PHYSICAL SCIENCES

STRING THEORY: ANOTHER APPROACH TO PHENOMENA

Bashirov M.
Candidate of Sciences in physics and mathematics, Ph.D.
Abbasov V.
Baku State University, student,
Baku State University
Baku, Republic of Azerbaijan.
https://doi.org/10.5281/zenodo.13863308

Abstract

Since 1915, the interrelation of the concepts of space, time, and gravity has suggested the possibility of a larger theoretical framework. This theory, which combines all the forces of space, time and nature in a quantum mechanical model, employed the Euler-beta function to form a unified framework for the string theory, which resembles tiny strands of energy. Various approaches have been proposed to explain both the physical field and the properties of matter through strings. In the work presented, why and in what forms the phenomena that occur with the vibration of the strings were clarified, and a few parameters of the strings were calculated using the mass of the string, considered the smallest mass. New string theory: an attempt has been made to explain a few phenomena taking place in the microcosm with a semi-string. At the same time, an attempt was made to explain the Compton effect, which makes the particle nature of light clearer, and the creation of electrically charged and uncharged particles based on string theory.

Keywords: String theory, semistring concept, smallest mass, Compton effect, creation of electric charges.

Introduction. A. Einstein combined space and time with the theory of special relativity and showed that movement in space affects the passage of time. A. Einstein further connected the concepts of space, time and gravity with the theory of general relativity and showed that the distortions in space and time are caused by gravity. These facts were a great achievement in science. A. Einstein envisaged a larger theory - a powerful framework that would take into account all the forces of nature, space and time - a combination he called a unified theory. However, A. Einstein's attempt ended in failure. Most of his contemporaries consider the search for a unified theory hopeless, misguided. The main concern of theoretical physicists became quantum mechanics - the emerging framework for describing atomic and subatomic processes [1]. Particles on this scale have such small mass that gravity is essentially negligible in their interactions, and thus general relativistic effects have been largely neglected in quantum mechanical calculations for decades. Then, in the late 1960s, attention turned to a different force—the strong force that binds protons and neutrons in atomic nuclei. Gabriele Veneziano, a young theorist at the European Center for Nuclear Research, made a major breakthrough in 1968 when he suggested that a 200-year-old formula, the Euler-beta function, could explain a large amount of data. A few years later, Leonard Susskind of Stanford University, Holger Nielsen of the Niels Bohr Institute, and Yoichiro Nambu of the University of Chicago significantly strengthened Veneziano's ideas by showing that the underlying mathematics of the equation minus the vibrational motion of the fibers led to string theory, which resembles tiny filaments of energy. The theory suggests that the strong force and particles are made up of strings. However, strings failed in its first incarnation as a representation of a powerful force, and many thought it unlikely to succeed as a solution to a more complex problem. This view resulted in the emergence of theoretical problems of string theory. First, some of his equations did not fit the theory, and second, the theory's mathematics required the Universe to have not only three spatial dimensions, but six other spatial dimensions. Due to these problems, the number of researchers working with string theory was reduced to two individuals in 1980 - Schwarz and Michael Green of Queen Mary College, London. However, in 1984, these two theorists made a major breakthrough. In a remarkable calculation, they proved that the equations of string theory are consistent. Based on these calculations, they realized that string theory has the potential to unify all types of matter with the 4 main forces in the Universe in a single quantum mechanical model [2]. After this result was published, researchers turned their attention to string theory. Within a few months, a unified framework of string theory was formed. Just as the different vibrational patterns of a pipe string produce different notes, so in string theory, the different vibrations of small strings were thought to produce different particles of nature. The mass and charge of the particle is determined by how the string vibrates. For example, string theory claims that an electron is made up of strings that go through a particular vibrational pattern, while envisioning quarks as strings that go through a vibrational pattern. Essentially, physicists claim to exist in particles found experimentally to link the forces of nature between vibrational patterns. Thus, string theory was proposed as the sought-after unification of all forces and all matter. Between 1984 and 1994, many theoretical physicists attempted to complete string theory by transforming this abstract, purely mathematical framework into a concrete, predictive theory of nature.

Case in point: With the creation of the universe, time and space began to emerge simultaneously, and matter began to expand from a single point. Therefore, matter and the physical realm, which are the manifestations of matter, have the same source. This source is the smallest particle in existence. It is clear that the smallest particle in existence must possess both matter and field properties. Given the properties of this primordial particle, all phenomena can be explained by this emerging theory, and this fact can eliminate existing contradictions. Sims have these properties. For this reason, string theory is considered the first major achievement after A. Einstein's theory. Everything that exists in matter as a whole is composed of strings. On the other hand, we know that energy is the most important quantity that exists in the Universe. Matter, as a whole, is built on a single energy. Trying to learn the secret of the universe, Nikola Tesla said, ``If you want to know the secret of the universe, look at the relationship between energy and frequency." Based on these facts, we can say that the uniform energy causes the strings to vibrate at a certain frequency, or vice versa, the vibration of the strings at a certain frequency causes the total energy that exists in the Universe. The reason that the concepts of space and time are a single whole can be attributed to the fact that matter is built on a single energy. The different types of energy that we observe in the macro world are actually different manifestations of the unified energy of matter. These facts show that the strings vibrate in different ways, when they vibrate, they form a physical field, and when they collide with each other, they form the corresponding particle. Different collisions produce different particles, different particles produce different atoms, and different atoms- different substances, and different substances reveal the wealth that exists in the Universe [3].

Problem Solving: Although the strings have a single source of energy for their vibration, they do not all vibrate in the same way. Only the strings that vibrate in the same way and shape combine to form the corresponding particle. Strings vibrating in different forms do not combine in this form, they only form a physical field in one place. To explain this picture, let's introduce the concept of "semi-string". Since there is a concept of direction in 3-dimensional space, we can say that these substrings can be directed in different directions. As a result of the interaction of half strings with the same direction, the corresponding form of vibration appears. Strings with identical vibration patterns can join, and this process takes place over a very short period of time. It is known that elementary particles undergo interconversion. They can be destroyed and reborn[4]. As a result of this, we can mention the event of the destruction of the elementary particle as a result of the change of the vibrating form of the strings existing inside the elementary particles, and the formation of a new particle as a result of the combination of strings with a new form. The reason for the change of this vibration form is the presence of identical and different vibrating strings located in different directions around one string and the energy exchange between them. The dimensions of strings are so small that the ratio of a single string to an atom is equal to the ratio of one atom to the entire solar system. All objects that exist in the space we exist in have mass and shape. Based on this fact, we can say that strings have mass and determine the value of this mass by mathematical calculation.

$$\frac{M_S}{M_A}=\frac{M_A}{M_{GS}} \to M_S=\frac{M_A^{\ 2}}{M_{GS}} \to M_S=\frac{(1{,}6830928\cdot 10^{-27})^2}{1{,}99266862\cdot 10^{30}}=1{,}42161187\cdot 10^{-84}$$

Here M_{GS} is the total mass of the solar system, M_A is the mass of the smallest atom, and M_S is the mass of a string.

Since strings are considered (for now) to be the smallest particles in the universe, we can say that the mass of 1.42161187•10^{-84} kg is the smallest known mass. There is no mass smaller than this value in the universe. Using the mass of a string, the values of a number of quantities can also be calculated:

1) If the number of wires in a hydrogen atom is N:

M_H=N•Ms from here N=M_H/M_s=1.18393271•10^{57}.

2) The mass of the smallest existing quark is 1.7Mev/c^2=3.02726556x10^{-30} kg. Based on this value, it is possible to calculate the minimum number of strings needed to create one quark:

N=M_k/M_s=3.02726556x10^{-30}/1.42161187x10^{-84}=2.12945996x10^{54}≈2.13x10^{54}

Here M_k is the mass of the quark.

3) The smallest elementary particle with rest mass that exists is the electron. The minimum number of strings needed to create an elementary particle.

N=M_e/M_s=9.11x10^{-31}/1.42161187x10^{-84}=6.40821886×10^{53}≈6.4×10^{53}

Here M_e is the mass of the electron.

4) Considering the mass of the Universe in kg, it is possible to approximately calculate how many strings exist in the Universe:

N=M_k/M_s=10^{53}/1.42161187x10^{-84}=7.03426878x10^{136}

5) Based on the relationship between energy and frequency, we can say that strings have a certain frequency and wavelength. Let's calculate the wavelength of a string using the expression λ=h/p:

$$\lambda_s=\frac{h}{p}=\frac{h}{cm_0}$$

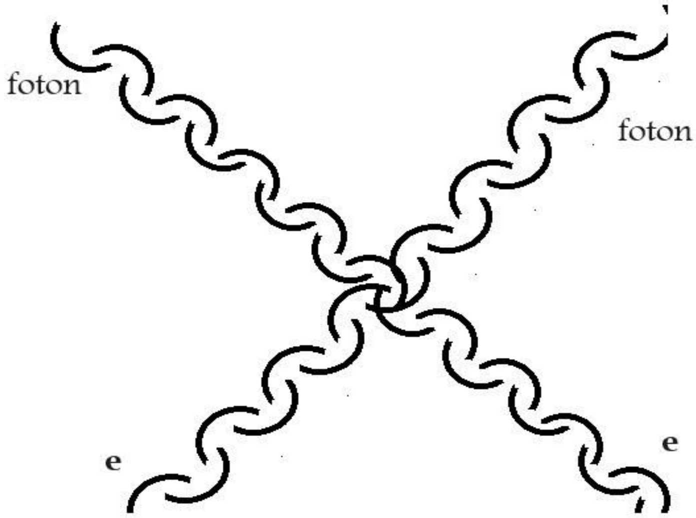
$$\lambda_s \approx \frac{6{,}626\cdot 10^{-34}}{299792458\cdot 1{,}42161187\cdot 10^{-84}} \to 1{,}5606\cdot 10^{42} \text{ m.}$$

6) The wavelength of the electromagnetic wave with the largest observed wavelength is λ≈10^5m. The ratio of the wavelength of a string to the wavelength of an electromagnetic wave

$$\frac{\lambda_s}{\lambda_E} = \frac{1{,}56 \cdot 10^{42}}{10^5} = 1.56 \cdot 10^{37}$$

This ratio is equal to $1.56x10^{37}$. So, the wave created by the strings is not an electromagnetic wave. It is this fact that explains why the results of accelerator-based tests fail. Obviously, it is impossible to observe strings with such a small wavelength. The wavelength of the strings is $3.8x10^{34}$ times larger than the Earth's equator. For the Sun, this value is equal to $2.24 \cdot 10^{33}$. The wavelength of the string is completely approximate. Fully applying the h-Planck constant and the speed of electromagnetic interaction propagation (c) to strings, as we do in the expression, is not correct. Planck's constant is associated with particles. Inside the particles there are about 10^{53} strings. Although the propagation speed of the electromagnetic interaction is very high, it is not the fastest speed in the Universe. It turned out that the rate of expansion of the Universe is greater than the rate of propagation of the electromagnetic interaction. As the universe expands, the physical field is created (its existing mass increases). We mentioned that the physical field is created through strings. It can be concluded that the propagation speed of the strings is greater than the propagation speed of the electromagnetic interaction. These facts reduce the accuracy in calculations for physical quantities. Because strings have such a small mass that prevents them from being detected directly, theorists are increasingly working to uncover testable indirect effects of string theory. In this regard, the dimensions of strings in string theory pose an additional obstacle. Imagining these extra dimensions as small and hidden is a reasonable explanation for their apparent absence. This is because strings are so small that they must vibrate in extra dimensions to form such a large Universe. Unfortunately, the equations of string theory allow the extra dimensions to take many different geometric forms, making it extremely difficult to make definitively verifiable predictions. Studying the influence of multi-dimensional spaces on these factors is a very complex issue. As we know, the 3dimensional space we live in is formed by the combination of a large number of 2-dimensional spaces. Similarly, 4dimensional space is formed by combining 3-dimensional spaces. We can never fully understand 4-dimensional space. Because we haven't seen what he looks like before. We cannot imagine what we do not see. Therefore, generally speaking, we cannot see and understand events, objects, entities, etc. that occur in multi-dimensional spaces. As we mentioned, every physical object existing in 3-dimensional space has mass, shape, etc. properties. But we cannot say that this fact is the same for 4-dimensional space [5]. That is, it is not entirely clear to say that matter is composed of strings in multidimensional spaces. It would be more correct to try to explain the phenomena related to our space with string theory.

Let's try to explain the Compton effect, which consists of the interaction of two elementary particles that behave like a particle (matter) and a wave (field), with string theory. These two elementary particles have the smallest masses in existence (the smallest number of strings in existence) and combine the properties of matter and field in them, as in strings. According to these approaches, it is possible to explain the Compton effect with string theory. Arthur Compton observed in 19^{23} when he was studying the scattering of X-rays by various substances that the scattered rays contained rays of wavelength λ as well as rays of larger wavelength λ'. The difference $\Delta\lambda=\lambda'-\lambda$ depends only on the parameters (we can call it the angle) between the original beam and the scattered beam. $\Delta\lambda$ does not depend on the composition of the scattering substance and the wavelength λ of the incident light. All the features of the Compton effect can be explained by the fact that photons corresponding to X-ray waves are scattered from practically free electrons because of elastic collisions. Free electrons are those electrons whose energy of binding with their own atom is much smaller than the energy that a photon can impart to an electron during a collision. Note that a photon cannot give all of its energy to an electron (or any other particle) during an elastic collision. In this case, the laws of conservation of energy and momentum would be violated. Suppose a photon with energy $\hbar\omega$ and momentum $\hbar k$ falls on an electron at rest. Before the collision, the energy of the electron is mc^2 (m-is the rest mass of the electron), and its momentum is 0. After the collision, its momentum is P, and its energy is $(P^2c^2+m^2c^4)1/2$. As a result of the collision, the energy and momentum of the photon changes $-\hbar\omega'$ and $\hbar k'$[6]. It is clear that there are strings that vibrate in different forms inside the photon and the electron. The energies of elementary particles are proportional to the number of strings inside them. As a result of collision, strings of electron and photon interact. Part of the strings inside the photon goes to the electron, and part of the strings inside the electron goes to the photon. At this time, the number of strings inside the photon and electron changes. As a result, the difference in number leads to a change in the energy and, accordingly, the momentum of the particles. The difference between the bond energy between an atom and an electron and the energy resulting from the photon-electron interaction causes this scattering to occur at a certain angle. Since the number of strings inside the photon is relatively small, they create a small energy difference on the atom and a noticeable energy difference on the electron. Scattering of photons from electrons that are tightly bound to their atoms occurs in such a way that the photon is scattered from the entire atom and energy and momentum are exchanged with the entire atom.



When the mass of the atom is much larger than the mass of the electron, then the Compton shift is negligible, λ' being practically the same as λ. As the atomic number increases, the relative number of tightly bound electrons with the atom increases, thereby weakening the binding line. In light elements (in which the number of strings is relatively small), the electron is considered free because the binding energy is small, and therefore Δλ does not depend on the type of substance. Since the number of strings in heavy elements is greater, this bond energy cannot be ignored, and since the bond energy of electrons is different in different elements, Δλ depends on the type of substance [7]. So far, we have looked at the state where the electron is at rest. However, if the electron is in motion, then the electron can give (or receive) some of its energy to the photon, and because the photon receives additional strings, its energy increases (or decreases), and its wavelength decreases (or increases). This effect is called the inverse Compton effect. It was possible to successfully explain the Compton effect based on string theory. We will give more details in the next posts. Strings are formed from pairs of semistrings. Half-wires carry charge and mass in the form of a "curved dipole" in the shape of 1/4 of a circle. Each half-string has a charge of e/12, and in the case of quarks, when 4 half-strings are combined, they get a charge of 4•(e/12)=e/3. When half strings of the same form are connected, they get a charge of 2•(e/12)=e/6. The mass of the half-strings connected in this way changes, and if opposite charges are taken into account in the opposite connection, they will accumulate and increase the mass.

$$\mathbf{N_1 \bullet (e/12) + N_2 \bullet (e/12) = (N_1 + N_2) \bullet (e/12)}$$

where $(N_1 + N_2) \bullet m$ is the mass of the string, m – 1 is the mass of the half string.

Thus, it was explained that the electric charges of the positron and the proton with q=e are the same, but their masses are different. If the half-strings are combined in the same harmony, the charge and mass increase, if they are combined in opposite harmony, the charge changes, and the mass increases. The combination of half-wires as a result of mutual influence is described.

This indicates the formation of a vibrating string.

String theory can also explain all the properties of matter. The development of string theory will allow a better study of matter and complete elimination of contradictions between divisions of physics. If the theory of the smallest microscopic component of matter - the string theory - was confirmed through the observations of the discovered micro-events and the largest astronomical realm of the cosmos, the result would be consistent with A. Einstein's search for unity.

References:

1. Becker, Katrin, Melanie, Schwarz, John (2007). "String theory and M-theory:A modern introduction". Cambridge University Press.
2. "String theory" Britannica.com.
3. Abbasov V ., Sarmasli V. " M THEORY" . NJD № 128. 2024.
4. V.Nasirov, R.Bayramli; General physics course, textbook. Baku 2022.
5. Bashirov M., Abbasov V. " A new approximation to Dark matter". NJD № 132. 2024.
6. Masimov E., Mursalov T. " Atomic physics". Baku-2002.
7. Masimov E ; Total physics course- V, Atomic physics. Baku-2010.