this point they authoritatively explain that this is caused by "gravitational potential energy being the radial integral of the force." We are sorry, but the clarification looks like something out of the core of Newtonian physics.

You may therefore ask what is happening in that place from a quantum point of view. One sees easily that at the center of Earth the gravitational increase of momentum (not force, exactly speaking) actually vanishes because it is a vector quantity, and AIM depends on gravitational wavevector. On the other hand, probabilities depend on a quantity that is called *gravitational randomization* and defined by

$$R(\boldsymbol{r},t)=\sum_{G\rightsquigarrow(\boldsymbol{r},t)}\frac{s_G P_G r_G}{2c^2},$$

where s_G, P_G, and r_G are the spin, pinnacle , and range of a graviton wave G with infinite speed, and the symbol $\rightsquigarrow$ should be read as 'has the target.' This notion is always well-defined because our universe enjoys a finite number of massive particles at every instant of observer zero[5]. If without gravity the probability of a spontaneous reaction of a massive q at $(\boldsymbol{r},t)$ would be equal to p, then after taking into account gravity it equals

$$\min\big(\max\big(p\big(1-\mathrm{sgn}(m)R(\boldsymbol{r},t)\big),0\big),1\big), \tag{37}$$

where m is the gravitational mass of q. The positive randomization can be reduced only if there is antimatter. As in the case of the Earth its amount is negligible, the randomization in the center is larger than on the surface. And, according to (37), the greater positive randomization implies less probabilities of quantum reactions.

Let q_0 and q_1 be similar particles at the center and on the surface of our planet correspondingly. Because Earth's rotation speed is relatively low, by virtue of (14) the probability of the decay of the former equals

$$p_0=p\left(1-\frac{\Gamma\sum_{q\epsilon\mathrm{Earth}}m_q\rho(r_q)\,r_q}{c^2}\right),$$

where m_q is the mass of q, and r_q is the distance between q and q_0.

Now consider the case of q_1. The distance between q and q_1 is equal to, on average, to $2.17r_q$ (obtained by computer simulation; it does not depend on the radius of the sphere). Acting carefully, we take 2 instead of 2.17 and get

$$p_1=p\left(1-\frac{\Gamma\sum_{q\epsilon\mathrm{Earth}}m_q\rho(2r_q)\,2r_q}{c^2}\right),$$

$$\Delta p\cong p_1-p_0=\frac{p\Gamma\sum_{q\epsilon\mathrm{Earth}}m_q\rho(r_q)r_q-m_q\rho(2r_q)\,2r_q}{c^2},$$

and using (16)

$$\Delta p\cong\frac{p\Gamma}{c^2}\sum_{q\epsilon\mathrm{Earth},r_q>\varepsilon}\frac{m_q}{2r_q}.$$

Assuming that on average $r_q=R/2$, where R is the Earth radius (for q such that r_q is close to $R/2$ the computer simulation gives $2.13r_q$), we obtain

[5] This follows from the facts that the number of types of fundamental particles and the energy of the universe are finite, and the inertial masses of neutrinos cannot be smaller than a positive number.

$$\Delta p \cong \frac{p\Gamma}{Rc^2} \sum_{q\epsilon \text{Earth}, r_q > \varepsilon} m_q,$$

$$\Delta p \cong \frac{p\Gamma M}{c^2 R},$$

where M is the mass of Earth, and, analogously as before, one gets

$$T_1 \cong T_0 \left(1 + \frac{p\Gamma M}{p_0 c^2 R}\right),$$

which — as $\Gamma M/R \ll c^2$ — gives the delay of the center

$$\Delta T = \left(\frac{\Gamma M}{c^2 R}\right) T_0,$$

or, using the surface acceleration $g = \Gamma M/R^2$,

$$\Delta T = \left(\frac{gR}{c^2}\right) T_0,$$

where T_0 is the age of the Earth equal to $4.54 \cdot 10^9$ years, which yields

$$\Delta T = 3.16 \text{ years.} \tag{38}$$

You see that the center of our planet is 'younger' by this value.

Let us compare this result with those of [61, 62]. First of all, we must say that Feynman, who inferred that the center of the Earth should have been by a day or two younger than its surface, was wrong. We agree with the authors of [62] that "even geniuses make mistakes," and we confirm their calculation, at least in order of magnitude. Using just general relativity, for the homogeneous Earth (assumed also in our analysis) they have obtained 1.58 years which is two times smaller than (38). After taking into account the Earth density profile they have got a more realistic result (2.49 years) which is still less than ours, and we have reserves.

As we have already said, quantum phenomena should be examined using quantum theories that do not refer to force and related concepts (see Fig. 3.). However, maybe in the future we will be able to send a probe deep into the Earth and solve this issue experimentally.

In AGA atomic clocks attempt to measure coordinate time (it is the only time), but gravity bothers them and that's why they are running late in the gravitational field. This follows exactly from (iv). However, it doesn't have to be about cuckoo clocks. Similarly, people who fly in airplanes do not have to be older than those who remain on Earth. It depends on the quantum reactions taking place within them.

We show that modern technology already makes it possible to build quantum clocks that are more accurate than atomic clocks. Our device is located at the equator[6] and consists of two parts: a daylight sensor and an atomic clock. Every day at dawn, the former resets the latter and starts displaying the time $t_0 + t$, where t_0 depends on longitude, and t is taken from the atomic clock. Of course, the time 24:00:00 is converted to 00:00:00 and the date is updated.

Let's compare the readings of our combo clock with the readings on another atomic clock next to it. If after a year the latter has a delay of D, the former only lags by

[6] This requirement is not necessary, but elsewhere on the Earth's surface a better computer would be needed, and near the pole our clock would be less accurate.

(approximately) $D/365$. And if someone had installed these clocks just after the Earth's formation, the atomic clock would now be at least two days (D times the age of the Earth) behind, while ours would still be a tiny fraction of a second behind.

The clock does not violate Einstein's equivalence, but it begins to reach into what is generally known as Mach's principle, and thus it gives a more correct time. It seems that a truthful gravity theory should refer to this principle in some way.

Obviously, the combo clock is not very handy and has a limited scope of application. This is, in essence, a thought experiment. Nonetheless, it suggests that the above-described binary clock can exist and fulfill the task better.

To conclude this section, we examine the behavior of these clocks based on general relativity. It is commonly assumed that atomic clocks show (apart from some side effects) time that is slowed down under the influence of the gravitational potential [62]. (It has been argued that, after all, atomic clocks measure the correct time.) It's clear this can't be proper time, so it is coordinate time. Indeed, this follows from the foundations of general relativity (gravity shapes not only space but also time).

If the assumption about atomic clocks were true, everything would be fine. We would have $D = 0$, and both clocks would work in full unison. Nevertheless, we demonstrate that there is a serious problem here.

Suppose that the second pair of such clocks was installed (also right after the Earth's formation) on a space station hovering above the first at a constant height h. Let's look at the current readings of all the clocks.

The day on the station can start at a different time than on Earth, but the difference is constant. It is easy to see that the combo clocks show the same number of days, and this is naturally the correct coordinate time. If the assumption is true, the upper atomic clock displays the same result. On the other hand, we know that the lower atomic clock has to be at least two days late (you can calculate it by putting $h = 12$ km and using the above formulas)[7]. Hence it cannot show coordinate time which flows just like at the station. (If time moved slower at the bottom, at some point it would be noon there, while it would be midnight at the station, or vice versa. This would be a ridiculous situation.)

One sees that the atomic clocks cannot fulfill the assumption simultaneously. They can only do this for one value of the gravitational potential, and one must obviously assume that this value is zero. This implies they always behave exactly as AGA predicts!

The situation is even worse (for Einstein's theory). If you find some other clock and claim that it works according to general relativity, using this reasoning we will be able to show again that it is simply running late in the gravitational field. You see that clocks that measure time according to Einstein's approach do not exist.

In the thought experiment we have identically constructed clocks that display the same time (contrary to [(4) of 62] based, using the methods of classical physics, only on weak equivalence and special relativity, and assimilated by general relativity), although they are experienced by distinctly different gravitational potentials. And conversely, two correct clocks next to each other show different times.

Suppose an observer (probably a robot or even a network of them) is on the Sun. They are able (e.g., using a sufficiently sensitive detector to detect particles emitted by Earth) to see our planet. Hence, by observing the space station (which could additionally emit something), they can measure time in Earth days (or hours, multiplying by 24) and, of course, they obtain the same value. Therefore, even on our star time passes at the same pace as on Earth, while according to general relativity the former should currently be

[7] Measuring time in, e.g., hours changes nothing. The combo clocks display the same value.

delayed by thousands of years [62]. And it would be practically inexplicable if the same did not apply to other orbital motions.

The Sun emits neutrinos that can penetrate the entire Earth. Their direction relative to our planet (if we assume it doesn't rotate) is different during the day and at night. Thus a combo clock with a neutrino detector placed at the center of the Earth can again measure time consistent with that on the surface, while general relativity predicts that the former is currently delayed by more than two years [62]. This case has a very general significance because the universe is saturated with neutrinos (they also penetrate black holes). And that is why — among other things — time flows at the same pace everywhere (of course, we omit the effects from special relativity without any equivalence principle).

Some experts were aware of these difficulties. For instance, we now understand why Feynman made the mistake in his calculations. He probably felt intuitively that something was erroneous here and he tried to minimize the evil symptoms.

It is now clear that the conception of time (whence also curved space-time) contained in general relativity is fundamentally wrong. The slowing down of time (used to build space-time) under the pull of gravity is a fiction. In our opinion, this mistake is related to the fact that Einstein's theory does not satisfy Mach's principle. Consequently, it neglects the possibility of measuring time using astronomical observations, and their results are typically — as in the examples — independent of the observer gravitational potential. And this error clarifies why it was so difficult to find a quantum theory of gravity; quantum reality has defended itself against contact with a classical theory that is not even approximately true.

Einstein understood that a correct theory of gravitation should have fulfilled Mach's principle, but he failed to do so. As he absolutely wanted to do something about this gravity, he took a shortcut. You may see the effects of this now.

16 The speed of light

The following rule of info-mechanics (with a nonzero VEL) is optional; we do not use it outside of this section.

✱ (v) (*Velocity of massless particles.*) In vacuum under O_0, the instantaneous group speed of massless particles measured at $(\boldsymbol{r}, t)$ is equal to

$$c(1 + \text{VEL}(\boldsymbol{r}, t)),$$

where VEL is a nonnegative function.

For example, we might put

$$\text{VEL}(\boldsymbol{r}, t) = \ln(1 + |R(\boldsymbol{r}, t)|). \tag{39}$$

If it is true, although a photon moves at the group speed c in vacuum without gravity, in the presence of this field light travels faster. This is possible because $\text{Sir}(m)$ equals 0 whenever $\text{Im}(m)$ is positive. On the other hand, massive particles must continue to move at speeds v less than c, since $\gamma(v)$ cannot be infinite or imaginary.

The question is whether the increased speed does not cause contradictions. Note that Tolman's paradox covers signals transmitted at speeds greater than c. Hence even light can cause anomalies. In AGA we are protected against them by the signal encapsulation principle. The recipient of the signal will see the light with an appropriate delay.

The increase in the speed of light will be able to be detected by computers equipped with binary clocks that show coordinate time. This does not have to be true with ordinary atomic clocks. Indeed, suppose that $R = R(\boldsymbol{r}, t)$ is positive and constant in a region of space-time. Then, by virtue of (35) and (37), the transmission time of the light signal, measured by such clocks, is equal to

$$\frac{T}{1-R},$$

where T is the time without gravity. If (39) holds, the factual velocity of the signal equals $c(1+R)$ whenever R is small, so we will get $c(1+R)(1-R)$, i.e., approximately c.

This suggests a way to confirm (v). Since we already know that space-borne atomic clocks are fast, you should use them to measure the speed of light in orbit. Getting a result identical to the earthly one will imply that (v) works (with, maybe, a modified formula for VEL).

According to Einstein's speculations, the speed of light could increase in the gravitational field, for this would allow the distance to be maintained despite the slower flow of time. However, it has no significance for orbital motions which, when combined with rotation, give many of the contradictions described in the previous section. Furthermore, as it seems that the constant c in the Lorentz transformation should not depend on position and time (via gravitational potential), and Einstein did not know the signal encapsulation principle, he may have had one more contradiction here. In AGA this increase is not needed, but we have formulated (v) to illustrate the power of info mechanics.

Let us note in passing that AGA admits also photons that move at group velocities less than c. This can happen when matter disturbs light. One sees that $\text{Sir}(m)$ cannot be replaced by an expression that only compares speeds.

17 Gravitational holes

By *gravitational hole* we mean an open[8] and spatially bounded region of space-time where gravity is so strong that light cannot escape from the hole with probability termed the *quality* of the hole. This definition resembles that of black holes in general relativity [63, 64], but we have removed the word 'even' before 'light'. Furthermore, we talk about the probability providing for the possibility of something like Hawking radiation.

We show that gravitational holes with a quality arbitrarily close to 100% (albeit lower than 100%) exist whenever arbitrarily large masses may be concentrated in bounded regions. Let H be a sphere with radius r. Suppose that a mass M at the center is so big that the gravity generated by other masses can be neglected (or, under some conditions, one may assume that gravity acts as if all the mass of an object were concentrated at the center). If a photon with gravitational mass m moves along the radius from a point s away from the center, where $0 < s < r$, towards the surface of the sphere, by (25) its momentum is reduced (see the clause 'whereby' of (ii)) by at least

$$\Delta p = \Gamma k|m|MT, \tag{40}$$

where T is travel time to the edge, and k is the minimum of ρ in $\langle s, r\rangle$, whence by (28) its energy is decreased by at least

[8] In the topological sense.

$$\Delta E = \Gamma k|m|MTv,$$

where v is its speed. By (5) we obtain

$$\Delta E \geq \frac{\Gamma kEMTv}{c^2},$$

where E is the initial energy of the photon, whence we get

$$\Delta E \geq \frac{\Gamma kM(r-s)}{c^2}E.$$

For sufficiently large M we have

$$\frac{\Gamma kM(r-s)}{c^2} > 1,$$

$$\Delta E > E,$$

so the photon cannot leave H (its energy[9] and momentum will become, at some point, so small that $|m|$-dependent gravity will turn it back preserving its speed magnitude).

Now we show that no photon — regardless of its path — can escape from H whenever it is within the sphere with the radius s. In fact, its momentum is reduced by at least (40) with a greater T. In addition, it is decreased by a portion that corresponds to AGA.. From (25) and (21) it follows that AGA does not help to leave H. Thus it is a gravitational hole with a quality not less than s^3/r^3, as promised.

The question is what happens to the matter contained in a hole. This depends on its chromatic properties that can be determined as follows. First, write on a piece of paper:

light-black-white.

Then check, maybe only theoretically, whether the quality of the hole is not decreased after removal of radiation including gluons (regular matter, antimatter). If this condition holds, cross out the word 'light' ('black', 'white' correspondingly). Finally, remove any unnecessary hyphens and you're done; this is the kind of your gravitational hole (see Fig 4.). If the name includes no hyphens, the hole is *pure*, and otherwise *mixed*.

Name	*In our U2*	*Lifetime*	*Absorbs*	*Main emission*
black	quite common	very long	reg. matter, radiation	antineutrinos
light (color, radio, glue)	rather rare	short	all but pions π^0 etc.	Hawking radiation
white	very rare	long	antimatter, radiation	neutrinos

Fig. 4. Pure gravitational holes.

A particle with inertial mass m_0 and gravitational m is termed *Archimedean* if

$$m_0 \leq |m|.$$

TIM states that all fundamental particles are Archimedean.

We prove that if the hole is black, light-black or light, an Archimedean particle q with positive gravity mass m or a gluon cannot escape (with probability practically equal to that for photons) from the hole. There is a sequence $\{e_n\}$ of events at which there are

[9] It can become exactly equal to zero with vanishing probability (or, if you prefer, you may stipulate in (ii) that the energy cannot be zeroed out). Remember that a photon is trajectoryless.

interventions of fields and particles that change the momentum of q. As our universe has a finite amount of energy, the number of massive particles is finite (see the first footnote in Section 15.). The same applies to colored ones because they occur, except in exceptional circumstances, inside massive ones. The number of photons can be infinite, but in such a case almost all of them act on q extremely poorly. All the particles send intermediate bosons at intervals. Thus in quantum physics we may take for granted that this sequence is finite.

We assume that solely gravity works at the last event e_n. Often this is true right away, and otherwise you may reason as follows: If the escape of q is not random, adding one event (this is possible as the hole is open) just with gravity should not be of significant importance. In fact, it may happen that q escapes only because gravitons are emitted, according to (i), at intervals, but the probability of such a case is negligible.

We have said that massless particles can move with subluminal speeds as well, so we infer that a photon q_1 can travel along the rectilinear path of q after e_n provided that at e_n the changes of momentum fulfill

$$(\Delta \boldsymbol{p})\hat{} = (\Delta \boldsymbol{p}_1)\hat{}.$$

If q is a gluon, it suffices to assume that the gravity mass m_1 of q_1 is equal to that of q. Otherwise, let us put

$$\mathrm{Im}(m_1) = m_0\gamma(v), \tag{41}$$

$$|m_1| = m\gamma(v),$$

where m_0 and v are, correspondingly, the rest mass and the speed of q at e_n. From (24) and the properties of the hole it follows that

$$\Delta p = \Delta p_1 = km\gamma(v),$$

where k is a factor determined by (24). By the formulae

$$E = m_0\gamma(v)c^2,$$

$$p = m_0\gamma(v)v,$$

we get

$$\Delta E = \frac{km\gamma(v)c^2}{v}.$$

By virtue of (28) one has

$$\Delta E_1 = km\gamma(v)v,$$

which gives

$$\Delta E_1 < \Delta E.$$

Since q is not turned back, $\Delta E \leq E$. However, from (41) and (4) it follows that q_1 also has the energy E. Hence we obtain $\Delta E_1 < E$, which implies that q_1 is not turned back either, and the photon escapes from the hole as well, which concludes the proof.

Let us briefly discuss the contents of Fig. 4. Gravitational holes may enjoy all possible colors because light ones can consist of fixed frequency photons (thus radio holes can exist as well). The probability of occurrence of light holes in our $U2$ is small, but we think that in future, using laser technique, they will be able to be created in an artificial way. Similar remarks apply to white holes (they are composed of antimatter), but they may require super large colliders. Obviously, the analysis whether and when the creation of artificial gravitational holes is safe will be necessary.

In our $U2$ black holes can be even stable, whereas the lifetime of light ones is rather short. Because they absorb matter, they quickly transform into light-black holes, and later into black ones. As far as white holes are concerned, in our universe they mainly absorb radiation.

The most interesting and widespread gravitational holes are obviously black [65]. They absorb regular matter and radiation, and emit antimatter that is created due to quantum reactions. The latter consists mainly of antineutrinos because positrons annihilate with electrons before reaching the surface of the hole. Note that the antineutrinos are invisible through optical telescopes (neutrino telescopes will also have difficulties because by (2) antineutrinos are gravitationally repelled by regular matter), so black holes, when viewed from a great distance, look as predicted by Einstein's theory.

By *Hawking radiation* we mean a collection of particles that escape from the hole, although the probability of this fact does not exceed $1 - q$, where q is the quality (so antineutrinos do not belong to it if the hole is black). You see that in AGA the existence of this effect does not need to be specially proved [66, 67].

Concluding the section, we would like to justify once more why gravitons should be info-bearing particles. Well, otherwise they could find it difficult to leave a black hole. As a result, it could act gravitationally less strongly than any star.

18 Event and light horizon

The surface of a gravitational hole is said to be *light horizon*. This term corresponds, of course, to the event horizon of general relativity, but the properties of these concepts are very different.

The most important difference is that — as Hawking and Penrose proved in [26] — some sort of singularity always occurs inside an event horizon, whereas there is no singularity inside a light horizon (and even in the entire space-time). Indeed, the function ρ is continuous, whence it takes only finite values, and — as we have mentioned — in our universe there are only a finite number of massive particles. This implies that their gravitational pull has to be limited. For massless particles the same follows from (17), since the energy of our universe is finite, and by virtue of (16) ρ is bounded.

You may reinforce the result owing to the statement of [2] that there was no singularity in our early $U2$. Consequently, AGA and GUN work calmly, while general relativity breaks down in at least two situations.

In [7] we may read: “Leonard Susskind, a prominent quantum gravity and string theorist at Stanford University,… and his colleagues want to understand what happens at the center of a black hole, and at the moment of the Big Bang.” One sees that AGA and GUN allow you to fully understand those circumstances. However, if anyone was expecting some terrible things to happen there, they may be disappointed.

It is highly likely that the gravitational field at the center of a black hole nearly vanishes, just as in the middle of the Earth. If you forget for a moment about general relativity, you may come to the conclusion that there is nothing strange in this. What's more, we have said that the gravitational randomization is finite at each event. This means that not only space, but also time never breaks down. In this manner AGA shows that black holes can exist without such incredible catastrophes.

According to [68], “a black hole's event horizon is essentially the point from which nothing can return. The name refers to the impossibility of witnessing any event taking place inside that border, the horizon beyond which one cannot see." Avi Loeb, chair of astronomy at Harvard University, adds succinctly [68]: "The event horizon is the ultimate prison wall — one can get in but never get out."

Explanations of this type, written by a wide variety of wise humans, are abundant in the literature. We cite them here because you will see in the next section that there are people who have decided to deny the existence of the event horizon precisely in general relativity.

The absence of the event horizon can occur, without problems, in theories that are essentially different from that of Einstein, and AGA is a good example. Indeed, as antineutrinos constantly escape outside the light horizon, using suitable neutrino telescopes you will be able to witness many events that take place inside it. Nevertheless, you shall not be able to do this with ordinary telescopes (you will see at most a black circle that stands out against the background stars, which has recently been beautifully demonstrated experimentally [69]), and this justifies the term light horizon.

It is not the ultimate prison wall either. For suppose that a spaceship approaches a black hole. If its crew is far-sighted, they should have enough antimatter on board to keep the ship non-Archimedean with a small positive gravitational mass. This ensures that the hole will gently pull the rocket inside. To come back after exploring its center, it is a shame to use fuel. Just throw away some regular matter, and the black hole will push your spaceship out of its depths by itself.

Surely you have noticed that in the above reasoning (2) plays a crucial role. If, instead of it, (1) is fulfilled (or you do not enjoy antineutrino telescopes and a sufficient amount of antimatter), the light horizon becomes an event horizon. However, even in this case AGA shall not lead to any singularities.

19 Gravitational waves of general relativity

This story began in 1969 when a physicist Weber announced that his detector [70] had registered gravitational waves predicted by Einstein's theory. This result was received with disbelief by the scientific community. Attempts were made to confirm it with similar equipment, but nothing was recorded except noise.

The next step was taken in 1974 when Hulse and Taylor discovered a binary pulsar that consisted of a neutron star and a (closer unknown) companion that moved around each other. Later they found [71] that the orbit was gradually shrinking, probably because of the loss of energy (acting 'antigravitationally'[10]) that must have been radiated away from the system. According to general relativity, the only possibility in that case was the emission of gravitational waves, and that option was accepted as an evidence for their existence.

Nonetheless, it should be said that there is also another explanation of the phenomenon. When the system was created, it had roughly equal numbers of neutrinos and antineutrinos. They, by virtue of (2), were gravitationally balanced, and thus the orbit could be relatively large. Then the particles were emitted, but this concerned more antineutrinos than neutrinos because the former were gravitationally repelled by neutrons. Consequently, unbalanced neutrinos remained in the system and they additionally attracted the particles of the two stars, whereas the radiated antineutrinos

[10] However, Einstein's gravity — unlike electromagnetism — cannot have a repulsive effect (see Section 22.).

did not hinder their approaching anymore. As the neutrino surplus grew over time, the orbit of the pulsar was on the decrease.

Moreover, we think that the pulsar may not have lost a significant amount of energy because otherwise this could have caused it to expand or even disintegrate. On the other hand, in our solution the emitted antineutrinos could be easily replaced by, e.g., particles of cosmic radiation. However, the gravitational mass of the pulsar could be considerably increased because you will see below that in the case of neutrinos it is many times greater than their inertial mass. By (19) the gravity between massive particles depends just on the former, so this process is somewhat similar to a star that collapses into a black hole, where the object also decreases in size under the influence of gravity.

In May 2015, an event seemingly unrelated to the section title occurred. The author announced [72] that he had a quantum gravity theory in which there would 'be no event horizons' [73]. A few months later this fact was experimentally confirmed because black holes had started to merge. To be precise, in September 2015 signals sent from their interiors reached the Earth [74-77], and, very fortunately for this story, they turned out to be just the gravitational waves of general relativity. Therefore, using them we will be able — contrary to the name 'event horizon' — to witness events that happen inside black holes.

However, we should be careful. The sources of the signals were completely invisible, but the discoverers explained that, after all, black holes did not shine. That is true, but the experiments [78, 69] showed that the surroundings of black holes should have been visible (at least using radio frequencies), especially that the energy of those gravitational waves was huge [79] (and their speed equaled c). In addition, the explorers seem to have forgotten that in general relativity black holes are defined with the phrase 'even light' instead of just 'light' [63, 64].

Gravitational waves can escape from a black hole only if they either are not subject to gravity or repel themselves from matter. That in itself would be incredibly strange, since they are the ripples of curved space-time (non-existent[11] in line with Section 15.), and its curvature is shaped by gravitation caused by matter. Nonetheless, let us assume that this holds, and inside a spaceship the waves are sent transversely to the direction of travel (transmitters and detectors are mounted on the walls). Without significant participation of gravity the movement of the waves has to be similar to that of light or another radiation. On the other hand, the discovery implies that in a gravitational field they will be deflected differently. Thus comparing their deflection with that of light, the spaceship passengers can distinguish — performing a local measurement — between the gravity pull and the rocket acceleration, which is at odds with Einstein's equivalence.

One seems that the experimenters probably wanted to confirm general relativity, but instead they introduced contradictions to it. As from a purely formal point of view Einstein's theory is fine, I had to react and in [80] I expressed my opinion on this discovery. Nevertheless, I admit the possibility that I am wrong. This issue is not very important, but I may promise that I will revoke my objections provided that this experiment is theoretically supported and contradictions are removed. Perhaps there is a cross between AGA and general relativity, in which black holes may not have an event horizon, and Einstein's equivalence does not hold, but at the same time there are gravitational waves in exact accordance with the predictions of Einstein (almost exact because just they violate Einstein's principle). To date, however, no such theory has been presented.

[11] Since there cannot be ripples of something that does not exist, our explanation for the pulsar's shrinking becomes the only possible one. This also provides additional justification for (2).

20 Mercury's orbital precession

We have shown that the most important predictions of general relativity, such as gravitational particles' deflection, redshift, time dilation and black holes, are recreated — and even enhanced — by AGA. Nevertheless, one area of research has not yet been addressed[12].

It is known that the perihelion of Mercury's elliptical orbit rotates. The amount of shift can be mostly clarified by using Newton's theory that implies that it is caused by the pull of other planets in the Solar System, but a discrepancy between observations and calculations remains. It has been removed by Einstein and others [81] with use of general relativity.

In the work we do not deal with this issue in the details. One reason is the flexibility of AGA whose formulas already differ somewhat from the Newtonian ones and can be still modified if necessary. Nonetheless, much more important is that the precession can be caused by dark matter. This statement may surprise you, but remember that in 1916 Einstein worked in a completely different situation. He wanted to eliminate the pull of the hypothetical planet Vulcan and, indeed, he did it beautifully.

However, Einstein could not know or only suppose that something invisible was lurking around us. As a result, general relativity is too accurate in this aspect (that is why we think that the attempt described in [82] is a step in the wrong direction). For at present it would not be reasonable to maintain that dark matter is everywhere except the Solar System (especially near the Sun). Thus the formulas of AGA may possibly be changed only when the influence of dark matter on Mercury's orbit is estimated. (If this dark mass equals, e.g., the supposed mass of Vulcan, nothing needs to be altered.)

21 Dark matter

In the section we are able to present a strikingly simple resolution to the tremendously difficult problem of dark matter. Already in 2009 we could read [83]: "Observations continue to indicate that the Universe is dominated by invisible components — dark matter and dark energy. Shedding light on this cosmic darkness is a priority for astronomers and physicists." The priority has not helped; both before 2009 and after lots of researchers lost a lot of time and money sitting at telescopes or in mines, or analyzing results from the LHC, AMS, noble gas containers, and other devices.

An interesting study was carried out in [84]: "Neutrinos could be key particles to unravel the nature of the dark matter of the Universe… Numerous astrophysical and cosmological observations support the hypothesis that a significant fraction of the energy density of the Universe is in the form of a non-baryonic, long-lived on cosmological time-scales and electrically neutral particle… These are precisely the properties that characterize the neutrinos, which then constitute a candidate for dark matter."

Nonetheless, in the further analysis the author of [84] comes to the conclusion that the only possible candidate is sterile neutrino. Unfortunately, sterile neutrinos have the

[12] In the work we do not deal with frame-dragging effects either, but they can be taken into account. E.g., the gravity between rotating objects depends, according to (19), on the speeds of the component particles.

same disadvantage as WIMPs, axions, neutralinos, etc. [85]; no one has experimentally confirmed their existence.

On the other hand, below we show that dark matter consists of usual neutrinos that are being obtained in many experiments. However, these will be particles that you still do not know.

The most important problem with neutrinos as dark matter is that their mass is so small. According to [86], "At first glance, neutrinos are the perfect dark matter candidate… When we look in detail, the idea of massive neutrinos is insufficient to make up 100% of the dark matter... the sum of all the neutrino masses is at most approximately 0.1 eV… approximately 0.5% to 1.5% of the dark matter is made up of neutrinos." Nevertheless, it must be stipulated that this data and calculation refers to the inertial mass of the three flavors of neutrinos, whereas astronomers detect the absence of the gravitational one (you probably agree). Fortunately, in this approach we have already decoupled them. And this is what plays a major role in our explanation.

When a neutrino oscillates [87], from the energy conservation principle it follows that its rest mass must remain unaltered. So what changes? TIM responds in a natural way (without artificial and ad hoc superpositions) that it is its gravitational mass. But this implies that the ratio of the two masses cannot be constant, i.e., they are essentially different.

However, the rest masses of neutrinos can be distinct as well. We use just the fact that they belong to an interval. They correspond to the flavor, but only at the event where a neutrino was created. Later, this dependence can cease to hold due to possible oscillations, whereas the gravity mass still shows the current flavor. Let us add that if (2) is true, the latter mass distinguishes neutrinos from antineutrinos (and in this fashion you finally get a common property that differentiates antimatter from regular matter, while there is no time going backwards because proper time does not exist).

We assume (in line with TIM) that the average gravitational mass m of neutrinos (without antineutrinos) of all the three leptonic flavors satisfies

$$m \cong 10m_e, \tag{42}$$

where m_e is the mass of an electron. For comparison, we have seen [86] that in the light of recent research

$$m_\nu \leq 10^{-7}m_e, \tag{43}$$

where m_ν is the average inertial mass of neutrinos. This implies that

$$m_\nu \leq 10^{-8}m. \tag{44}$$

You might ask why the gravitational mass of neutrinos is so large, but you should rather question why their inertial mass is so small. TIM clarifies that both of these masses ought to have an order of magnitude equal to at least ten electron masses[13], but the inertial one is — for reasons related to the uncertainty principle — reduced. On the other hand, the gravitational charge remains unchanged, and we express this fact symbolically by (44).

In the universe there are about 100,000 times more neutrinos than protons [88]. We assume that about half of them are, in fact, antineutrinos that, according to (2), balance themselves gravitationally with neutrinos. However, the former are sometimes pushed out of galaxies and end up in intergalactic space.

[13] This follows from the fact that the tinion composition of neutrinos is similar to that of muons.

Suppose that barely 1,000 antineutrinos per proton have passed into intergalactic space. This implies that about 1,000 unbalanced neutrinos have remained, and they are what make up dark matter.

Now consider what constitutes the mass of our $U2$. According to [89], "About 75% of the mass of matter is Hydrogen and most of the remaining 25% of the mass is Helium. Heavier elements are relatively rare. Given that Helium has two protons and two neutrons, we can estimate the number of neutrons to be about 10% of the number of protons." It seems we may add another 10% for heavier nuclei, electrons, free particles, and radiation. Thus using (42) we obtain for gravitational mass

$$\frac{\text{dark matter}}{\text{baryonic matter}} \approx \frac{1{,}000\nu}{1.2p} \approx \frac{1{,}000m}{1.2m_p} \cong \frac{10{,}000m_e}{2{,}200m_e} \cong 4.5, \qquad (45)$$

and the value is in good agreement with experience (cf. Fig. 2. of [2]).

This estimation is very rough (it operates only with orders of magnitude, i.e., powers of 10) and it will be able to be significantly improved in the future, but you should not say any more that the mass of neutrinos is too small [86]. However, there is another important problem. According to [90, 91], dark matter ought to be cold, i.e., their particles must move at non-relativistic speeds, whereas the collection of standard neutrinos (of the Standard Model) remain hot.

To solve this issue, note that neutrinos are relativistic because their rest mass is so little. They are created in reactions with other particles that move, most frequently, slowly compared with the speed of light. If $m_\nu = m_e$ were satisfied, the neutrinos would be slow as well. From (43) it follows that a neutrino moves at a big speed b instead of a small s such that

$$\frac{\gamma(b)}{\gamma(s)} = 10^7, \qquad (46)$$

whence their energy is unaltered. This indicates that an interaction that reduces the energy of a particle with the speed b at least 10^7 times turns it into a particle with a velocity less than s, i.e., into a non-relativistic particle.

Let us compare a standard neutrino with a TIM-consistent one that move at the same speed trying to overcome a strong gravitational field. They have the same rest mass and momentum, but according to (22) and (44) the force that acts on the latter is 10^8 times greater. Thus we may assume that after some time its energy will be reduced 10^8 times. As a result, the standard neutrino will reduce its speed slightly, whereas the other will become non-relativistic.

As neutrinos move in different directions, their speed can even increase. For example, when a neutrino approaches the Earth, it is accelerated. Near the center of the Earth no force acts on the particle, and later it is slowed down. If there is an accompanying antineutrino, it will behave in the opposite way, and after passing the Earth the particles will run side by side again.

We may assume that about 2% of neutrino-type particles sometimes attempt to move in directions that go beyond the galaxy. Antineutrinos are able to leave it without troubles, whereas neutrinos only lose energy. And just the latter constitute the cold dark matter.

The above reasoning can be applied to objects other than galaxies, e.g., their groups or clusters or even larger structures, stars, black holes, gas, dust, plasma, etc. The percentages of neutrinos that form their dark matter may be different. For example, they have to be high in dwarf galaxies and dwarf spheroidals because gravity is strong there, and due to their small sizes there are many paths that lead out of them.

This is where you might concern and ask: Can we have an arbitrarily large dark matter density in any region of space, since neutrinos are fermions and obey the Pauli exclusion principle? [92] The answer is: Yes, no other particles are needed. This is possible again due to the gravitational mass. The mystery lies in the fact that it is not a single value for neutrinos with the same leptonic flavor, but it belongs to an interval. (When a neutrino overcomes a fairly strong gravitational field, e.g. that of the Sun, and the gravity mass interval for one leptonic flavor is over, the neutrino has to go to the next, i.e., it has to oscillate.) Two particles that differ only in gravitational charge are in distinct states, so they can occupy the same position simultaneously. Thus neutrinos are able to behave like bosons.

Let us note that our solution clarifies where the seemingly enormous energy of dark matter comes from. Since it is cold, in reality it is a negligible fraction of the energy of baryonic matter, and this problem literally disappears. Indeed, as (45) refers to the gravitational mass, not energy, from (44) it follows that the fraction is less than $4.5 \cdot 10^{-8} < 10^{-7}$. This is exactly in line with experience; after all you do not feel the existence of invisible energy several times larger than the visible one.

Some maintain that dark matter is composed of unknown particles that interact only gravitationally, and for this reason they cannot be detected. In that case, the question is: Do they want to go in for physics without knowing how the major part of the world (since it is to be compatible with general relativity) was created? For comparison, in our approach you already know all reactions responsible for creating dark matter.

Now you see that the perfect and most natural candidate for dark matter turns out to be really a very good candidate; nothing is missing for it. That is why we think that this resolution of the hugely difficult problem is strikingly simple. Obviously, it has been made possible thanks to our theory with gravitational mass, but new theories are precisely in order to create new opportunities.

In this context, it is worth noting that our solution is consistent with Newtonian gravity which will be able to be used in approximate calculations. Just take for granted that the masses m in the equations $\boldsymbol{F} = -mM\boldsymbol{r}\hat{}/r^2$ and $\boldsymbol{F} = m\boldsymbol{a}$ (or, more generally, that with the derivative of relativistic momentum) can be distinct. This was, in fact, the original assumption of that great scientist. Admittedly, Newton assumed that, in the case of matter known to him, these masses were equal, but he left the possibility of differentiating them in his equations. As Newton was an inquisitive researcher, he may have suspected that other kinds of matter would be discovered in the future.

Consider an object that contains n neutrinos. According to AGA, the gravity between it and other objects depends critically on n even when its total energy (due to other particles) remains constant. This means that gravity depends on the structure of the object, which excludes the possibility of describing the interaction by means of any geometry. In particular, our solution is at odds with general relativity which will not be able to be used even in rough calculations.

You may ask if it is worth looking for other dark matter. In our opinion, the likelihood of success is very remote. On the other hand, the failures will additionally confirm AGA. Thus the author has nothing against it.

22 Dark energy

Our resolution of the dark matter problem yields an immediate solution to the dark energy issue as well, but before discussing this we must deal with a slightly different thing. The authors of [83] initially defend general relativity very much, and then show their ignorance:

> „The leading interpretation is that the Universe is filled by something — dubbed dark energy — that 'antigravitates'. Whereas the possibility for gravitational repulsion does not exist in Newtonian gravity, it does exist in general relativity."

The second sentence of this quote contains two horrendous errors because in reality it is exactly the opposite. Newton knew nothing about antimatter, but if he had known, he would have certainly considered (2) leading us to 'antigravity'. (This follows from the fact that Newton thought in terms of fields.) And, for the reasons given in the previous section, (2) does not contradict his original theory.

On the other hand, in [93] and Section 19. you may find proofs that any gravitational repulsion (available locally, e.g., via particles or waves respectively) is at odds with Einstein equivalence, i.e., the cornerstone of general relativity. This applies, in particular, to the negative pressure dreamt of by [83] and others [94].

There is only one excuse for the fact that professors of physics (or related branches of science) make such terrible mistakes. People usually expect new theories to open up new possibilities. However, this is not the case of general relativity because Einstein concreted the scene.

The first sentence of the above quote is, in principle, consistent with the facts. We have said that some antineutrinos are pushed out of galaxies and end up in intergalactic space. By virtue of (2) and (19), they 'antigravite', and just they form 'true dark energy' mentioned in [2], i.e., dark energy without the effects of the rotation of our $U2$ inside our superuniverse.

The intergalactic space is not, of course, empty, but it contains galaxies and other objects that consist of (mainly regular) matter. A fast antineutrino tries to get inside them, but the return path is closed; now the particle is in the situation of neutrinos that attempt to exit from the galaxy. Consequently, the antineutrino only loses energy and becomes non-relativistic.

Therefore, we think that the true dark energy is cold as well, which gives the last column of Fig. 2. in [2]. You should remember that it involves the absolute value of gravitational mass (not energy that is still negligible).

We can define *gravitational screening* as the damping of gravity fields caused by the presence of antiparticles. As we have said in Section 19., this effect should be taken into account in the description of pulsars. Another application is the case of the whole cosmos; antineutrinos that reside in the intergalactic space weaken the gravitational attraction between galaxies. This solution is strikingly simple as well (you don't have to look for, e.g., particles with negative pressure). It was rejected by physicists because they had no plausible gravity theory admitting (2).

Concluding the topic of dark matter and dark energy, we note that AGA could provide a solution of their problem even if (1) were true for every particle. Then we would have to assume that the average gravitational mass m of regular neutrinos and antineutrinos of all the three flavors fulfills

$$m \cong 10^{-1}\, m_e,$$

and instead of (45) we would have

$$\frac{\text{dark matter}}{\text{baryonic matter}} \approx \frac{100{,}000\nu}{1.2p} \approx \frac{100{,}000m}{1.2m_p} \cong \frac{10{,}000m_e}{2{,}200m_e} \cong 4.5,$$

and the entire dark energy would have to be explained via the accelerated motion of our $U2$. Its (spin and/or orbital) angular velocity can be treated as a cosmological constant, but — unlike the creator of general relativity — owing to GUN we know where it comes from. It can take any value suggested by the experience, e.g., be constant over time and very small.

You could also use the estimation of the neutrino dark matter in [86] and assume that

$$m \cong 100 m_{\nu},$$

which should transform about 1% into 100% (in (46) 7 can be replaced by 2). Nonetheless, we think that both of these variants are far less likely.

23 Excess of antiparticles

In [95] the author wrote: "Dark matter doesn't annihilate." At present, one sees that it is indeed so (even a neutrino and an antineutrino do not annihilate because they repel each other very strongly), but many humans did not believe in it, and they searched for signs of annihilation [36-38]. In this way, they wanted to explain growing with energy the share of positrons in cosmic radiation.

Although this effect has nothing to do with dark matter and dark energy, it can be related to gravitation, as presented below. The essence of the explanation is illustrated in Fig. 5.

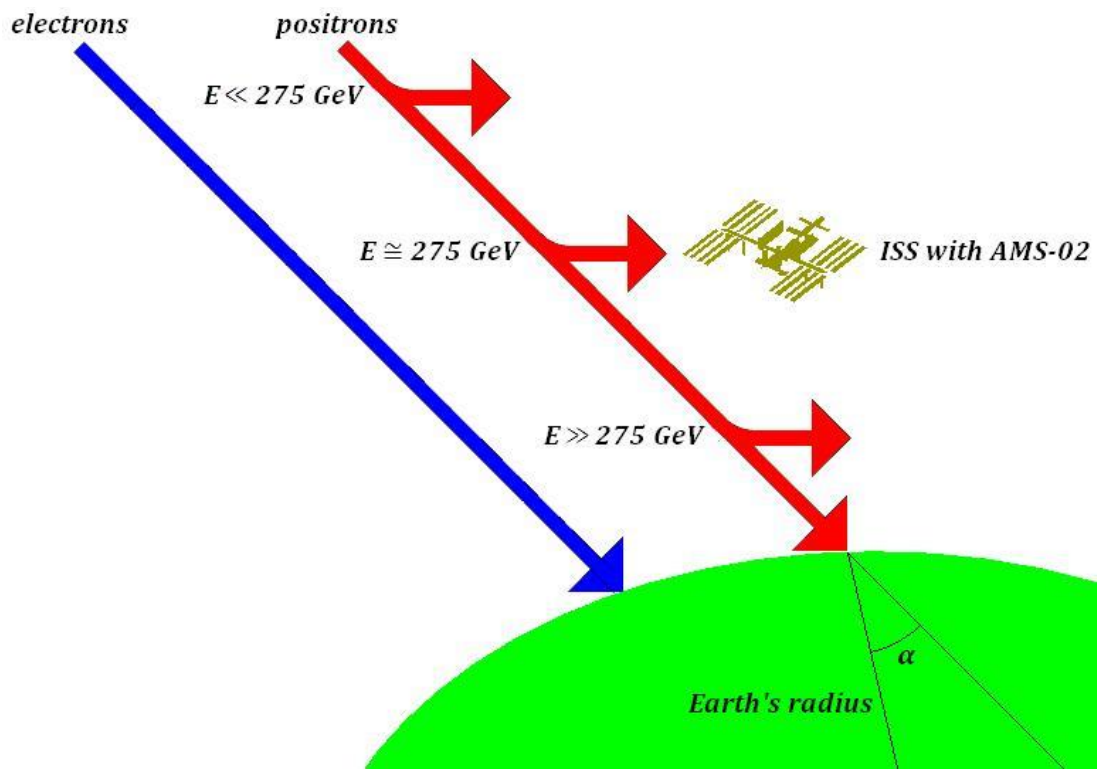

Fig. 5. The excess of positrons in cosmic rays.

In our analysis a key role is played by probabilities. We show that if (2) holds, the probability of detecting a particle can be different from its actual contribution to cosmic radiation.

Suppose that an electron and a positron of the same energy are approaching the Earth. Let $p < 1$ be the probability of detecting the former by AMS. If (1) is true, p is also the detection probability of the latter. On the other hand, in the case of (2) — if the energy is neither too low (i.e., one has $p > 0$) nor too high — the positron may be turned back, which implies that it can be registered with the probability $2p - p^2 > p$. This is where you are already able to guess what's going on.

In Fig. 5. the angle between a cosmic ray and the Earth's radius is denoted by α. Under the influence of gravity this can change to α', whereby in the case of electrons one has

$$\alpha' \leq \alpha,$$

whereas for positrons, by virtue of (2), we get

$$\alpha \leq \alpha'. \tag{47}$$

Note that in Fig. 5. the red arrows are directed to the right, and the example above shows that there might even be $0' = \pi$.

We have seen in Section 15. and Fig. 3. that probabilities are related to time, and something like that takes place here too. For (47) causes that the residence time of positrons in the near-earth space increases (e.g., they can fly alongside the ISS for longer). As a result, the probability of their detection by AMS increases as well.

At this point, you already know what caused the seeming excess of positrons. Nevertheless, the question is why it first grew with energy and then fell. Well, if the energy of a positron is low, and α is sufficiently big (depending on the energy, α may even vanish whenever its amount is very small), the particle is not able to get close to the ISS. Gradually, as the energy rises, more and more positrons (relative to the number of electrons, of course) get into the vicinity of the station.

However, if their energy is high, positrons can easily overcome Earth's gravitational repulsion (they have a high escape velocity directed in the opposite direction). Consequently, $\alpha' \cong \alpha$, their behavior becomes similar to that of electrons, and the excess disappears. This implies that there must be a maximum of it, and in the case of AMS-02 it happened for the energy equal to 275 GeV.

One sees that, qualitatively, everything is correct. The exact calculation is obviously beyond the scope of the work. The members of that group may perhaps do it (or carry out a computer simulation).

There is another possible verification, albeit probably more expensive: AMS needs to be situated further or closer to Earth. If this effect were caused by (2), it should alter somehow. On the other hand, for a remote astronomical phenomenon this ought not to have any significance.

If we are talking about costs, The New York Times [96] wrote: "Alpha Magnetic Spectrometer… is one of the most expensive scientific experiments ever built." Nonetheless, we think that it can pay off. For the experimental confirmation of (2) may one day be regarded as one of the most important scientific discoveries.

24 Weak interactions

We begin this section with a dialogue between two particle physicists:

“We know that a free neutron decays into a proton, an electron, and an electron antineutrino…”

“Wait, wait, each quantum reaction should be caused by an interaction. What does it in this case?”

“You're right. Strong interaction cannot help us here because it does not work with electrons. Electromagnetism is out due to the antineutrino. There is still gravity left, but it seems to be very weak…”

“Shall we take some virtual particle?”

“Yes, this recently discovered W^- boson will be good. So let us assume that the decay begins with the emission of a virtual W^- boson from one of Down quarks that exist within the neutron…”

“Why must it be virtual?”

“Because it should be off shell.”

“What for?”

“After the emission the Down quark becomes an Up one. Thus it electrostatically attracts the W^- boson which, in order to get away, has to overcome the electromagnetic interaction…”

“That is about 10^{36} times stronger than gravity [97]. It is clear, but I don't see the connection.”

“According to AGA, the W boson has also a gravitational mass whose absolute value is, in the real case, equal to its inertial mass.”

“Yes, something is starting to dawn on me… The former — since it is a charge — remains unaltered in the virtual case.”

“That's right. On the other hand, the W^- can have a rest mass about 10^{36} times less than its real counterpart. Speaking more precisely, it is at least $\frac{2}{3}10^{36}$ times less.”

“Where have you got this value from?”

“The charge of the Up quark is equal to $\frac{2}{3}Q$.”

“And what causes it?”

“As the inertial mass is so small, even the Newtonian law $\boldsymbol{a} = \boldsymbol{F}/m$ implies that the acceleration of the virtual W is about 10^{36} times greater than that caused by the usual gravity. Consequently, gravitation works 10^{36} times stronger.”

“So its strength is comparable to that of the electromagnetic interaction?”

“Exactly.”

“But the latter will also increase, since you have decreased the inertial mass…”

“No, as I wanna introduce a minor amendment to Coulomb's law.”

“Really?”

“Nothing special... Look, here's a board, I'm gonna write it... The force that acts on a particle should be multiplied by its shell deviation, i.e.,

$$d_s = \frac{mc^2}{\sqrt{E^2 - p^2c^2}},$$

where E, p, and m are its current energy, momentum, and rest mass, or simply by

$$d_s = \frac{mc^2}{E_0},$$

where E_0 is its rest energy.“

“I see. For particles on shell it won't change anything.”

“Or alternatively you may multiply the force by the ratio of inertial mass to absolute value of gravity mass.”

“Agreed. TIM tells us that for real Up and Down quarks, electrons, and W bosons this ratio equals 1. For other electrically charged particles it should be measured because it can be slightly different.”

“As a result, this virtual boson will move with the same acceleration or — how well you know it — quantum dynamics caused by the electrostatic interaction.”

“I can already guess. Because, according to TIM, the gravitational mass of the boson is negative or otherwise its rest mass can be assumed to be less than zero, there is a very strong gravity repulsion between it and the quark. Thus the former can move away, and then decay into the electron and the antineutrino.”

“Which diverge from each other because the gravitational mass of the latter is negative as well.”

“Great. However, I've heard it was experimentally measured that the approximate strength of a force in this reaction was merely 10^{25} times greater than the strength of gravity [97].””

“It was at larger distances (though obviously less than the diameter of a proton), for the rest mass of the boson increases if it is possible. I am convinced that when they do measurements at distances about 10^{-18} meters, my result will be obtained [98].”

“So no additional interaction is needed?”

“What for? Occam taught us not to multiply beings. Nevertheless, gravitational field strengthened by virtual W or Z bosons might be termed weak nuclear force.”

The above conversation is naturally a fiction, but it could have happened if AGA, partially TIM, quarks, and the massive bosons had been known prior to the introduction of weak interactions into physics [99]. And then no one would have thought of inventing new forces.

The short range of the weak interaction is, of course, caused by the short lifetime of the massive bosons, and our interpretation precisely explains (no calculation is needed[14]) why its strength decreases exponentially with distance. Its intermediate particles are still gravitons; the single virtual boson plays an auxiliary role. It is also controlled by the intermediate bosons of the electromagnetic field.

As the rest mass of the virtual particles can change completely arbitrarily, the dynamical properties of the standard weak force and ours are indistinguishable. Something similar goes for reactions. If, for instance, weak isospin is conserved, gravity may obey the principle too. If the weak interaction violates some symmetries, gravitation can naturally do the same (since even its charge is not conserved). Both gravity and weak forces act on all fundamental fermions (does Nature need two universal interactions?). On the other hand, as electromagnetism preserves the symmetries and it does not work for neutrinos, we think that bringing into life the electroweak interaction is far-fetched. (In reality, electromagnetism is related to another fundamental field, and it is better to consider the baryoelectric field instead of the electroweak field, see [35] and Fig 11.)

Note that there is a logical justification for the existence of the massive bosons. Namely, they can actually be compared to photons. Indeed, the latter carry a (magnetic) interaction that could not exist without the basic (electrostatic) interaction. Thus the weak field plays the role of a ‘gravity-magnetic’ force that could not work without spin-2 gravitons.

[14] A good mathematician (including Copernicus) counts very little. They try to reorganize — via logic — the problem so that at least tedious calculations become unnecessary. This is feasible as Nature is, in fact, simple.

The weak interaction is the only fundamental field that does not create bound states such as hadrons and nuclei (strong force), atoms and molecules (electromagnetism) or black holes and other astronomical objects (gravity). However, if it is a special case of gravitation, this exception disappears.

We are not going to urge anyone to apply our interpretation, but difficulties may occur. For example, the physicists in the dialogue above have assumed that the W^- boson must overcome the attraction of one Up quark. However, there are two more quarks nearby, held together by strong forces. If the boson does not move away from both Up quarks, one of them will bond with the electron, and the neutron will not decay. Though there is also a Down quark, their total electric charge equals 1, not 2/3. Thus we think that at distances less than 10^{-18} meters weak interaction ought to be at least slightly stronger than electromagnetism. Our weak forces can meet this requirement, whereas the standard ones cannot (in line with the Higgs mechanism [100-102]).

On the grounds of the Standard Model, it may be argued that the strength of the W and Z particles weakens with distance compared to photons due to the large mass of the former, but this reasoning does not explain why after acquiring mass they became more universal (thus in the case of neutrinos the massive bosons are already, in fact, stronger). Therefore, we advise you to remember that you still have the good old gravitation.

25 The seventh quark

As we believe that weak nuclear forces are, in fact, gravitational interactions, and due to this they do not have to be artificially combined with others [103], no Higgs boson is needed. This implies that the only, in essence, reason to treat the particle discovered [104] at CERN as such a boson disappears. After all, no one has proved that it may have something to do with acquiring mass by anything. Note that the Higgs theory says nothing about acquiring or transforming gravitational masses. It is compatible with a false approach (general relativity by virtue of the examples given in Section 15.) and attempts to eliminate the concept of mass altogether. Moreover, GUN shows that our universe could evolve without phase transitions.

Therefore, the question arises where that particle has come from. Again, TIM can provide an answer. As in the Standard Model, there is a generation concept in TIM, but it is defined differently (based on tinion composition). Consequently, although fermions have merely three generations [105], some of them (in the case of quarks) may contain more than two particles.

In particular, TIM predicts the existence of an additional quark with the charge $\frac{-1}{3}Q$ and a mass from 40 to 80 GeV/c^2. If this is confirmed, it will be the seventh quark known on Earth.

Since the number seven is associated with something extraordinary in many cultures, the quark has been called *magical* (whence it is denoted by m). This term corresponds to 'beauty' and 'true', but note that the mass of m is between the masses of the bottom and top quarks. Thus the seventh quark may be termed *middle* as well.

If we talk about the masses, our quark can remove an asymmetry of the Standard Model. Indeed, after taking it into account the total masses of quarks with positive and negative electric charges will be equal with accuracy to the order of magnitude. We may also suppose that a true and equivalent partner for t is just m, not b.

The so-called *magical* particles were tentatively considered in [106]. At present we can make it clear that by them we mean particles whose quark composition contains m or $\overline{m}$. These and others anticipated by TIM will be detected, in principle, only after launching super large colliders, but it is possible that one of them has already been registered. Of course, we have in mind this boson from CERN.

We think that its most probable quark composition is $m\overline{m}$ (because $\overline{m}$ obviously consists of antitinions of the particles contained in m), and this conjecture has recently been corroborated experimentally [107-109]. Indeed, as b is the heaviest quark lighter than m, and their electric charges are equal, the reaction

$$m\overline{m} \to b\overline{b}$$

is the most natural (m and $\overline{m}$ must eventually collide, whereas $H^0 \to b\overline{b}$ requires a more complicated theory). This decay channel of a particle with the mass 125 GeV/c^2 should account for about 60% of all its decays (for a Higgs boson, whence the more for our simpler solution), and the value has been obtained. This implies that the mass of the magical quark equals about 60 GeV/c^2, which confirms the prediction of TIM with almost 100% accuracy.

In [109] we may read: "While the result is certainly a confirmation of the Standard Model, it is equally a triumph for our analysis teams". The first part of this sentence is an example of wishful thinking, while the rest is true. We thank them for determining the mass of our quark and ask for more. To unambiguously confirm something better than the Standard Model (TIM is not a conglomeration of ideas) it suffices to find at least one boson with a mass about 125 GeV/c^2 and the spin 1 (the Higgs particle must have the zero spin).

You may also look for bosons with masses of around 60 GeV/c^2, i.e., with one of the following quark compositions: $m\overline{d}$, $m\overline{s}$, $m\overline{b}$, $\overline{m}d$, $\overline{m}s$, $\overline{m}b$. We can explain why they have not been detected before. Let us define a new quantum number, called *magic*, by

$$M(q) = -(n_m - n_{\overline{m}}),$$

where n_m and $n_{\overline{m}}$ are respectively the numbers of magical quarks and antiquarks included in the composition of the particle q. Magical particles are related to strange ones because the tinion compositions of m and s are very similar. Thus it is possible that magic, like strangeness, is conserved during strong and electromagnetic interactions, but not during gravitational (weak, in particular) ones. This implies that magical quarks must be created in pairs.

26 Info-mechanical principle of energy conservation

The authors of [110] ask: "The Cosmic Background Radiation (CBR) has red-shifted over billions of years. Each photon gets redder and redder. What happens to this energy?" and they answer that some "will say that radiant energy becomes gravitational energy. Others will say that the energy is simply lost."

Consider another example. Suppose a cosmic object was trying to pass Earth, but it was captured by the Earth's gravitational field, as a result it hit our planet, and did a lot of damage. We already know that this increase of energy was due to the uncertainty principle, but the energy did not vanish. Does it mean that energy is not conserved?

Newtonian physics copes with these problems owing to potential energy, but this notion cannot be correctly applied to massless particles and is at odds with Lorentz transformations. In general relativity [110, 111] there are two divergent views. Some attempt to introduce additional concepts, and others say that the mathematical apparatus is the most important, and you should not litter it, especially that contradictions — unforeseen by the creator of that approach — can occur.

In AGA energy has to be conserved because the theory should be compatible with GUN. We have said in [2] that the principle may be violated only as a result of bombing from another cosmos. Fortunately, this can be achieved by starting from the basics of our approach. It suffices to assume that the total energy of our universe is the sum of two portions: *hard* and *soft*. The former generalizes the Newtonian kinetic energy, i.e., it is the sum of values of E from (7) and (8) as well as of binding energy, whereas the latter is defined as the difference between the amounts of hard energy which has been used to set up an interaction with info particles and hard energy obtained as a result of such an interaction.

The info-mechanical principle of energy conservation says that *the sum of hard and soft energies is finite and constant on average.* We allow soft energy to be negative, so it is possible that at time zero it vanishes, but experiments with info particles will give us more hard energy than we will use to prepare them. This should not come as a surprise because, after all, huge energy associated with mass is also given to us by Nature.

A comparison can be useful. Introducing the formula $E = mc^2$, Einstein increased the classical energy by a component equivalent to mass and he postulated that the total energy should have been conserved. Introducing info-bearing particles, we increase the relativistic energy by an amount related to the info-mechanical interaction and we postulate that the total energy should be conserved. We have no single formula, but the key here is to define info particles in a strict manner independent of energy.

It is worth emphasizing that our info-mechanical principle of energy conservation is not trivial because it implies the standard one. For instance, if two massive particles collide elastically, info bosons do not act. Thus the products of this event must carry the same energy. More generally, if info particles have given as much as they have taken, hard energy is conserved.

Soft energy resembles Newtonian potential one, but it is relativistically consistent and more general. For instance, if a photon moves overcoming a gravitational field, its hard energy decreases, and the soft one of our universe increases.

We can also talk about the soft energy of an isolated system. It is connected with info particles whose waves with their sources are included in this system. Thus Theorem 7.1. of [2] also applies to experiments with gravity.

According to the terminology of [2], in our $U2$ the law is conditional. Nonetheless, as there are no bombings made from $U0$, in $U1s$ the info-mechanical principle of energy conservation is unconditional.

We can also talk about hard and soft momentums of our universe that correspond to the analogous portions of energy. They are well-defined vectors because the energy is finite. The same goes for angular momentum. And, without the bombardments, the total sums of the momentums remain constant on average.

It is possible that, in the future, the last clause of those principles will be able to be skipped. Note that, when observing quantum phenomena, uncertainty arises mainly from the use of electromagnetic waves which could not exist without the electrostatic interaction. Therefore, if it and other fundamental fields are depicted based on info mechanics, we may assume that the quantum fluctuations of hard energy are exactly balanced by those of soft one. That way the uncertainty can be hidden.

In [2] we promised to define energy with the help of gravity, so we do it now. We start from massless particles whose gravitational mass has been defined via energy in Section 2. However, from a theoretical point of view, it is reasonable to do the opposite because in $U0$ we already have residual gravity, whereas initially we do not say anything about energy there. Thus we assume, in line with (4), that the energy of a massless particle with a gravitational mass m is equal to $\mathrm{Im}(m)c^2$. As this type of particles is constantly involved in reactions with massive ones, the energy of the latter can be defined via the conservation principle.

27 Progressive AGA

We have said that any formula of AGA may be arbitrarily modified whenever this is suggested by experience. In the section we would like to present a change whose need for introduction seems very likely. Namely, instead of (18) we propose

$$\text{AIM}(\boldsymbol{e},\boldsymbol{v},m,s) = \text{SNS}(m,s)\underbrace{\gamma(v,m)\gamma(\boldsymbol{ve},m)}_{\text{QUADRATIC AGA}}|m|(\boldsymbol{e}+\text{AGA}(\boldsymbol{e},\boldsymbol{v})).$$

As you can see, we have added the multiplier $\gamma(\boldsymbol{ve},m)$ here. Its effect in the case of $\boldsymbol{e}\|\boldsymbol{v}$ explains why this option is called 'quadratic *AGA*'. More generally, we may consider

$$\text{AIM}(\boldsymbol{e},\boldsymbol{v},m,s) = \text{SNS}(m,s)\gamma(v,m)\underbrace{\gamma^{\text{E}}(\boldsymbol{ve},m)}_{\text{POSITIVE EVE}}|m|(\boldsymbol{e}+\text{AGA}(\boldsymbol{e},\boldsymbol{v})),$$

where the parameter E (this letter indicates energy gain) also has the nice name *Eve* suggested by the formula. Thus the quadratic *AGA* is equivalent to the unitary *Eve*. (Obviously, the positive *Eve* is most likely natural. Nonetheless, it is also possible that it is not constant, but depends on, e.g., $|\boldsymbol{v}|$.) This modification is so important that we introduce (Fig. 6.) a special name for the theory that uses it.

Related theories	*Name of AGA*	*Value*	*Gravity*
Newton	constant	1	does not depend on particles' speeds
Einstein, conservative AGA	linear	$\gamma(v)$	depends on energy
progressive AGA	quadratic cubic	$\gamma^2(v)$ $\gamma^3(v)$	gives a new powerful source of energy also possible under the positive *Eve*

Fig. 6. The values of scalar *AGA* for collinear velocities.

Of course, the quadratic *AGA* is irrelevant to photons, so we may immediately consider the approximate formula for force (cf. (19))

$$\boldsymbol{F}_{21} = -\Gamma m_1 m_2 \gamma(v_1)\gamma(v_2)\gamma(\boldsymbol{r}^\wedge\boldsymbol{v}_2)\rho(|\boldsymbol{r}|)(\boldsymbol{r}^\wedge + \text{AGA}(\boldsymbol{r}^\wedge,\boldsymbol{v}_2)),$$

that acts on q_2 due to massive q_1, or (cf. (23))

$$\boldsymbol{F}_{21} = \frac{-\Gamma E|m_2|\gamma(v_2)\gamma(\boldsymbol{r}^\wedge\boldsymbol{v}_2)\rho(|\boldsymbol{r}|)(\boldsymbol{r}^\wedge + \text{AGA}(\boldsymbol{r}^\wedge,\boldsymbol{v}_2))}{c^2},$$

if q_1 is massless with energy E.

When modifying an AGA formula, you must always check whether the change does not conflict with other relevant parts of the theory. In this case one sees that the gravitational interaction will be stronger, so black holes will remain. For small velocities

$\gamma(\boldsymbol{ve})$ is close to 1 and it equals 1 if the vectors are orthogonal. In addition, you may check that if the angle between $\boldsymbol{e}$ and $\boldsymbol{v}$ is greater than 6°, $\gamma(\boldsymbol{ve}) < 10$ even for $|\boldsymbol{v}| = c$, that is, the quadratic *AGA* cannot alter the magnitude order of the interaction (6 is the smallest integer with this property). This is important and implies that, in practice, the quadratic *AGA* only works when the angle between the velocity and the gravitational wave vector is less than 6°.

The gravitational deflection of relativistic massive particles will be somewhat greater, but this is still possible, since no decisive experiments in this area have been made so far. Particle physics also provides the basic motivations for introducing this option. Generally speaking, there are situations where gravitation must be reinforced without the help of virtual massive bosons.

Consider a diboson [112], i.e., the pair of fundamental bosons, at least one of which is massive and there is no attractive electromagnetic or strong interaction between them (e.g., $\gamma W^{\pm}$, γZ^0, $Z^0 W^{\pm}$, $Z^0 Z^0$ and even $W^{\pm} W^{\pm}$). Since we have given up on distinguishing weak forces, the coupling between them must be of a gravitational nature (and in the case of dibosons that contain a photon there is no alternative). However, common gravity is too weak to meet this challenge.

A solution is to assume that the massive particle inside a diboson vibrates in such a manner that the quadratic *AGA* is able to act. In addition, the weak interaction can sometimes (e.g., during collisions) work without massive bosons, and then the positive *Eve* may be needed.

In those examples the energy is great for a very short period of time, but particles can be permanently accelerated to high speeds, and it is easy to see that, owing to the term $\gamma(\boldsymbol{ve})$, the quadratic *AGA* can produce a large surplus of energy. The question is whether this fact violates the energy conservation principle. The answer is negative provided that its info-mechanical version is used.

When setting up an experiment with gravity, we may use an amount X of hard energy. As gravitons are info particles, X will increase the soft energy. After performing the experiment, we can obtain an additional amount Y of hard energy, and Y will decrease the soft energy. Even if $Y \gg X$, our energy conservation will hold.

The idea immediately arises to use the quadratic *AGA* to produce energy, especially that thanks to it gravity can act stronger than any other interaction. We think that this is possible, but we cannot go into detail here. A schematic diagram of a gravitational power plant is shown in Fig. 7. If the energy of colliding particles is sufficiently large, the positive Eve should act and yield a much larger portion of energy.

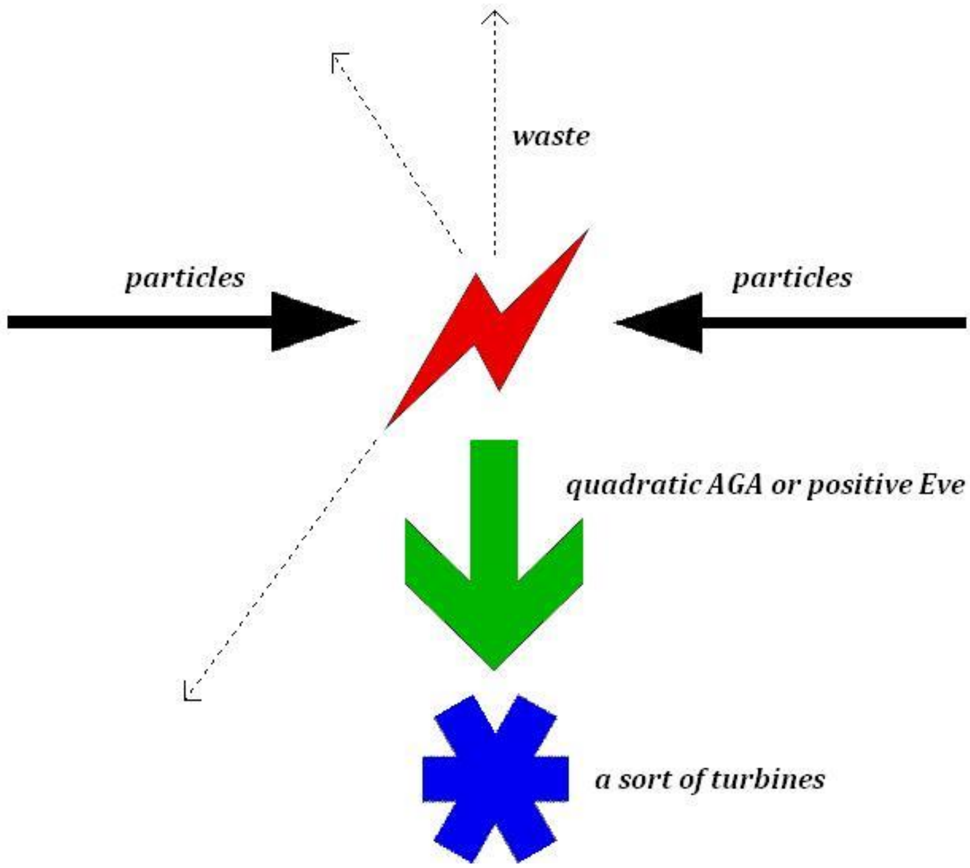

Fig. 7. Schematic diagram of a gravity power plant.

It is worth noting the high safety of this method. Indeed, in a gravitational power plant the particles are only dangerous if they are heading down, and then they cannot get outside. Let us add that the positive *Eve* can also work inside stars, prolonging their lives.

28 The cause of global warming

In the section we present two possible macroscopic confirmations of the quadratic *AGA*. The more important of them is connected with shaping the climate of our planet.

We think that the periodic warming of the Earth's climate was, is, and will be caused by slight increases in the speed of cosmic ray particles (mainly high-energy neutrinos that are unaffected by geomagnetism, and very fast electrons) that arrive at us. If general relativity or the conservative AGA were true, these velocity increments would be insignificant. In the case of the progressive AGA, however, they can give large energy gains provided that the rays are directed almost exactly to the center of the Earth. And their absence causes cooling.

As the direction of the fast rays is essential, let us compare two cases. In Fig. 8., the radiation falls on the northern hemisphere (say, in the winter in this hemisphere) and (maybe, in summer, these seasons are irrelevant) on the entire rotating Earth. The question is: What will be the energy distribution in these areas after 24 hours?

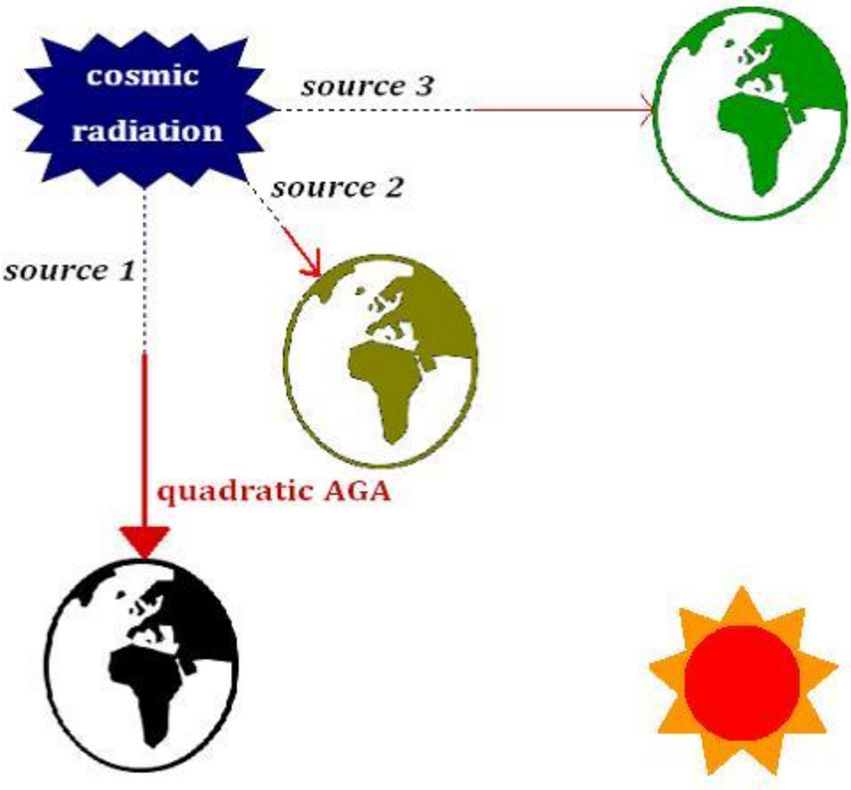

Fig. 8. The cause of global warming.

If *Eve* vanishes, the answer is simple. In winter, all points of the northern hemisphere will receive little energy, whereas in summer the points on the entire surface of the Earth will obtain twice less energy. As this process can be repeated, with the same probability, for the southern hemisphere, we get that the entire Earth will be evenly heated with a negligible amount of energy.

If the quadratic *AGA* works, the situation changes dramatically. We apply the criterion of 6° from the previous section. It implies that in winter only a small area around the North Pole will be essentially warmed, and it will last for 24 hours. On the other hand, in summer a point on the equator will be significantly irradiated merely for 48 minutes. Indeed, 6° corresponds to the distance $6L/360$, where L is the circumference of our planet. As the point is heated before and after reaching the optimal position, we take twice the distance, i.e., $12L/360$ denoted by l, and we get the time

$$\frac{l}{L}24\text{h} = \frac{24 \cdot \frac{12L}{360}}{L}\text{h} = \frac{24 \cdot 12}{360}\text{h} = 0.8\text{h}.$$

At this point we have to take into account that neutrinos as well as extremely fast electrons are able to penetrate the Earth right through. This causes that warming one of the poles is usually combined with warming the other, and a point on the equator will be heated twice within 24 hours. Thus we infer that the heating of the North (or South) Pole will be

$$\frac{24}{0.8 \cdot 2} = 15$$

times larger than that of a point in the equatorial belt. Of course, it can be irradiated by another source as well, but the likelihood of such a coincidence is small. On the other hand, the probabilities of the three sources in Fig. 8 are, in principle, identical.

Let us note that instead of 6° we could take an angle ψ from the interval $(0°, 90°\rangle$ and obtain $90°/\psi$ instead of 15. This ψ might be termed the threshold angle between cosmic ray velocities and Earth radius (cf. α in Fig. 5.), from which gravitation actually works. It can be defined in various ways, whereby the vanishing *Eve* is indicated by $\psi = 90°$, and then there are no differences between the pole and the equator.

Now we want to compare the warming behind the polar circle with that of the whole Earth. Obviously, a measurement station near the pole will show a greater temperature rise than that installed further away. Applying the simplest interpolation, we may assume that the warming at a point on the parallel of latitude $\varphi\ N$ or $\varphi\ S$ is

$$\frac{\psi}{90°} + \frac{(1 - \frac{\psi}{90°})\varphi}{90°},$$

$$\frac{\psi + \varphi - \frac{\psi\varphi}{90°}}{90°}$$

times larger than that of the pole. As the length of the parallel equals $L\cos\varphi$, we obtain that it participates in global warming in proportion to

$$\text{warming}(\varphi) = \frac{L\cos\varphi\left(\psi + \varphi - \frac{\psi\varphi}{90°}\right)}{90°}. \tag{48}$$

To shorten the notation, we use the following function

$$w(\varphi, \psi) = \cos\varphi\left(\psi + |\varphi| - \frac{\psi|\varphi|}{90°}\right).$$

(48) implies that

$$\frac{\text{warming(zone from } \varphi_0 \text{ upwards)}}{\text{warming(Earth)}} = \frac{2\int_{\varphi_0}^{90°} w(\varphi, \psi)d\varphi}{(1 - \sin\varphi_0)\int_{-90°}^{90°} w(\varphi, \psi)d\varphi}$$

because the surface area of the spherical cap with a contact angle φ is equal to half of $S_{\text{sphere}}(1 - \sin\varphi)$. (You may check that for $\psi = 90°$ this ratio equals 1.) Similarly, one obtains

$$\frac{\text{warming(zone from } \varphi_0 \text{ upwards)}}{\text{warming(rest of hemisphere)}} = \frac{\sin\varphi_0\int_{\varphi_0}^{90°} w(\varphi, \psi)d\varphi}{(1 - \sin\varphi_0)\int_{0°}^{\varphi_0} w(\varphi, \psi)d\varphi}.$$

For our purposes, just assume that the position of the polar circle is equal to 66°. We get for $\psi = 6°$

$$\frac{\text{warming(polar zone)}}{\text{warming(Earth)}} = \frac{2\int_{66°}^{90°} w(\varphi, 6°)d\varphi}{(1 - \sin 66°)\int_{-90°}^{90°} w(\varphi, 6°)d\varphi} = 2.05,$$

and the maximum value following from the most general analysis, for $\psi = 1°$,

$$\frac{\text{warming(polar zones)}}{\text{warming(rest of Earth)}} = \frac{\sin 66° \int_{66°}^{90°} w(\varphi, 1°)d\varphi}{(1 - \sin 66°) \int_{0°}^{66°} w(\varphi, 1°)d\varphi} = 2.51. \qquad (49)$$

The results are in good agreement with experience [113-122], while the traditional climate models do not keep up with the pace of change [123, 124]. We believe that this fact is a strong confirmation of the quadratic *AGA* or at least the positive *Eve*.

In [125] we may read "The West Antarctic Peninsula is one of the fastest warming areas on Earth, with only some areas of the Arctic Circle experiencing faster rising temperatures. However, since Antarctica is a big place, climate change is not having a uniform impact... ASOC believes that understanding climate change impacts on Antarctica is a matter of critical importance for the world and for the continent itself."

It is indeed exceedingly strange that the carbon dioxide produced in remote metropolises attacks this very peninsula so much. That is why we suggest another solution to this problem. The warming is caused by the quadratic *AGA* that depends on latitude, which explains extremely well a higher increase of temperatures in the polar regions. Furthermore, note that *AGA* becomes stronger if the gravitational acceleration grows. The latter, in turn, depends on many factors such as latitude, altitude, differences in the topography, the density of the substrate, the distribution of this density in the earth's crust, and even the (time-dependent) pull of other solar system bodies, especially the Sun and the Moon.

When it comes to latitude, decreasing the gravitational acceleration due to the apparent centrifugal force created by the Earth's rotation should be taken into consideration, and it works weakest near the poles. At these locations g also grows as a result of the flattening of Earth, i.e., less distance from the center of the planet. Thus both of these effects further confirm our analysis.

Finally, Earth's magnetic field cannot be neglected. This follows from the fact that — as we have said — *AGA* also operates with the help of particles from cosmic radiation. The geomagnetic field can alter their direction[15] that is — as we have seen — very essential. If all the factors are taken into account, the value of (49) can be increased.

Our approach explains nicely the periodicity of climate change (no alterations of the Earth's orbit around the Sun are needed). The point is that certain sources of cosmic rays are quite stable. On the other hand, the Earth performs various periodic movements, alone or together with the solar system. Thus, for instance, if a source radiates along the axis that connects the Earth with Polaris, its impact on our planet will change dramatically due to the precession of the equinoxes. The proper motions of celestial objects play an important role as well. Nonetheless, the periodicity is not perfect because, in longer intervals, some sources fade away and others appear.

The greater sensitivity of the polar zones to cosmic radiation is not, in itself, dangerous. The degree of global warming depends on the speed of relevant (coming from certain directions) rays. If this velocity increases (perhaps owing to a shift in these directions), the temperature will rise.

There are also positive aspects of this phenomenon. It is naturally true that without the Sun there would be no life on Earth. Nevertheless, without the quadratic *AGA* the average surface temperature of our planet would be much lower. And it is possible that a few billion years ago the positive *Eve* gave the ultimate impetus to the emergence of life on Earth.

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[15] This applies, of course, even to electrically neutral particles because any magnetic field consists of photons, and they can be scattered on neutrinos, pions, etc.

Another potential confirmation of the quadratic *AGA* will be discussed very briefly. According to [126]: “Since 1994, satellite measurements have revealed gamma-ray flashes coming from altitudes of tens of kilometers. Researchers speculate that these flashes could be produced by electrons accelerated by thunderstorms, but previous measurements hadn’t found sufficiently large thunderstorm potentials. However, the newly observed potentials in the gigavolt range are much closer to the values required to produce the observed gamma rays. Gupta’s team is now setting up gamma-ray detectors around GRAPES-3, hoping to provide conclusive evidence by catching gamma-ray flashes in coincidence with a gigavolt-level thunderstorm.”

The quadratic *AGA* may be somehow involved in the process. We think that Gupta’s team [127] can really confirm this coincidence. Nonetheless, you should consider where the energy of these thunderstorms comes from. In our opinion, *AGA* can accelerate electrons, and at the same time (or thus) give the energy of thunderbolts. Note that all of this is exactly in line with our explanation of global warming.

29 Logically consistent quantum field theory

In [29] and Section 5. we have shown that quantum field theory based on virtual particles is not able to correctly describe the action at a distance, which occurs in the electrostatic and strong interaction. On the other hand, we suggest that this can be done in a way analogous to that used for gravity.

For this purpose you will need, first and foremost, info-bearing particles that can replace gravitons. Fortunately, they exist [35] and are called *pherons* (this term comes from the Greek word 'pherein' that means 'to carry'). In fact, pherons are force carriers of all interactions different from gravity (see Fig. 9.).

Name	*Spin*	*Colors*	*Application*
graviton	0	black	gravitational field
graviton	0	yellow (red + green) and anti-yellow	quantum entanglement
graviton	0	all remaining two-component	
graviton	2	black	gravitational field
pheron	0	black	inertia
pheron	0	all one- or two-component	strong interaction
pheron	2	black	electrostatic interaction (baryoelectric field)
pheron	2	yellow and anti-yellow	quantum entanglement
pheron	2	magenta (<u>b</u>lue <u>a</u>nd <u>r</u>ed)	reserved for <u>bar</u>yonic field (not needed if baryoelectric field is used)
pheron	2	all remaining two-component	

Fig. 9. Info-bearing particles and their applications.

At this point you could protest by asking what then about photons. Well, they remain real quanta of the magnetic field, while real spin-2 black pherons might be termed the quanta of the electrostatic field.

As intermediate pherons can be either superluminal or luminal, the propagation speed needs to be checked beforehand. The following experiment should clarify this matter.

Two photons are not sources of electrostatic interaction, but after the creation of an electron and a positron or before their annihilation the leptons are. Modern technology should make it possible to examine when Coulomb's law begins to work or ceases to do it. (Or, e.g., you could estimate the initial time of electric charge influence after the decay of a neutron.) If the velocity equals c (we admit that this is rather plausible, for c is a primary electromagnetic constant, but the verification is necessary), you should use info waves that travel at the speed of light (some of them are defined below).

When only virtual particles were at your disposal, you had no choice. Using info mechanics, you have two possibilities (depending on experience, of course). The approach can be similar to that of gravitons, where mappings GEN and AIM depend on the electric charge, and its sign is transmitted by spin. In both cases, the theory will be consistent with Lorentz transformations, but only in the case of superluminal (infinite under observer zero) velocity it will satisfy Mach's principle (as every interaction is the source of certain non-inertial movements) and will be more flexible. We think that this variant is more likely (when deriving his equations, Maxwell assumed that Coulomb's law acted instantaneously), but it has a minor flaw; in frames that move quickly relative to O_0 the relativistic transformations of momentum will have to be applied.

Note that you may construct info waves that go directly to the target (with infinite speed) or do not work at intermediate events (due to the specific rules of info mechanics). This eliminates the situations from the standard quantum field theory, where some matter can disturb the movement of virtual bosons (and, consequently, slow down their speed).

Analogous remarks go for strong interaction. However, its force carriers do not need a nonzero spin, and instead they have to enjoy colors. What's more, they must be all possible colors. Fortunately again, Fig. 9. shows that such info particles exist; spin-0 pherons have the colors of quarks (x and $\bar{x}$) as well as of gluons ($x\bar{y}$). Thus each energetic colored particle can emit pherons with its color to every event (with a suitable time) of space-time of the hadron, and others (enjoying a matching color) can absorb them, change their momentum, and emit a subluminal pheron to fulfill the color conservation principle.

The theory obtained in this way will not contain the contradictions listed in [29], and it will be simpler than QCD. In fact, the info-mechanical rules cannot permanently alter the momentum of an info particle, and it does not send other info ones (at least in this case), so there is no additional interaction between intermediate bosons and energetic particles. Obviously, six real gluons play a role similar to that of photons, i.e., they are emitted and absorbed by quarks (which creates a 'color-magnetic' interaction).

It seems that info bosons of strong interaction are superluminal. In this case, you will be able to shape the theory very flexibly. For example, to avoid contradictions, a function similar to ρ of Section 10. can be helpful. You may use the waves analogous to those of Section 6. with their total color being black (only their target should have the color of an energetic sender). Remember that, to be in compliance with the elaborate signal encapsulation principle, a quark should emit pherons with a new color only after the event at which the change occurred.

30 Origin of inertia

In [128] we may read that "...the origin of inertia is and remains the most obscure subject in the theory of particles and fields. Mach's principle may therefore have a future

— but not without the quantum theory.” From this it follows that in the section we resolve one more immensely intricate problem of physics, which even the great Einstein could not handle.

By *binary wave* we mean a duplet of two info particles, one of which has a velocity that does not exceeds c, and the other moves along two closed curves (two identical ellipses under an inertial observer, see Fig. 10.) at a speed not less than c. On the wave node (the common point of the curves) they coincide, and only then the speed of the latter is exactly equal to c. The wave is *subluminal* if the velocity of the former is less than c, and it is *standing* if the slow particle is immobile.

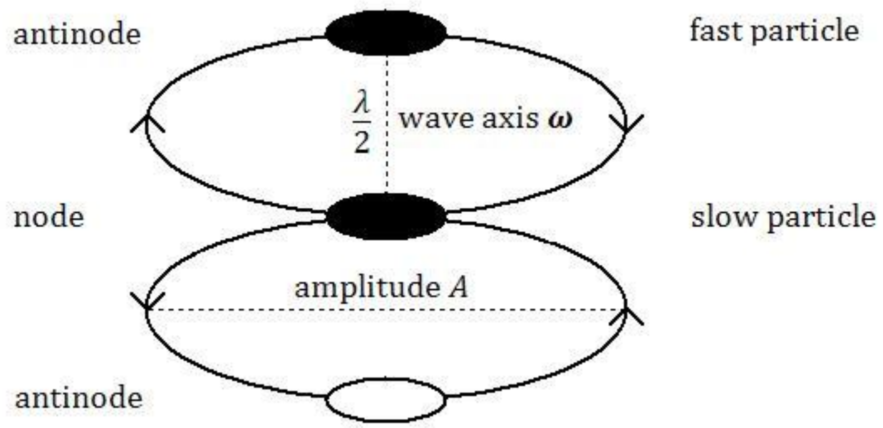

Fig. 10. Inertial (binary) wave.

By the *waveperiod* T of the wave we mean the time of flight between the nodes (and antinodes under inertial observers). We define also the *wavelength* $\lambda = cT$ and the *frequency* $f = 1/T$. By *inertial wave* we mean a subluminal binary wave that consists of two spin-0 black pherons.

We introduce the following rules of info-mechanics.

✱ (vi) (O*rigin of inertia*.) Under O_0, at every event of space-time there is the node of a unique stable standing inertial wave.

✱ (vii) (*Inertia of massive particles.*) If a massive particle with a rest mass m is at the node of an inertial wave whose subluminal pheron has the zero instantaneous speed and an acceleration $\boldsymbol{a}$, then under the same observer its momentum is increased, on average, by a portion of the momentum of the wave, that is,

$$\Delta \boldsymbol{p} = \frac{m\boldsymbol{a}\lambda}{c}, \tag{50}$$

where λ is the length of the inertial wave.

Of course, in (vii) the subluminal pheron gains energy and momentum by virtue the uncertainty principle, and can transmit them to the energetic particle. You see that inertia is caused by uncertainty as well. On the other hand, the fast pheron is only used to determine the wave node.

Inertial waves, like gravitational ones, are created in O_0, but the former are received in every frame. This raises the question of whether (vii) can hold without contradictions, since each observer sees momentums of the others (they remain unchanged because the instantaneous relative speed vanishes). They must be somehow cancelled out because the sum of uncountably many momentums is undefined. We may assume that in the case of an inertial observer the momentums of (50) for any $\boldsymbol{a}$ and $-\boldsymbol{a}$ cancel each other out. More generally, if the pheron has an acceleration $\boldsymbol{a}$, the observer of (vii) can obtain

$$\frac{m\lambda}{c}\left(\boldsymbol{a} + (-\boldsymbol{a} + 1.1\boldsymbol{a}) + (-1.1\boldsymbol{a} + 1.01\boldsymbol{a}) + (-1.01\boldsymbol{a} + 1.001\boldsymbol{a}) + \cdots\right), \quad (51)$$

that is, only the momentums that do not appear above are canceled out with their opposites. If the operations are performed according to the priority indicated by the brackets, (51) is equal to (50).

This, of course, cannot be regarded as a proof of (vii) that is, anyway, a postulate. Nevertheless, we may assume — in the absence of a general definition — that in this case Nature arranges cancelling out an infinite number of momentums in a manner similar to that suggested by (51), which justifies (vii). The numbers of (51) can be in any numeral system, and binary seems the most natural.

Just as with gravitational waves, we take for granted that the lengths of inertial waves are extremely small (e.g., satisfy (12)). Since we believe that the speed c remains unaltered in any frame, the transfer of (50) happens at time intervals Δt equal to λ/c. If it is tiny (which occurs in the vast majority of cases), $\Delta\boldsymbol{p}/\Delta t$ approximates the derivative of momentum, i.e., force. Taking into account the fact that the acceleration of the observer with respect to Mach's frame equals the negated acceleration of the subluminal pheron, we obtain that the force that acts on the energetic particle satisfies

$$\boldsymbol{F} \cong -m\boldsymbol{a},$$

and the formula obtained by the force transformation for nonzero speeds.

Inertia also includes, obviously, massless particles, but the formulation of a relevant info-mechanical rule goes beyond the scope of this work. We just note here that this problem is rather technical in nature. Indeed, a photon encounters the nodes of inertial waves and in this manner receives full information on how to behave.

Our explanation can be interpreted in terms of fields. Indeed, we may say that there is an inertial field, analogous to the gravitational one, whose quanta are spin-0 black pherons that are very similar to spin-0 black gravitons. However, the gravitational field enjoys also other quanta.

(vii) cannot give any effect under Mach's frame and other inertial observers in $U1s$ (in our superuniverse the waves have the same form). This is not entirely true in a universe of degree greater than 1, where each observer may feel inertia that comes from higher-level worlds. According to [2], this leads to Hubble's law in our universe.

In [2] we left unanswered the question of if the rotation of our $U2$ can be detected in local experiments performed on Earth. At present, we are able to clarify this issue. The key observation is that λ/c is small but only in the universe in which an inertial wave has been created. As our $U2$ enjoys a space-time with infinite sizes, and it is a small particle in our $U1$, in the former the length of an inertial wave created in the latter is usually enormous. Consequently, the frequency has to be tiny. The facts imply that the intercosmic inertia acts on particles very strongly albeit very rarely.

If an electron is knocked out of the Earth once per, say, minute, it will be very difficult for us to detect this fact even though the particle reaches a huge speed. However, there will be a lot of those events in a galaxy. As the total energy of knocked particles is great, gravity causes the entire galaxy to move in the same direction.

One sees that Mach's frames can rotate and rush forward with any acceleration inside their superworlds of nonzero degree. Although they feel intercosmic inertia, it cannot be detected by local experiments.

31 Entangled particles

In the section, we pave the way to describe quantum entanglement on the basis of info mechanics. As all black info-bearing particles have been already used, for this purpose we choose the yellow color that is probably the most popular color that arises from the combination of other two. Maybe, in the future, we will be able to check what color (i.e., xy or $x\bar{y}$) Nature has chosen.

In the following info-mechanical rules that only concern the spin of fundamental particles [129], we use the binary waves of the previous section and the hexagonal waves of Section 6. with yellow components. By the spin of the first we mean that of its slow particle.

We will need some additional concepts related to binary waves under inertial observers. In this case one may assume that the wavelength is the distance between the antinodes. The line through them is termed the *wave axis*. Note that it can be different from the direction of the wave velocity (equal to that of the slow boson). The wave may rotate, and then the wave axis is a vector. It is even possible that the upper and lower ellipse rotate in a different way, so we obtain two magnitudes and senses that can carry additional information. For the spin entanglement they do not matter, so we may assume that the waves are two-dimensional.

The length of the ellipse axis orthogonal to the wave axis is termed the *amplitude* A of the wave. We take for granted that A and λ are less than the Planck length. Just like in Section 6., the pinnacle fulfills $P = A/\lambda$.

Now we can formulate the rules. Yellow info bosons that accompany energy particles under these rules will be called *guardian angels*[16] or *guardians*[17] for short.

✱ (viii) (*Creation of fundamental particles*.) If a real energetic fundamental particle is created, a binary wave of yellow gravitons with a random pinnacle begins to accompany it, whereby if there is another particle with entangled spin, under O_0 their pinnacles are identical and natural greater than 1, and otherwise $P = 1$.

✱ (ix) (*Measurement of spin*.) Under O_0, if the spin of a particle with its guardian that has a wave axis $\boldsymbol{\omega}$ and a spin $2s_0$ is measured in a direction $\boldsymbol{d}$, the sign of the obtained result s is equal to $\operatorname{sgn}(s_0 + 1/2)$ with the probability

$$\frac{1 + (\boldsymbol{\omega}\hat{\ }\boldsymbol{d}\hat{\ }s_0\,)^2}{2},$$

and the guardian is replaced by a binary wave of yellow pherons with the same pinnacle P, the wave axis $\boldsymbol{d}$, and the spin s_1 such that

$$\operatorname{sgn}(s_1) = \operatorname{sgn}(s),$$

[16] This terminology should be acceptable since ghosts have been already present in particle physics.

[17] If we assume that guardians are yellow, and the intermediate bosons of baryonic field are magenta, all colors are uniquely determine.

whereby if $P \neq 1$, then — right after the measurement — a hexagonal wave of yellow pherons with the same pinnacle and the spin $-s_1$ is sent, with infinite speed, to every point of space.

✱ (x) (*Entanglement of spin*.) If two yellow info bosons are at the same event and enjoy the same pinnacle, the slower takes the flavor and spin of the faster one.

The rules should depict the behavior of quantum spin during measurements (in (ix) we take into account that the spin of info bosons equals -2, 0 or 2). By the way, we have explained here (in the two first rules without the whereby clauses) how the particle remembers the direction and the result of a spin measurement (no hidden variables needed), even without entanglement. Note that in the whole paper we talk about the spin of info particles as an objectively existing value, whereas the spin of energetic ones may not exist at all; the rules give the probabilities of obtaining some measurement results.

Pay attention to the important role of the pinnacle in this mechanism. As it may be any number, the probability of random compliance vanishes (which justifies the 'pin' abbreviation). On the other hand, it holds for entangled particles under O_0, and one sees that the causal relationship between the measurements always takes place in this frame. Indeed, the necessity of choosing an observer for this purpose is obvious. Therefore, Mach's frame is applicable also in this case.

Let us note in passing that by virtue of (viii) and (ix) each real energetic particle has its own guardian angel (virtual ones don't need them since their spin cannot be measured experimentally). The set of all the guardians of particles that make up the body of a human can be called their guardian angel. It doesn't have to be just a joke; if we learn to detect info bosons directly, the photographs of our guardian angels can find application in medicine[18]. As guardians do not have to occupy the exact positions of their energy particles, this method can be less invasive than other diagnostic techniques.

The approach can be extended to other physical properties. Suppose, for instance, that a pair of particles is generated in such a fashion that their total momentum $\boldsymbol{p}$ is known, and one particle is found to have the momentum $\boldsymbol{p}_1$. This implies that the momentum of the other particle, measured at any time, must be found to be $\boldsymbol{p} - \boldsymbol{p}_1$. The hexagonal wave can transfer the direction of the momentum by its waveversor (in this case it does not have to indicate the source), the sense is able to be transferred by assuming that, e.g., the wavetail is anti-yellow, whereas for the magnitude its pin-1 can be used (the main pinnacle is still an identifier). Indeed, in (11) we assumed that it equaled r because we had known that r would be needed to calculate the gravitational randomization. On the other hand, r doesn't matter here, so we may take for granted that the back amplitude is equal to $\lambda|\boldsymbol{p} - \boldsymbol{p}_1|$.

In the case of energy the entangled particles should have information about its maximum value E, while the binary wave has no wavetail. Thus you should use a binary rotating wave or a ternary one. The latter has two fast particles (one of which is anti-yellow) and due to this it enjoys two amplitudes. The second of them can store an additional value, so you may assume that $A_1 = \lambda E$.

The info-wave development can be continued, which enables us to depict, inter alia, the quantum entanglement of many particles as well. A superluminal wave can enjoy $n-1$ anti-yellow particles in its tail, which allows it to store n values (back amplitudes are distances between adjacent particles). On the other hand, a slow wave is able to do the same whenever it has n amplitudes (the main one corresponds to a yellow particle,

[18] My imagination sees signs in clinics: X-ray, CT scan and GA photo, i.e., guardian angel.

and the remaining ones are ordered by the slope angles of their ellipses with respect to the first one). In both cases negative numbers can be indicated by the fact that the spin of a particle is different from that of the target or the slow one.

If you have several vector quantities, the use of slow waves with many rotating fast particles is possible, whereby their amplitudes should specify the type of quantity (except for the main one, a number less than 1, see below). You may also transmit superluminal waves with the same pinnacle, pinnacle-1 indicating what quantity it is about, and pin-2 giving its magnitude.

You may wonder why we have said that the identifiers of yellow info particles are natural, not, e.g., rational. Well, they can be so, but not for spin (by our assumption). Obviously, we do not know the identification method applied by Nature. Nonetheless, we have to choose something so as not to run into contradictions. We suggest to assume that the identifiers contain a fractional part depending on physical quantity, for instance,

0.001 — momentum,
0.002 — energy,

etc. Consequently, e.g., if an energetic particle is accompanied by a rotating yellow graviton with its pinnacle of the form $n + 0.001$, one knows that the axis of the latter indicates the total momentum.

Let us add that in the case of entangled position or flavor energetic particles do not exist until a measurement at all, and the complete information on them is stored in yellow info-bearing waves that can occupy, with the same pinnacle, whole regions of space-time.

Now you probably see what is going on here. Info particles are constantly working in the background, and if someone does not know about their existence, they perceive quantum world as something full of paradoxes [130-134]. We believe that info waves participate in virtually every manifestation of quantum reality.

32 Conclusion

The work can be summarized in one sentence: In our opinion, Einstein made a caricature of interactions out of gravity, whereas we have tried to make gravitation great again. It enjoys, first of all, its own charge, does not work seemingly, and can act very strongly — albeit without infinities — even in microworld. We think that this picture of the most important field is more in line with experience, and may allow you to avoid introducing new interactions.

It should be made clear that this is not Einstein's fault; he was just born too early. When he started his scientific career, only one massive elementary particle was known[19]. On the other hand, the undisputed peak of technology at that time were electric elevators[20], and Einstein knew them perfectly well[21]. He was riding the elevators and thought that with their help he would be able to depict all reality. That could not have worked, for in Nature particles were far more relevant than elevators.

We consider the most important benefit of this work to be the explanation of the dark matter absence that has plagued physicists for many years. Obviously, the ardent

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[19] The corpuscular theory of light had also existed since at least the days of Newton. Einstein thought that Planck's work [135] presented only a variation of that theory.
[20] Their era began at the end of the nineteenth century in Germany.
[21] Einstein, as a very young man, was the chief electrician of an international exhibition in Geneva.

followers of Einstein's approach may continue searching for it, e.g., in mines (instead of making constantly unfulfilled predictions, such as those in [83], because how long can it last?).

AGA already has dark matter, and even if — by some miracle — dark matter compatible with Einstein's theory is detected, AGA will remain true. You will still have a quantum gravity theory that is consistent with Lorentz transformations, satisfies Mach's principle, and does not lead to singularities. Hence, the time devoted to AGA will not be wasted. On the other hand, this discovery will not help general relativity because, due to the contradiction depicted in Section 15., it will remain a false approach.

When the author created the title of the work, he could not say that general relativity was definitely false. Hence he used the word 'Alternative'. The contradiction, found later, changes the situation. The approach presented in the paper becomes the only true theory of gravity with no alternative.

However, the acronym AGA may continue to be used, albeit with a different meaning. It should be understood as *Additional Gravitational Amendments*. This expansion reflects the fact that the theory makes corrections to Newtonian gravity. When the particle velocities are small compared to the speed of light, the distances between them are large compared to the Planck length, and the observer moves slowly with respect to observer zero, the AGA formulas transform into Newton's formulas.

Although we do not need new particles in the case of dark matter, the existence of a few of them is predicted in the paper. This includes, in particular, the seventh quark. If you argue that this is contrary to the Standard Model, we have a question: Do you really think that super-large colliders, which — sooner or later — will be launched on Earth, will no longer discover any new particles[22]?

In addition to the seventh quark, the author once came across four peculiar particles. They enjoyed a 0 or 2 spin, unheard of among other fundamental ones. However, even more strange was the fact that they had to carry zero energy and momentum. Then he guessed that two of them were the long-sought gravitons and named the other two pherons. This was the genesis of info mechanics.

In the paper we have shown that info bosons and info mechanics are able to replace virtual ones and perturbation theory correspondingly. Indeed, the momentum of energetic particles can be altered in a fashion consistent with quantum physics. This possibility is ensured owing to a quantum prime principle, i.e., that of uncertainty, and this is a new paradigm of our approach. As a result, info waves are the natural counterparts of classical forces that changed momentum in a smooth manner.

Nonetheless, it is far from everything. For consider a virtual particle that strikes like a hammer. Can this event change any probabilities (not related to the displacement of the hit object)? It is hard to assume. On the other hand, you have seen that info particles modify quantum probabilities with ease, and they are able to do much more. This demonstrates that information is more powerful than blind force.

One could therefore say that, in a sense, the gravitons of AGA replace the curved space-time of general relativity. The fundamental difference is that the particles are much more flexible. For example, they do not require the equality of gravitational and inertial mass.

Let's imagine that today — when AGA is known and general relativity with its contradictions cannot impose anything — Eötvös would come to a scientific conference and announce that weak equivalence is true because he, together with his team, had

[22] Physicists of the 19th century also thought that there would be no new particles.

checked the equality of those masses on some garbage and platinum. He would be ridiculed. We could hear shouts from the hall: 'What about pions? What about muons and taus? What about neutrinos? What about heavy quarks?' and finally ‘How about antimatter?'

The assumption that both of these masses were equal came from the pride of 19th-century physicists who thought they already knew all forms of matter. Einstein worked scientifically in the next century, but mentally he was still stuck in his college days. He needed weak equivalence to use the latest trend, i.e. non-Euclidean geometry. However, that's what was wrong because it doesn't fit quantum physics.

At this point you may be surprised because so far you have been convinced that this geometry is the cure for all ills, that physics is geometry, etc. So let's try to discuss this matter in more detail.

Let us note, first of all, that non-Euclidean geometry was not discovered by physicists or geographers, but mathematicians did, and they are the ones who should be asked what it can be used for. Einstein was fortunate that the great mathematician and physicist Poincaré tried to advise him. He wrote that something such as spacetime should have been as simple as possible (and Euclidean spacetime meets this requirement), but many humans thought that Poincaré was afraid of hard problems. Unfortunately, the latter died in 1912, and the former then turned to second-rate mathematicians who could merely explain some technical details to him.

Poincaré was one of the creators of topology. Most theorems of this branch of mathematics are generalizations of facts about Euclidean spaces. Mathematicians try to prove them under the weakest possible assumptions, but first they test them in and between various abstract spaces. Thus non-Euclidean geometries are used to find examples and counterexamples. This role is important, but not the most important.

Nevertheless, there is a branch of mathematics that deals only with non-Euclidean geometries, in which Euclidean space is rejected with disgust. It is called differential geometry and this term should dispel the misconceptions. Interesting non-Euclidean geometries are usually related to differentiation in a significant way[23]. And since most physicists have agreed that general relativity cannot be true, it must be said that it has not been a matter of replacing one non-Euclidean geometry with another.

As we well know, any quantum particle is, in essence, a probability wave. As our universe consists of quantum particles, it is also a great wave of probability[24] and manifests itself as a discrete set of events. Since we can see, even only using gravity as an example, that superluminal speeds occur in Nature[25], there is no natural and non-trivial non-Euclidean geometry that embraces all the events. (The discrete topology gives nothing.) On the other hand, Euclidean spacetime is natural and is certainly not trivial. Poincaré knew Planck's theory [135] and could have guessed that it would end this way, whereas Einstein tried to negate the importance of probabilities[26] in physics and this was his third fatal mistake (after introducing finite maximum speed and removing gravitational mass). You can now see that Nature does exactly the opposite.

The question arises why this happens, why we have quanta controlled by probabilities instead of proper time. In our opinion, this is not an accident or Nature's malice towards

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[23] Curved space-time, described by Einstein's equations, could belong to differential geometry, although its mathematical properties are rather weak.

[24] This means that — in complete contradiction to Einstein's statement — God delights in playing dice.

[25] No inflation can eliminate them.

[26] In his explanation of the photoelectric effect, Einstein referred to [135], but instead of probabilities he wrote about the work done by photons. This usage is incorrect because, inter alia, they are trajectoryless.

Einstein and other classical physicists. The point is that certain goals can only be achieved in a discrete way. For instance, effective computing machines could only be built when Turing created their digital foundations. Another well-known example is provided by the necessity of avoiding the infinite energy in Nature [135].

The supposed slowing down of time by gravitational potential was also a fatal mistake, but it would not have happened if Einstein had had more imagination regarding mass. On the other hand, if he had realized that there was something wrong with time, he might have guessed that the same thing was happening to mass. Note also that the slowed time was needed in general relativity, inter alia, to make the theory Lorentz-invariant. Thus we think that any attempt to introduce non-Euclidean geometry into the foundations of physics will affect time, causing contradictions similar to those described in Section 15.

At this point we can say that the use of non-Euclidean geometry in physics has brought more harm than good. Indeed, the image of the most important field has been seriously distorted. As a result, some physicists have been stuck in years of fruitless searches for non-existent things (Einstein's gravitational waves, dark matter and dark energy compatible with general relativity, the Higgs particle, etc.). Others have been forced to consider absurdities (infinite energy inside black holes, space-time inflation, unrealistic cosmological models, artificial combination of totally different interactions, etc.). Journals dedicated to the false gravity theory have been springing up like mushrooms. Many conferences have been organized on general relativity, the Higgs particle and operator, electroweak interaction, etc. Their only effect has been the waste of paper and high CO_2 emissions (this also applies to the efforts of most climatologists, since they have intended to save the planet on the basis of false theories). Do you want to keep playing this?

Feynman maintained that modern physics was based on three cornerstones: special relativity, general relativity, and quantum field theory. In his day, he was right, but he did not anticipate that all three of these pillars would be cut. Indeed, special relativity is only 50% true[27] as plenty of superluminal signals exist in Nature; one just has to look carefully. QFT enjoys at most 25% truthfulness because only quantum electrodynamics without electrostatic interaction can survive. Finally, general relativity is completely untrue, since its fundamental object does not exist.

Note that this is very good. If we cut down only one or two pillars, modern physics might not hold up on two or one pillar. As a result, it could fall and break. And so it falls gently, can be lifted and based on three new cornerstones (corresponding, in a sense, to those of Feynman): superluminal relativity (Lorentz transformations with signal encapsulation and elaboration instead of Minkowski spacetime, by which also termed ERA expanded as Encapsulated Relativity Approach), GUN (the image of the entire Nature with the de Broglie wave-particle duality), and IM (Information Mechanics, i.e., the quantum basis with the Heisenberg uncertainty principle). The most important and model example of their use (the lowest horizontal layer of the physics building, see Fig. 11.) is this approach to gravity.

[27] However, even for the special relativity part concerning only Lorentz transformations, some quantum-related corrections will have to be made.

<table>
<tr><td colspan="2">Level</td><td colspan="3">Description</td></tr>
<tr><td rowspan="2">Observation deck</td><td rowspan="2">Attic</td><td colspan="3">CUP (the acronym cannot be expanded in this work). You will be able to admire the beautiful view of Nature from here while sipping a cup of drink.</td></tr>
<tr><td colspan="3">quantum entanglement, quantum equations, quantum optics, etc.</td></tr>
<tr><td colspan="2">Fourth floor</td><td colspan="3">BED (BaryoElectric Dynamics). The name of this theory is justified by the existence of certain connections between the baryonic and electromagnetic fields. The occupant of this bedroom, TIM (Tinion Internal Model), uses a baryoelectric charge defined as the sum of the two charges [35]. You can check that it is an integer even for quarks!</td></tr>
<tr><td colspan="2">Third floor</td><td colspan="3">CAT (Color Arithmetic and Theory). It contains the full arithmetic of colors and color theory, i.e., chromodynamics. In my opinion, the word 'quantum' is unnecessary in this case. However, you may also speak about new QCD.</td></tr>
<tr><td colspan="2">Second floor</td><td colspan="3">new QED[28] (Quantum ElectroDynamics). Here 'Quantum' is essential. The theory can be treated as a part of BED [see 35], i.e., it may use the fourth floor bedroom.</td></tr>
<tr><td rowspan="2">First floor</td><td rowspan="2">Veranda</td><td colspan="3">AGA (Additional Gravitational Amendments). A rowdy subtenant called Weak Field lives on this floor too.</td></tr>
<tr><td colspan="3">SIT (Superluminal Information Technology). Here you will be able to sit and relax. Artificial intelligence using superluminal signals and IM will only be what we expect. Such AI will do everything for you.</td></tr>
<tr><td colspan="2">Pillars (cornerstones)</td><td>ERA (Encapsulated Relativity Approach).</td><td>GUN (Grand Unification of Nature).</td><td>IM (Information Mechanics).</td></tr>
<tr><td colspan="2">Cellars (equipment and materials)</td><td>Lorentz transformations,
Einstein's formulas,
signal encapsulation Ⓢ and elaboration Ⓔ,
probabilities.</td><td>universes,
intercosmic transformations,
quantum relativity principle,
Planck's formulas,
De Broglie's duality.</td><td>info bosons,
info waves,
Heisenberg's uncertainty principle.</td></tr>
</table>

Fig. 11. The edifice of new physics.

As you have probably noticed, AGA is a new class scientific theory (like an autonomous car among ordinary ones). It cannot fall, but it greatly appreciates experimentation; the tests serve to improve it (through the learning process), not to disprove it. We think that — thanks to the uncertainty principle (which makes it very favorable) — info particles, as opposed to virtual ones, will be directly observable in the future. It is also significant that AGA solves difficult problems without any reference to God, while in general relativity the inevitable question (unknown to Einstein and the founders of the inflation theory) arises as to who or what set all these parameters of curved space-time. And (using the same engine) you will be able to build other theories of this class.

The work also provides additional justification for GUN. If only our universe existed, in the case of Galileo transformations the classical relativity principle could rather hold (with $c = \infty$ and Ⓔ, i.e., if the light reflection takes place with infinitesimal delay). Nevertheless, this would be impossible in the case of Lorentz transformations considered together with, e.g., the effects of inertia. (Simply put, Lorentz transformations force multiple universes.) In this situation, GUN ensures that the quantum relativity principle is true (and in addition to inertial observers many other

[28] One sees that it is not my acronym. From mine — created in cooperation with Nature — you can build a sensible sentence, e.g.: *AGA and TIM SIT in BED with CAT, CUP and, in this ERA, GUN.* (The last thing is probably to defend against Weak Field.) On the other hand, IM (it can be pronounced like I'm) points out that nothing exists as well.

things, such as dimension numbers, time's arrows, regular matter and antimatter[29], etc., are treated equally, and these relationships also require many universes), and at the same time it enables us to define Mach's frame with respect to which the inertia effects arise and thanks to which AGA meets Mach's principle.

According to the most common cosmological models (based on general relativity), our universe evolved from a single event denoted, under an observer, by (0,0,0,0). It could not be embedded in another structure, otherwise we would have a non-Euclidean geometry similar to that found in geography. However, nothing could have been created from these four zeros (no divine particle can help in such a situation) unless someone outside had programmed the evolution of our universe. Who could that have been? Maybe God? In science? The multi-universe GUN allows you not to refer to this non-physical being.

Anyone who has read [2] will probably admit that we are not afraid of difficult problems. Our resolution was possible by relying on Euclidean spaces, and Fig. 11. should make you sure that that we have not lost anything that is needed in Nature. You could attempt to do something similar based on non-Euclidean geometries, but we think you'll get bogged down in irrelevant technical details right from the start. This is what Poincaré warned against.

GUN shows that you may safely leave non-Euclidean geometries to mathematicians and let them differentiate. In our opinion it is good that physics, albeit based on mathematics, is a separate field of knowledge.

In the previous section, we have used Mach's frame to describe quantum entanglement, and this shows that there are no miracles in Nature. The distant particles of a quantum system communicate (via info bosons) with each other at infinite speed, and this does not lead to any contradictions. We may therefore conclude that quantum physics is a particle theory, not a superposition theory. Indeed, if there were no particles, there would be no quantum physics. And they — unlike superpositions — are basic physical objects.

Of course, physicists can still depict certain phenomena by the evolution of the state vector[30], but they should remember how and why this evolution occurs. They may also say that some particle is a superposition of others, but they should be aware that this is only a manifestation of the quantum entanglement of the particle flavor. And in no case are they allowed to create — like some Gods — arbitrary superpositions because this can lead to serious errors. For instance, if the founders of QCD had not been able to create gluon superpositions on paper (where are those particles now?), maybe they would have noticed that the exchange of virtual gluons was nonsensical [29]. A similar matter occurs with the bizarre particles (neutrinos made up of more fundamental neutrinos) created ad hoc to explain the phenomenon of neutrino oscillations.

Using Mach's frame (you could call it the *preferred* frame [136] if you prefer) and info mechanics even the Schrödinger equation can be made relativistically consistent. That it works on Earth is strange, but when our planet is replaced by observer zero, everything becomes logically correct. The equation probably uses the info waves of infinite velocity, while the Dirac (or Dirac-Kowitt) equation is based on the ones propagated at speeds that do not exceed c.

The case of the inertia origin shows that without info bosons even very wise humans are helpless. To understand this, imagine what your life would be like without zero that

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[29] Our universe has more regular matter than antimatter because some other universes of our *U1* have more antimatter than matter. On the other hand, the entire Nature is perfectly symmetric.

[30] The funniest thing about all this is that physicists think that Nature is largely composed of (state) vectors, whereas I — as a mathematician — have to restore normality and remind them that it consists only of particles.

also fills a certain gap. You must not reiterate the mistake of the Ancient Romans who saw no need to introduce zero, since it was nothing. And only when you skillfully combine zero with nonzero, i.e., information with energy, you can obtain everything.

In the main thread of the paper, Planck's name has only been mentioned in connection with his length and time. Nevertheless, this can be unfair to him. Let us recall that in [135] he introduced new particles — later called photons — that had zero inertial mass and made it possible to avoid infinite energy catastrophes. Now we go further and introduce new particles — already termed gravitons — that enjoy zero energy and thus make it possible to avoid infinite energy disasters. You see we use the best science.

Planck was the first to incorporate probability into the foundations of physics. As the American engineer Shannon showed, probabilities are closely related to information. This is why this latter concept plays such an important role in quantum physics. And information is most fully utilized in info-mechanics (for only here has been information completely released).

As we said earlier, to use probabilities, Planck needed a discrete environment. If the theory [135] were published today, it could be called the digitization of light, and then we would have the digitization of the entire Nature. You see that in this case the physicists were ahead of Turing and other mathematicians.

The paper is highly critical of Einstein. It must be said, however, that he did one thing well, even very well. He was the first to consistently replace Galileo transformations with Lorentz ones, ahead of Poincaré and Lorentz. As a result, he obtained (7) that is important for info particles as well. Nevertheless, it would be better for all if Einstein stopped there (not everyone can be Marie Curie). General relativity would be, sooner or later, formulated by other physicists [see 24], and we could now say that our dear Albert was more prescient than them.

Einstein was a classical physicist who painfully collided with quantum reality. Fortunately for him, the Lorentz transformation belongs to both classical and quantum physics (cf. Fig. 3.). That's why we will always remember him.

It is evident that our quantum gravity theory could not have been built without info mechanics. The deeply important applications of both of these conceptions have been given or outlined in this work. You probably already see that by applying info mechanics — instead of geometry, perturbation theory and other tools borrowed from mathematics — you will avoid Einstein's misfortunes and will always be in harmony with Nature. That is why we believe that info-bearing particles and info mechanics will play for quantum physics a role similar to that played by forces and Newtonian dynamics for classical physics.

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