A simple and unified explanation of modern physics

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Abstract

In this short paper, we summarize how a new approach to the Universe, which has recently been detailed in two books [2c to 2f], makes it possible to find a simple, unified and coherent explanation of all the theories of modern physics.

The basic concepts of this approach can be summarized simply as follows: *(i)* the support of the Universe is a kind of *«ether»* which consists of a solid and massive lattice, with the simplest possible elasticity, in which matter is represented by the set of topological singularities of this lattice (loops of dislocations, disclinations and dispirations), and *(ii)* this lattice exclusively satisfies in absolute space the basic classical physical concepts of Newton's law and the two principles of thermodynamics.

With these basic classical concepts alone, we find all the modern theories of physics, namely that the behaviors of this lattice (the Universe) and its topological singularities (the Matter) satisfy electromagnetism, special relativity, general relativity, gravitation, quantum physics, cosmology and even the standard model of elementary particles.

Introduction

Modern theories of physics are based on *mathematical relations postulated to explain observed phenomena*, and not on an inference of these mathematical relations from an understandable first principle. Electromagnetism is based on the *Maxwell's equations*, without simple explanations of what electric and magnetic fields really are, what electric charge is, and how electromagnetic waves can propagate in a vacuum. Special relativity is based on *Lorentz transformations*, without any explanation of the root causes why time expands and lengths contract when an object moves at high speed, or in relation to what the object is moving. General relativity is based on the famous *Einstein's equation* that relates the curvature of space-time to the mass and energy of matter in space, without any real explanation of why matter "curves" space-time, and even what exactly is space-time. Quantum physics is based on *Schrödinger's equation*, without any explanation of the deep reason for this relationship, what the wave function really is, and what defines the boundary between a classical and a quantum behavior of an object (quantum decoherence). *Cosmology* postulates behaviors of the universe

injecting concepts, such as *black matter* and *dark energy*, which have no underlying physical explanation for the moment, and which are introduced arbitrarily to match theory with experience. The *Standard Model of Elementary Particles* is constructed from numerous experimental observations, but without any explanation of what an elementary particle really is, why it has mass and electric charge, what its spin really is, what differentiates leptons and quarks, why there are three families of leptons and quarks, what are really weak and strong forces, and how to explain the confinement and asymptotic freedom of the strong force.

Added to this is the fact that these various theories do not have a common origin, and that it seems very difficult, if not impossible, to unify them, even by resorting to mathematical subterfuges, such as those imagined in the numerous trials of unified field theories that seek to define a coherent theoretical framework capable of taking into account the different fundamental forces of nature.

Recently, we have shown that these apparent difficulties in giving a simple and unified physical explanation to the observed phenomena and the equations that translate them, as well as in unifying the various fields of modern physics, can be overcome by an original and new approach to the Universe, which considers that the Universe could be a finite, elastic and massive solid, *a "cosmological lattice"*, which would move and deform in an infinite absolute vacuum. In this a priori strange concept, it is assumed that the Universe is a lattice of simple cubic crystalline structure, whose basic cells have a mass of inertia that satisfies Newtonian dynamics in absolute space, and whose isotropic elasticity is controlled by the existence of an internal energy of deformation as simple as possible. It is also assumed that this lattice is likely to contain topological singularities, i.e. structural defects such as loops of dislocations, disclinations and dispirations, which would be the constituent elements of Ordinary Matter.

If this original concept is developed in detail using an approach similar to the one used in solid-state physics, it can be shown, by a purely logical and deductive mathematical path, that the behaviors of this lattice and its topological singularities satisfy "all" the physics currently known, unifying the physical explanations of the various modern theories, and spontaneously bringing out very strong and often perfect analogies with the major theories of the macrocosm and microcosm, such as Maxwell's equations, special relativity, Newtonian gravitation, general relativity, modern cosmology, quantum physics and even the standard model of elementary particles.

In search of a Theory of Everything

The search for a Theory of Everything able to explain the nature of space-time, what matter is and how matter interacts, is one of the fundamental problems of modern physics. Since the 19th century, physicists have sought to develop unified field theories, which should consist of a coherent theoretical framework able to take into account the various fundamental forces of nature. Recent attempts to search for a unified theory include the following ones: the *«Great Unification»* which brings together electromagnetic, weak and strong interaction forces, the *«Quantum Gravity»* and the *«Looped Quantum Gravitation»* which seek to describe the quantum properties of gravity, the *«Supersymmetry»* which proposes an extension of space-time symmetry linking the two classes of elementary particles, bosons and fermions, the *«String and Superstring Theories»*, which are theoretical structures integrating gravity, in which point particles are

replaced by one-dimensional strings whose quantum states describe all types of observed elementary particles, and finally the *«M-Theory»*, which is supposed to unify five different versions of string theories, with the surprising property that extra-dimensions are required to ensure its coherence.

However, none of these approaches is currently able to consistently explain at the same time electromagnetism, relativity, gravitation, quantum physics and observed elementary particles. Many physicists believe that the 11-dimensional M-Theory is the Theory of Everything. However, there is no broad consensus on this and there is currently no candidate theory able to calculate known experimental quantities such as for example the mass of the particles. Particle physicists hope that future results from current experiments - the search for new particles in large accelerators and the search for dark matter - will still be needed to define a Theory of Everything.

But these researches seem to have really stagnated for about 40 years, and many physicists now have serious doubts about the suitability of these theories [1a-1g]. Since the 1980s, thousands of theoretical physicists have published thousands of scientific articles that are generally accepted in peer-reviewed journals, even if these papers have contributed absolutely nothing new to the explanation of the Universe and solve none of the current mysteries of physics. An enormous amount of energy has been mobilized to develop these theories, in a race to publish more and more esoteric articles, in search of a form of "mathematical beauty" that moves ever further away from the "physical reality" of our world. Moreover, enormous sums have been invested in this research, to the detriment of fundamental research in other areas of physics, in the form of the construction of ever more complex and expensive machines. And, to the despair of experimental physicists, the results obtained have brought almost nothing new to high-energy physics, contrary to the "visionary" and optimistic predictions of the theorists.

What if the Universe was a lattice?

In the approach presented here [2a-2f], the problem of the unification of physical theories is treated in a radically different way. Instead of trying to build a unified theory by tinkering with an assembly of existing theories, making them more and more complex and esoteric, even adding strange symmetries and additional dimensions for their «mathematical beauty», one starts exclusively from *the most fundamental classical concepts of physics*, which are *Newton's equation* and *the first two principles of thermodynamics*. And with the help of these fundamental principles, and by developing an original geometry based on Euler's coordinates to describe the topology of the Universe, we come, by a purely logical and deductive path, to suggest that *the Universe could be a crystal, an isotrope, elastic and massive three-dimensional cubic lattice, and that the constituent elements of Ordinary Matter could be topological singularities of this crystalline lattice*.

On the basis of this original concept, we can develop a very complete description of the spatio-temporal evolution of this solid lattice, which is called *the «cosmological lattice»*, by introducing into an infinite absolute space a purely imaginary observer called the Great Observer ***GO***. If this observer is equipped with a reference system composed of an orthonormal absolute Euclidean reference frame to locate the points of the solid lattice and an absolute clock to measure the temporal evolution of the solid lattice in the absolute space, a very detailed description of

the spatio-temporal evolution of the lattice can be worked out on the basis of the Euler coordinate system [3a-3b]. In this coordinate system, the Great Observer ***GO*** can describe in a very detailed way *the distortions (rotations and deformations) and contortions (bending and torsion) of the lattice*. By introducing the basic physical principles of Newtonian dynamics and of the two principles of thermodynamics, he is able to describe the spatio-temporal evolution of the cosmological lattice, by assigning to it a mass of inertia per basic cells and a specific internal energy of distortion per volume unit of the lattice. And he can also introduce *topological singularities (dislocations, disclinations and dispirations) in the form of closed loops* [4] *into this lattice, as the constituent elements of Ordinary Matter.*

If this original idea is developed in detail, it can be shown by a purely logical and deductive mathematical path that, for an elastic lattice satisfying Newton's law and having the simplest possible isotropic elastic properties, the behaviours of this lattice and of its topological singularities satisfy "all" of the physics currently known [2a-2f], by spontaneously bringing out very strong and often perfect analogies with the great current physical theories of the Macrocosm and the Microcosm, such as *Maxwell's Equations* [5], *Special Relativity, Newtonian Gravitation, General Relativity, Modern Cosmology* and *Quantum Physics*.

But this theory does not only find analogies with the other theories of physics, it also proposes original, new and simple explanations to many physical phenomena that are still quite obscure and poorly understood at the present time by modern physics, such as the deep meaning and the physical interpretation of *cosmological expansion, electromagnetism, special relativity, general relativity, quantum physics,* and *particle spin*. It also offers new and simple explanations of *quantum decoherence* (the limit of passage between a classical and a quantum behavior of an object), *dark energy*, *black matter*, *black holes*, and many other phenomena.

The detailed development of this theory also leads to some very innovative ideas and predictions, among which the most important is the appearance, alongside *the electrical charge*, of a new charge characterizing the properties of topological singularities, ***the curvature charge***, which is an inevitable consequence of the treatment of a solid lattice and its topological singularities in Euler coordinates. This concept, which does not appear at all in modern theories of physics, such as general relativity, quantum physics or the Standard Model, implies *a very slight deviation from the equivalence principle of general relativity*: the inertial mass and the gravitational mass of a particle are very slightly different. If the inertial mass of a particle and its antiparticle are the same, the gravitational mass of an antiparticle is very slightly higher than that of its antiparticle because of their opposite sign curvature charge. And even in the case of the neutrino, the effect of the curvature charge outweighs the inertial mass, and the gravitational mass of the neutrino becomes negative *(antigravity),* then the gravitational mass of the anti-neutrino is positive and the inertial mass of the neutrino and the anti-neutrino are identical, very small and always positive. This concept of curvature charge has very important consequences and provides new explanations for many obscure points in modern physics, such as *weak force, matter-antimatter asymmetry, galaxy formation, segregation between matter and antimatter within galaxies, formation of gigantic black holes in the heart of galaxies, the apparent disappearance of antimatter in the Universe, the formation of neutron stars, the concept of dark matter, the bosonic or fermionic nature of particles*, etc.

Finally, by studying lattices with special symmetries called *axial symmetries*, symbolically

represented by *"coloured" 3D cubic lattices*, we are able to identify an amazing lattice structure whose looped topological singularities coincide perfectly with *the complex zoology of all the elementary particles of the Standard Model*, and which also allows us to find simple physical explanations for the *weak and strong forces* of the Standard Model, including *the phenomena of confinement and asymptotic freedom* of the strong force.

About the epistemology of our lattice approach of the Universe

Our lattice approach to the Universe is based on the *two basic concepts* mentioned in the summary, which are disarmingly simple. And by judiciously applying these two perfectly classical initial concepts (massive and elastic solid lattice, Newton's law, principles of thermodynamics), it is really *very surprising* to note that the behaviors of this lattice (the Universe) and its topological singularities (the Matter) satisfy all modern theories of physics, even though we postulated that the lattice in absolute space rigorously follows the perfectly classical laws of Newton and thermodynamics.

But in this approach of the Universe, nothing comes yet to give a definitive explanation to the existence of the Universe, to the root cause of the big bang, and to the actual composition of the solid, massive and elastic cosmological lattice. These points remain, at least for the moment, within the scope of individual philosophy or beliefs. But, from an epistemological point of view, this theory shows that it is perfectly possible to find *a very simple framework to understand, explain and unify the different theories of modern physics*, a framework in which there would no longer be many mysterious phenomena other than the "raison d'être" of the Universe.

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