S E S 2 0 1 0
Sixth Scientific Conference with International Participation
SPACE, ECOLOGY, SAFETY
2–4 November 2010, Sofia, Bulgaria

COMMENTS ON THE VARIABILITY OF BASIC CONCEPTS ABOUT THE UNIVERSE

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Key words: *renormalization, hierarchy, variability, space*

Abstract: *A critical interdisciplinary analysis of the causes for imperfection and discrepancy in the created and tested concepts about the Universe is made. Possible future attempts are commented.*

КОМЕНТАРИ ЗА ПРОМЕНЛИВОСТТА В ОСНОВНИ ПРЕДСТАВИ ЗА ВСЕЛЕНАТА

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Ключови думи: *ренормализация, йерархия, изменчивост, космос*

Абстракт: *Представен е критичен интердисциплинарен анализ на причините за непълнота и несъответствие в създаването и използването на основни концепции за Вселената. Обсъждат се възможни бъдещи опити.*

> “The search for truth is more precious than its possession”
> Lessing

Can the rate of past discoveries be used to predict future ones? There are always complex factors of how science is actually done. The contemporary theories are valued not by their predicative or even explanatory value - but by number of physicists, which these theories are able to employ. A source of uncertainty is how changes in funding and the development of new techniques and technology can alter the pace of discovery. Some objects are more difficult to find the smaller they are, for other the opposite is true, since the bigger they are, the rarer and more unstable they tend to be. Some of the properties for a host of natural phenomena conform to Benford's law. It states that for many sets of numbers, the first digit of each number is not random with a 30.1% chance that a number's "leading" digit is a 1 and progressively higher leading digits get increasingly unlikely. Such distributions are "scale-invariant".. How widespread the law is in nature is not known. Although not all sets of numbers obey this law, probing if properties that adhere to Benford's law in nature also do so in computer simulations could be a way to check and improve misbehaving models.

Scientists must investigate asymmetric situations.

We learn through focusing in the small details and errors and then, after creating a new theory, we try to forget them! The interesting point is that as soon as we make a new discovery that gives as a better image of were we are in the world, we want to believe that we know everything, and the "one and only" theory is very close! The informational singularity is not a sharp boundary, but system of mutually overlapping processes.

In the very centre of identifying where we are, we face the problem of "deciphering" "complex" motion. One of the critical parts is an equation stipulating that the force between two objects gets rapidly weaker as the distance between them increases. Called the inverse-square law of Newton’s theory of gravity, it has been tested over the years both by observing the actual movements of the planets and stars and by experiments conducted in labs that examined gravity at the level of a few feet. BUT Pioneer 10, Galileo and Ulysses are being pulled back to the Sun by an unknown, constant force. One of the difficulties of measuring gravity is that it is so weak and whether gravity falls off with distance even faster than Newton specified. Some theorists relate the "Pioneer Anomaly" to the quantum vacuum fluctuations which at large distances could mimic 'dark matter', whose non-existence is advocated by the Modified Newtonian Dynamics. Other theorists believe that one reason gravity is so weak is that it 'bleeds off' into extra spatial dimensions that are undetectable with contemporary scientific devices, much less with our own human senses. Several lines of evidence hint that quantum gravity at very small distances may be effectively two-dimensional. If spontaneous dimensional reduction proves to be correct, it suggests a fascinating relationship between small-scale quantum spacetime and the behavior of cosmologies near an asymptotically silent singularity.

The magnetic fields could have played a very fundamental part in the structure formation. Unless one isolates how and where and perhaps when they are generated, it is hard to put together a satisfactory story of the universe. It would be high time in earnest to study what the original 20 Maxwell's equations can reveal, because by now we should have the computing power to use those. When described by ideal dynamics, Magnetic fields are mathematically and physically equivalent to a vorticity. This makes it difficult to determine the origin of magnetic fields, since it means that magnetic fields have helicity, which is a kind of "topological charge," which cannot change under the influence of an ideal force, forbidding the emergence of any vorticity from an initial zero value. Topology forbids it, because of its conservation laws like argument principle - there just have to be created the whole fluxon-antifluxon pairs. Vorticity/fluxons are more fundamental than charge, but there is still something behind it. Such fluxons should have additional energy density per length - explaining e.g. many orders of magnitude larger energy of magnetic reconnections on Sun's corona than predicted. The theory of scalar magnetic field, which was commonly accepted at the Kelvin/Tesla times is completely forgotten by now. This is a product of consequential reductionism and mathematical Platonism in physics of the last century: all phenomena, which are more complex, then formal math can currently follow are neglected as an unpublishable ones. To generate magnetic fields (a vorticity) from a state of no magnetic field, we must break the topological invariant. For that to happen, the effective force has to be so that it cannot be expressed as a perfect gradient. Non-ideal mechanisms, ranging from something called the baroclinic effect to processes stemming from inflation, quantum chromodynamics phase transitions, and radiation effects, are used to get around this constraint. However, while these mechanisms likely play a role in magnetic-field generation at some scales, none of these effects can be considered a universal mechanism that operates at all scales. Since all non-ideal mechanisms are too weak and not general enough to explain the origin of magnetic fields, the ideal dynamics is proposed to be reexamined. The result is that vorticity/magnetic fields can be generated in strictly ideal dynamics, as long as the dynamics is embedded in the twisted spacetime described by special relativity effects that can destroy the topological constraints that would otherwise forbid the creation of magnetic fields. The mechanism can seed a magnetic field, which can then be amplified by the dynamo mechanism to create larger magnetic fields. Basically, the relativistic distortions of spacetime can modify the way in which inhomogeneous flow fields interact with inhomogeneous entropy. The new mechanism is especially dominant for highly relativistic flows, such as cosmic particle-antiparticle plasmas, plasmas in the magnetosphere of neutron stars, etc. The discovery could help to understand the origins of the massive magnetic fields in astrophysical settings, shed light on the properties of large physical systems, and possibly even advanced spacetime geometries. Does Nature choose one consistent mathematical framework over another? Most physicists seem to expect answers in the form of geometry. They have been blinded by the elegance of classical mechanics and have ignored the signs given by quantum mechanics that geometry will ultimately not provide the answers they seek? Geometry is a great tool with lots of descriptive power. Geometric notions are pervasive and absolutely unavoidable in physics. But geometry used in physics is essentially arbitrary. If you pretend that the geometry used in your calculations is real, then you are stepping into a dangerous territory. A point is a fundamental geometric axiomatic construct. To talk about defining a point in the first place, you end up using concepts like dimensions or volumes. Sure, you can talk abstract numbers (scalars), but those aren't the same thing as points. And even the concept of numbers (and indeed, all of arithmetic) is essentially geometrical at heart: e.g. being closely related to things like the "number line". In physics, theories and laws distillate the workings of the real world into stark, sweeping statements of universal validity. The physical laws are generally couched in the language of mathematics. The mathematical quantities are ciphers, proxies for the tangible objects of the real, physical world and their measurable properties. But this is merely a convenient shorthand. That was all true until the uncertain, fuzzy world of quantum theory arrived on the scene- particles do not have fixed properties until they are observed.

Almost every civilization has its ‘cosmogonical’ myths about the inevitable ‘universal catastrophe’. Although the idea is embedded in different forms- ‘death-birth’ cycles, partially regulated by mystical powers, their core is that the observed universe should have an end. Nowadays these feelings are embedded in concepts like inflation, orbital chaos, both common with the fuzzy unpredictable outcome. Eternal inflation is a quantum cosmological model where inflationary bubbles, each being a universe, can appear out of nothing to expand and go on forever, or to collapse and disappear again. In an eternally inflating universe, every event that is possible will eventually occur an infinite number of times. This makes impossible to forecast when an event, such as the probability that a universe like ours exists, will occur. The ‘zug-zwang’ is because of the "measure problem": am attempt to determine the number of bubbles that exist at any given time plus the number of 'observers' in each bubble to come up with the relative frequency of observers that can live in one universe compared to the relative frequency of observers who can live in another universe. The only way to avoid this conundrum is to introduce a cut-off point, or some recent discovery like the interpretations of observation data, which indicate that fundamental physical ‘constants’ could have different, locally active values, with the ‘disgrace’ for the universality and eternity of physical laws as an outcome.

The "theory of everything" is one of the most cherished dreams of science. If it is ever discovered, it will describe the workings of the universe at the most fundamental level and thus encompass our entire understanding of nature. The attempt to reconcile quantum mechanics with general relativity is a prerequisite for a theory of everything. But rather than coming up with one or two rival theories whose merits can be judged against the evidence, there is a profusion of candidates that address different parts of the problem and precious few clues as to which (if any) might turn out to be correct. Part of the problem with unifying gravity and quantum mechanics is what happens to gravity at small scales. The closer two objects are to each other, the stronger the gravitational attraction between them; but gravity also acts on itself, and as a result, at very small distances a feedback loop starts. According to conventional theories the force should then become ridiculously strong – which means there's something wrong with conventional theories. A "fixed point"- a distance below which gravity stops getting stronger could help solve the problem, and lead to a quantum theory of gravity. Theories assume that space and time exist, and then try to build up the rest of the universe. Quantum gravity tries to do away with them. The basic idea of Loop quantum gravity (LQG) is that space is not continuous, as we usually think, but is instead broken up into tiny chunks 10^{-35} meter across. These are then connected by links to make the space we experience. When these links are tangled up into braids and knots, they produce elementary particles. LQG is so far the only real rival to string theory. As the universe formed in the Big Bang cooled, defects formed between different regions of space that cooled in different ways and there was only an abstract network of "nodes" of space, in which each node was connected to every other. This network collapsed and some of the nodes broke away from each other, forming the large universe we see today.. The defects in space were the cosmic strings- predicted in the 1970s and not to be confused with the subatomic strings of string theory. The fundamental particles we observe are not actually particles, but tiny cosmic strings that only "look" like particles. The mathematics of string theory also looks to то on extra spatial dimensions- radical suggestions, but many theorists find the string approach elegant and have proposed numerous variations on the basic theme that seem to solve assorted cosmological conundrums. There are just too many variants of the theory, any one of which could be correct – and little to choose between them. To resolve this, some physicists have proposed a more general framework called M-theory, which unifies many string theories. But this has its own problems. Depending how you set it up, M-theory can describe any of 10^{500} universes. Some physicists argue that this is evidence that there are multiple universes, but others think it just means the theory is untestable.