THE UNIFYING OF THE FORCES OF NATURE

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Abstract

This paper takes a look at the formulating of the unified field theory and the theory of everything. It shows how a unified field theory and theory of everything may be obtained.

Keywords: forces of nature, dimensions, supersymmetry, simulation, unification

PACS: 04.20.Cv, 11.30.Pb & 89.20.Ff

Introduction

The paper proposes a practical way to arrive at a unified field theory and theory of everything, based on the author's experiences with computer simulation. Having only a beautiful theory and beautiful equations to model nature are insufficient for affirming the characteristic of the universe. The affirmation has to be ultimately carried out by physical experiment. However, in lieu of physical experimentation, computer simulation is proposed, simulation with powerful software having been effectively utilized in areas such as aeronautical, electronic, mechanical and marine designs, wherein it now becomes unnecessary to produce costly prototypes. A few possible ways of unification are also presented.

1 Forces Of Nature And Unification

Our views of nature may be modified in the future. For instance, superstring theories, which had been neglected in the past, are now the "in" thing, being regarded by many scientists as beautiful, or, elegant, and a possible theory of everything.

Einstein had attempted to unify the four forces of nature, i.e., gravity, weak nuclear force, strong nuclear force and electromagnetism, but had failed. As in the past, he was unable to derive the electromagnetic field equations, even for the weak-field approximation. He was to live to the end of his life without any success with the unified field theory.

Einstein had thought that David Bohm would be the first scientist to solve the unification problem. But ironically the latter regarded the concern with the unified field theory problem as merely an unnecessary fuss, dismissing it as an "illusion of parts" and simply relegating the problem to the logical constraints of topology; he resorted to the metaphysical way of interpreting the universe, calling it the "looking-glass" universe.

However, gravitation and electromagnetism can be linked and the result can be anti-gravitational force and/or torsion in

space-time. There is also the belief that there is an anti-gravitational force for every gravitational force, just as there is an anti-particle for every particle. Nobel Laureate Richard Feynman had suggested that anti-particles are like ordinary particles moving backwards in time, which implies that anti-particles should have anti-gravity.

Gravitation has always been thought of as a pulling or attracting force, just like the force of attraction between two magnets. Gravitation and magnetism may be different manifestations of the same thing. And, gravity may be a pushing force instead, a force that presses down on all objects in the direction of the centre of the earth. In fact, a push is equivalent to a pull, the former originates at the back of an object while the latter originates at the front. So far, gravitational forces are seen as forces of attraction only, while magnetic and electric forces are forces of attraction and repulsion. There may be a gravitational force of repulsion. All this will affect our approach towards the unified field theory.

There is evidently a "looking-glass" characteristic in the universe. David Bohm, the British scientist whom Einstein had once hailed as being the person who would one day solve the unified field theory problem, had postulated that our universe is a vast fluid nothingness or no-thingness in which everything is. He had spawned a surprising relationship between maps and terrains. According to him, in the "looking-glass" universe, our mapmaking changes the very terrain, and the terrain in turn changes our map; maps, mapmakers and terrains intertwine to form an integral whole. In other words, different things are really one thing. Heisenberg's Uncertainty Principle postulates that the experimenter affects the experiment and vice versa, and the experimenter is also part of the experiment. Accordingly, all things are relative, how things are really depends on how or from what angles we look at them; there is a "yin" to every "yang", and the "yin" and the "yang" combine to make the "yin-yang" which is an integral whole - so good cannot be distinguished from bad for they belong to the same whole, the "yin-yang". Regarding Einstein's unified field theory, Bohm maintained that it is based on the illusion of parts (gravity, strong nuclear force, weak nuclear force and electromagnetic force) and that it is a futile problem. The observer is the observed, the part is the whole – all this seems more metaphysics than physics, but nevertheless this has evidently been the state of physics. Bohm believed that unification could be expressed by using the logical relations of topology, as is stated above. [1, 4, 6, 7, 9-12]

2 Failure

The failure in deriving the unified field theory is the failure to derive an equation which will link our visible macro-world with the invisible micro-world of the quantum particles, which will link the gravitational force with the weak nuclear force, strong nuclear force and electromagnetism, an equation which should encapsulate the totality of information about the universe. If Bohm's interpretation were correct, all these four forces are actually one and the same force, being different manifestations of the same force. Can any of these four forces exist without the others? They are all evidently essential parts of our universe, making up the whole. [2, 12, 16]

3 Gravity

Gravity, which is crucial in the formulation of a unified field theory, can be described by the following formula:-

$$F = G \frac{M_1 \quad M_2}{R^2}$$

where F is the gravitational force of attraction, G is the gravitational constant, M_1 and M_2 are the masses of two objects and R^2 is the distance between masses.

Before Newton discovered gravity, nobody had known it existed or had thought that there was such an attractive force. Einstein in his General Theory of Relativity interpreted it as a curvature of the space-time continuum, a geometrical form. Can gravity be the fifth dimension, in addition to the four dimensions of General Relativity comprising of the three physical dimensions and the time dimension, as Theodor Kaluza had suggested, which impressed Einstein greatly? [1, 4, 6, 7, 9-12]

4 Hilbert Space

Can the physical world be considered infinite-dimensional, i.e., a Hilbert space, instead of four-dimensional, a commonly held view? It depends on how we look upon the physical world, on our mental inventiveness, and is thus subjective. Quantum particles in the micro-world, unlike the objects in the macro-world, are comparatively unpredictable where their actions or movements are concerned and can only be predicted if at all in a probabilistic fashion. We will never be able to know for certain where a quantum particle will turn up next. Moreover quantum particles are capable of being at two different places at the same time, and, also capable of instantaneous travel or teleportation, which is "spooky" and incomprehensible, and evidently in defiance of gravity. We can have a quantum field equation involving infinite dimensions. According to modern quantum mechanics, all possible physical states of a system correspond to space vectors in a Hilbert space. An infinite-dimensional Hilbert space will also fit in with the theory of the existence of an infinite number of

parallel universes which are connected with each other through worm-holes. [13-15, 17]

5 Supersymmetry

According to Einstein's theory of gravity, the hypothetical quantum of gravity, the graviton, which is a spin-2 boson, interacts extremely weakly with other matter, far more weakly than neutrinos; it is so weak that no instruments so far have been able to detect it. In the supergravity extension of this theory of gravity, the graviton finds a superpartner, the gravitino, which is a spin-3/2 fermion. Under local supersymmetric transformations these two particles transform one into the other. When quantum calculations were carried out using supergravity theory, it was discovered that the infinities which plagued the earlier gravity theory with only the graviton were now being cancelled by equal and opposite infinities produced by the gravitino. This is evidently the result of the deeper consequence of the presence of supersymmetry. Though it is not certain whether the supergravity theory is completely renormalizable, this "softening of the infinities" appears to be a step toward a viable theory of quantum gravity. As simple supergravity theory includes only the graviton and the gravitino, this hardly corresponds to the real world with its many particles. Most of those who have worked on supergravity feel that some crucial idea is still missing. Without this crucial idea the theories simply do not describe the real world.

How do we make supergravity theory realistic? If we can solve this problem, we can have supergravity theory as a completely unified field theory. It has been shown that the principle of local supersymmetry is so restrictive that only eight possible supergravity theories exist, which are each labeled by an integer N = 1, 2 . . . 8. Supergravity theory shares the same features with its progenitor, the Theory of General Relativity, namely, conceptual power and mathematical complexity. Perhaps, by postulating the existence of a single master supersymmetry we can have a unified field theory that accounts for the whole universe. [13, 14, 17]

6 General Relativity And Curved Space-Time

The following is Einstein's equation for General Relativity:-

$$G_{im} = -\mathbf{K}(T_{im} - 1/2 g_{im} T)$$

This beautiful equation expresses the curvature of space-time. The left-hand side refers to a set of terms which characterise the geometry of space, while the right-hand side refers to a set of terms which describe the distribution of energy and momentum, i.e., the left is the geometry side, while the right is the matter side. Reading from left to right is space-time telling mass how to move, while reading from right to left is mass telling space-time how to curve. In General Relativity, there is neither absolute time nor space and gravitation is not a force, or, pull between

one object and another but a property of space and time. All this represents a great conceptual leap by the theory's creator, Einstein. As for the coordinate system of Einstein's General Theory of Relativity it has no basis in reality and is only a mental construct used to describe the space-time continuum of the General Theory of Relativity.

A suggestion is to change the left-hand side of the equation, the geometry of space, which is here a four-dimensional space-time continuum, into an infinite-dimensional space, a Hilbert space, which is as follows:-

$$G_{imH} = -\mathbf{K}(T_{im} - 1/2g_{im}T)$$

What kind of geometrical form can represent this infinite-dimensional space? One geometrical form of this nature can be an infinite number of Moebius Strips which are intricately intertwined and linked with each other (with each Strip being cut lengthwise into several narrower strips that are connected together at narrow points, which represent parallel universes). It is thought that since we are only able to move around in the three large, observable spatial dimensions comprising of length, breadth and height, and one of time, all other dimensions must be very small and thus invisible to us, being curled up in a multidimensional space (which may be construed as representing the invisible micro-world of the quantum particles). This is in keeping with the concept of the unified field theory which Einstein had attempted to formulate by combining General Relativity and quantum theory. [10]

7 Success

One may wonder when a unified field equation will be discovered. However, without a good understanding of gravity, this unified field equation will not come by easily. This unified field equation will of course link both the macro-world and the micro-world (through gravity, which will be the common denominator for both). Once the experimental confirmation of the existence of the graviton, the hypothetical quantum of gravity, is achieved, we should be surer of obtaining a unified field equation that accounts for the whole universe, which may be supported by the existence of a single master supersymmetry. Superstring Theory now appears to pave the way towards achieving this difficult goal. [2, 12, 16]

8 Universal Laws

Can there be some yet to be discovered universal laws which govern everything that exists in the universe? It is difficult to tell but it will be very useful to know these laws. This then will really be the theory of everything.

To many, including scientists, even Einstein, the laws of nature had been created by a Supreme Being, a God (whom Einstein believed does not play with dice). Alternatively, can all of

nature be a computer simulation carried out by a very advanced race of beings? In 2001, a philosopher called Nick Bostrom had begun circulating a paper titled "Are You Living In A Computer Simulation?" This has been considered a good possibility. [3]

9 Practical Affirmation

It appears a good idea to get some computer game designers and/or computer programmers to collaborate with the scientists to produce a simulation of life and existence in the universe. This is probably a mammoth if not impossible task. These programming experts and scientists have to sort of play God. What will be the parameters involved, the coordinate system to be utilized (e.g., three-dimensional, three-and-a-half dimensional, four-dimensional, etc.), the algorithms or mathematical formulas to be used for governing the movements of virtual objects (which will be important as they may be equivalent to the field equations of the unified field theory), and so on? With such a simulation, we may be able to understand better how the forces of nature, e.g., the mysterious but all-important gravitational force, behave. In this manner, which can be considered a kind of reverse engineering, success with the unified field theory and the theory of everything may be achieved. [2, 12, 16]

10 Conclusion

The missing link in this unification process is gravity, which is still not a fully understood phenomenon. We like to think that gravity affects our position and movement in space. But gravity may not be what we think it is. It may not even exist, which means that our search for gravitational waves and gravitons may be a futile exercise. The search for gravitational waves is still ongoing. The existence of gravitational waves so far is inconclusive - there is only indirect evidence of their existence. In the gravitational effect known as frame dragging, objects occupying the space near to a rotating object get swept around with it; rotating objects drag space around with them rather like a spoon in treacle (syrup). In 2004, scientists analyzing data from two Earth-orbiting satellites apparently found evidence of frame dragging - they claimed to have detected the minute frame dragging effect of our planet. There is the possibility of extracting useful energy from the rotation of our planet. There is speculation that this could serve as a power source for an advanced civilization.

Is all the space occupied by us and around us really one immensely large, flexible sheet of curved space-time as is posited by the General Theory of Relativity? Or, is there an infinitude of such "flexible sheets"? That is, is gravity just one flexible sheet of curved space-time or more, perhaps infinitely more? Earth is a sphere but all of us are evidently "stuck to this sphere" and do not fall off it. What is the force, if it exists, which causes this? Will this force be an attractive or pulling force, or, a pushing force? Can gravity be a kind of

fluid, whether air, gas or liquid? (We can descend, glide or fly up through the air like how a bird or an aeroplane does. We can dive into and descend in, surface in, float in, and swim in, a pool of liquid. All these may be interpreted as manifestations of "gravitational effect".) Can gravity be electrical, electronic, quantum or nuclear? Or, is gravity none of these but something else, as Richard Feynman had speculated?

What we regard or interpret as the attractive force known as gravity may be just a facet of electromagnetism, which comprises of an electric field and a magnetic field, wherein one mass attracts or repulses another mass and pulls or pushes the latter towards or away from itself (a pull/attraction and a push/repulsion may be viewed as equivalent, the former being a force exerted in front of a mass to move it while the latter is a force exerted behind the same mass to move it in the same direction). If this were the case, the weak nuclear force, strong nuclear force and electromagnetism would be sufficient to account for the phenomena of both our macro-world, the universe, and the micro-world of the quantum particles. The gravitational wave and the quantum of gravity, the graviton, may be non-existent and may never be found, though evidence of their existence is still being sought after; a good reason why they are not directly found (the gravitational wave is only indirectly deduced) can be that they are non-existent, and, when physical experiments fail to detect them directly (though it is thought that they are very weak and instruments are not sensitive enough to detect them) after a long period of time we should be prepared to make a turnaround instead of continuing banging the head against the wall.

There is another possibility. All space wherein both the macro-world of the universe and the micro-world of the quantum particles occupy may be a sea of invisible, yet undetected, material or fabric, much as all space is occupied by fluid such as air, liquid or gas. This material may be called "ether" or any other terms. This is the substance where all matter in the macro-world and quantum particles in the micro-world are theoretically submerged in (this submerging effect being manifested possibly as the gravitational effect evident in the universe), much as objects exist and perambulate in fluids such as air, liquid or gas. This is theoretically the most basic constituent of space such that a vacuum in space is theoretically non-existent. The ether, which has been contemplated heretofore, is apparently comparable to this material or fabric, which may be regarded as the fabric of the cosmos. This will theoretically become the link between all the forces of nature in both the macro-world and the micro-world, without which nothing can exist, similar to the case of the very basic life-giving oxygen without whose existence in the air or in liquid no animals, insects or marine life can exist. This will probably be the spark-of-life, the life-giving, the activity-causing, the mobility-causing, the motion-causing, the behavior-causing, the action-causing, agent which causes

activity, motion, change in all particles and matter, e.g., compositional and positional/directional/gravitational changes, including possibly consciousness, which may be regarded as the essence, soul or spirit of existence or life. Quantum particles in the micro-world apparently have a "life" of their own, e.g., light particles or photons are always in motion, like the animate objects in the macro-world. What is the cause of this apparent life in the macro-world of the universe and the micro-world of the quantum particles if not for this life-giving, action-causing essence which for want of a better term may be called "ether", "life-giver", "life-force", "life-fluid", "change agent", "activator", "essence", "energizer" or any other suitable term? The cells which make up our bodies, the bodies of animals and the bodies of plants are apparently living ones using up oxygen to generate energy while quantum particles also generate energy. This possible agent, which we may, e.g., call "life-fluid", which probably causes all this activity in the cells and the quantum particles can be regarded as the common link between these two things found respectively in the macro-world and the micro-world. The forces in both the macro-world and the micro-world may thus be unified in this manner. However, detecting and confirming the existence of this theoretical life-giving, action-causing agent common to both the macro-world and the micro-world is likely to be a hurdle. We can now only define it abstractly as an agent which causes activity, motion, change in particles and matter including possibly consciousness. This theoretical agent may also be regarded as the controller of nature, the director which guides all activities in nature, like how the DNA regulates bodily functions and the computer software regulates computer functions. Figuring out what will constitute this important agent, e.g., whether it is a form of energy, whether it is made up of some particular atoms, whether it is a sort of fluid, and so on, is a difficulty, which has to be resolved before experiments can be carried out to detect it. [1, 4, 6, 7, 9-12]

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