EFFECTIVE THEORIES AND THE PHENOMENOLOGICAL INFORMATION

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The concepts of effective theories in science and of primary theory are reconsidered in the light of the integrative (structural-phenomenological) model of reality. It is shown that the structural effective theories are viable for scales from the universe down to the Planck scale, but not for the deep domain of reality below Planck scale, neither for the domain of all the different universes of existence. For the domains where structural effective theories are possible, these may be extended to a form of structural-phenomenological effective theories.

Key words: effective theory, structural-phenomenological theory, phenomenological information, integrative science, primary theory, category of all the universes, Planck scale, orthoexistence.

INTRODUCTION

The development of the concept of effective theories in science was presented in a good description by Gordon Kane.[1] The theory of effective theories takes into account only the structural physics and not the structural-phenomenological framework that comprises informational phenomenological processes (such as qualia, experience, senses, orthosenses) *i.e.*, the domain of integrative science.[2,3] What happens to the effectives theories when phenomenological information processes are present?

The aim of this paper is to study the influence of the phenomenological information on the effective theories in generalization of what is studied by structural physics. The structural effective theories are a good first approximation for many domains of reality, when the phenomenological processes may be easily or suitably neglected. When not, it is necessary to study the conditions for improving a structural effective theory to form a more complete structural-phenomenological framework.

For some domains it may happen that the background of a structural effective theory cannot be used, or is not available at all. Such cases are examined in the following parts of the paper. The theory of some domains, for instance the deepest reality of existence (orthoexistence) and the category of all universes which exist, must assume a phenomenological background. These domains are more phenomenological than structural, that is the phenomenological processes predominate. These domains have not an effective structural theory, or, in short, an effective theory.

EFFECTIVE THEORIES IN THE FRAME OF STRUCTURAL SCIENCE

Gordon Kane argues that the "the jargon for the modern way of thinking of theories and their relations is the method of effective theories" [[1], p. 41]. Following Gordon Kane, we keep the following characteristics of an effective theory:

- An effective theory is a theory of a domain of nature, delimited in physics by its scale.
- Every effective theory has some input parameters that are given, either by experimental measurements, or by an effective theory of a domain of immediately smaller scale.
- "If a theory has inputs, it is an effective theory" [[1], p. 43].
- "Each effective theory works well at its level, but it breaks down as we go to smaller distances and find new kinds of structure" [[1], p. 45]. In other words, it breaks down at shorter distances, or larger energies [[1], p. 52].
- "All the effective theories coexist simultaneously, and are part of our description of nature" [[1], p. 46].
- "Each level of understanding of nature can be described by an effective theory" [[1], p. 134].
- Effective theories replace reductionist ideas [[1], p. 41].
- An effective theory is not the fundamental theory (the primary theory) [[1], pp. 126–127, 135].

Every *segment of the structural nature* has its effective theory. The main segments of nature considered by Gordon Kane for the structural physics are:

- Large scale universe.
- Stars.
- People-size objects.
- Cells (we add this one)
- Atomic size.
- Nucleus size.
- Elementary particle size.

In Fig. 1 are represented these segments.

Universe	Stars, planets	People size objects	Cells	Atomic size	Nucleus size	Elem. particle size	Under Planck scale

Fig. 1

To every domain of Fig. 1 corresponds a specific theory: theory of the universe (or cosmology), theory of stars and planets (or stellar and planetary theories), theory of objects (including biological objects), theory of cells (biological theory), theory of the atom (or atomic theory), theory of the nucleus (or nuclear theory), theory of elementary particles.

However, there are also general theories:

I. CLASSICAL SCIENCE = Newtonian science and Einstein's relativity theory = prequantum physical science [[1], p. 8].
II. STANDARD MODEL.
III. SSM (Supersymmetric Standard Model) represented, for instance, by Gordon Kane's minimal supersymmetry standard model (MSSM) [[1,4]].
IV. STRING THEORY with some differing models [[1], p. 135].

Between the theories represented by the the segments of Fig. 1, and the above more general theories, there are connections. Thus, Gordon Kane observes:

> "To fully grasp the relation of the Standard Model to the rest of physics, and its strengths and limitations, it is useful to think in terms of effective theories. An effective theory is a description of an aspect of nature that has inputs that are, in principle at least calculable using a deeper theory. For example, in nuclear physics one takes the mass, charge and spin of the proton as inputs. In the Standard Model, one can calculate those quantities, using properties of quarks and gluons as inputs. Nuclear physics is an effective theory of nuclei, whereas the Standard Model is the effective theory of quarks and gluons. From this point of view, every effective theory is open-ended and equally fundamental – that is, not truly fundamental at all. Will the ladder of effective theories continue? The MSSM solves a number of problems the Standard Model does not solve, but it is also an effective theory because it has inputs as well. Its inputs might be calculable in string theory. Even from the perspective of effective theories, particle physics may have special status. Particle physics might increase our understanding of nature to the point where the theory can be formulated with no inputs. String theory or one of its cousins might allow the calculation of all inputs – not only the electron mass and such quantities, but also the existence of spacetime and the rules of quantum theory. But we are still an effective theory or two away from achieving that goal."[4]

For the cosmological theory of the large scale universe, mass, energy and gravitational forces are all important. In this case, classical physics may be sufficient, because "the only force that matters is gravity […] It doesn't matter whether the particles that make up stars and planets are composed of quarks or not, nor does it matter how many forces there are at small distances inside a nucleus. Because of this indifference, cosmology can make progress regardless of whether we understand how stars work, whether protons are made of quarks and so on. We can learn from astronomy data that there is dark matter. At the same time, if dark matter is composed of particles, we cannot learn from astronomy or cosmology what kind of particles they are, because cosmology is insensitive to the properties that distinguish one particle from another, such as their mass and what charges they carry." [[1], pp. 41–42]

PRIMARY THEORY AND THE PLANCK SCALE

The Planck scale is defined by the Planck length, time, mass and energy (Table I), derived by combinations of the speed of light *c*, Planck constant ħ, and Newton's constant G (which measures the strength of the gravitational force).

The Planck length (l_p) and the Planck time (t_p) are the smallest length and the smallest time one can define [[1], pp. 47–51]. Gordon Kane considers that a future theory at the **smallest** distances is an ultimate theory or final theory, but he prefers to name it *primary theory*.

Table I

Planck length $: l = \sqrt{\frac{G\hbar}{c^3}} = 1.616\times10^{-35}$ [m]

Planck time $: t = \frac{l}{c} = 5.390\times10^{-44}$ [sec]

Planck mass $: m = \frac{\hbar}{cl} = 2.177\times10^{-8}$ [kg]

Planck energy $: E = mc^2 = 1.221\times10^{19}$ [GeV]

"Therefore, I would like to choose a somewhat different name. I find I like calling it the primary theory, a term that suggests the theory one arrives at after going through a sequence of effective theories at smaller and smaller distances. As we will see more clearly in a few paragraphs, the primary theory should be the description of nature at a distance scale of about 1 Planck length, or about 10^{-35} meter." [[1], p. 46]

And further:

"Suppose now that we have just discovered the primary theory. To present the results, we have to express the predictions and explanations in appropriate units. What units should we use? We expect the natural units for the primary theory to be very universal ones, not dependent on whether the universe has people or stars. There is only one known way to make universal units. There are only three universal in nature common to all aspects of nature – to all interactions and all particles. They are

Planck's constant ħ; the speed of light (denoted by *c*), which is constant under all conditions; and Newton's constant G, which measures the strength of the gravitational force. Because Einstein proved that energy and mass are convertible into one another, and gravitation is a force proportional to the amount of energy a system has, everything in the universe feels the gravitational force. In fact, using these three quantities – ħ, c, and G, it is possible to construct combinations that have the units of length, time, and energy. We expect all the quantities that enter into the *primary theory*, which are solutions of the equations of the primary theory to be expressible in terms of the units constructed from ħ, c, and G." [[1], pp. 48–49]

Still further:

"The Planck length and time can also be interpreted as the smallest length and time that we can make sense of in a world described by quantum theory and having a universal gravitational force. […] Now the fascinating thing is that if we put an object having the Planck energy in a region with a radius of the Planck length, we satisfy the conditions to have a black hole! We cannot separate such a region into parts, or get information out from a measurement, so we cannot define space to a greater precision than the Planck length! Because distance is speed × time, and speed can be at most the speed of light, and there is a minimum distance we can define, there is also a minimum time we can define – that comes out to be the Planck time. We saw above that the Planck scale provides the natural units for expressing the primary. theory when the units are constructed from the fundamental constants ħ, c, and G. Now we see a second reason for expecting the Planck scale to be the distance scale for the primary theory: there does not appear to be a way, even in principle, to make sense of smaller distances or times. The times when events occur cannot be specified, or even put in order, more precisely than the Planck time.

There is a third interesting argument that gives the same answer. The gravitational force between two objects is proportional to their energies and grows as the distance between them decreases. Consider, for example, two protons. Normally, the repulsive electrical force between them is much larger than the attractive gravitational force. But if the energies of the protons are increased to the Planck energy, then the gravitational force between them becomes about equal to the electrical force between them. All the forces become about the same strength at the Planck scale, rather than being widely different in strength as they are in our everyday world. Thus we might expect the gravitational force to unify with the others at the Planck scale, just as one might hope for in the primary theory. […]From the universe down to the Standard Model domain is about 46 powers of 10, and from the Standard Model to the Planck scale is only about 16 more powers of 10. Looked at that way, perhaps it does not seem so far." [[1], pp. 50–51]

It seems that Gordon Kane considers the primary theory to apply to the Planck scale. The currently popular string theory assumes quantum theory and a space-time framework. But the primary theory "includes a derivation of space-time, and the meaning and number of dimensions explain why quantum theory and relativistic invariance are the rules of nature, where the laws of physics come from, and why M-theory is the unique theory describing our world." [[1], p. 135]

Universe	**Elementary particle size**	**PLANCK scale**	**Sub-Planck scale**

Fig. 2

Then, at the Planck scale a special intersection takes place between string theories and a zone, that we name Sub-Planck Scale (Fig. 2), without space and time. Below the elementary particle size, below the limit of the Planck scale, there is the deep reality (orthoexistence) and therefore the effective last theory at this scale can not be a primary theory in the sense explained by Gordon Kane. In fact, *no effective theory of the structural physics can be a primary theory*. A primary theory might be possible only for the deep reality (orthoexistence), which is primarily phenomenological.

EFFECTIVE THEORIES IN PHYSICS

An interesting position concerning the effective theories in physics is followed by Howard Georgi[5]:

"**Effective Field Theory**. One of the most astonishing things about the world in which we live is that there seems to be interesting physics at all scales. Whenever we look in a previously unexplored regime of distance, time or energy, we find new physical phenomena. From the age of the universe, about 10^{18} sec, to the lifetime of a W or Z, a few times 10^{-25} sec, in almost every regime, we can identify physical phenomena worthy of study.

To do physics amid this remarkable richness, it is convenient to be able to isolate a set of phenomena from all the rest, so that we can describe it without having to understand everything.

Fortunately, this is often possible. We can divide up the parameter space of the world into different regions, in each of which there is a different appropriate description of the important physics. Such an appropriate description of the important physics is an "effective theory." The two key words here are **appropriate** and **important**.

The word "important" is key because the physical processes that are relevant differ from one place in parameter space to another.

The word "appropriate" is key because there is no single description of physics that is useful everywhere in parameter space.

The common idea is that if there are parameters that are very large or very small compared to the physical quantities (with the same dimension) that we are interested in, we may get a simpler approximate description of the physics by setting the small parameters to zero and the large parameters to infinity. Then the finite effects of the parameters can be included as small perturbations about this simple approximate starting point. This is an old trick, without which much of our current understanding of physics would have been impossible. We use it without thinking about it. For example, we still teach Newtonian mechanics as a separate discipline, not as the limit of relativistic mechanics for small velocities. In the (familiar) region of parameter space in which all velocities are much smaller than the speed of light, we can ignore relativity altogether. It is not that there is anything wrong with treating mechanics in a fully relativistic fashion. It is simply easier not to include relativity if you don't have to.

This simple example is typical. It is not necessary to use an effective theory, if you think that you know the full theory of everything. You can always compute anything in the full theory if you are sufficiently clever. It is, however, very convenient to use the effective theory. It makes calculations easier, because you are forced to concentrate on the important physics.

In the particle physics application of effective theories, the relevant parameter is distance scale. In the extreme relativistic and quantum mechanical limit of interest in particle physics, this is the only relevant parameter. The strategy is to take any features of the physics that are small compared to the distance scale of interest and shrink them down to zero size. This gives a useful and simple picture of the important physics. The finite size effects that you have ignored are small and can be included as perturbations.

Again, this process is very familiar. We use it, for example, in the multipole expansion in electrodynamics, or in replacing a physical dielectric with a uniform one. However, in a relativistic, quantum mechanical theory, in which particles are created and destroyed, the construction of an effective theory (now an effective quantum field theory (EQFT) is particularly interesting and useful. An EQFT is particularly useful, because among the short distance features that can be ignored in an effective theory are all the particles too heavy to be produced. Eliminating heavy particles from the effective theory produces an enormous simplification.

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Effective field theory is more than a convenience. There is another way of looking at it, however, that corresponds more closely to what we actually do in physics. We can look at this sequence of effective theories **from the bottom up."**

From the above quotation it may be seen that there is a special strategy for effective theories (in the structural realm). This strategy implies that any features of the physics of a domain of an effective theory that are small compared to the corresponding distance scale, may be shrinked down to zero size, *i.e.*, may be neglected. In fact, the phenomenological processes are unconsciously treated in this way. These phenomena are neglected. Then, one obtains "a useful and simple picture of the important physics", in other words of the structural physics. The phenomenological phenomena might be included later as small perturbations if their effect were indeed small. But this should be proved for any effective theory of the structural reality by an evaluation of how strongly combined the structural-phenomenological phenomena are.

THE DOMAIN BEYOND THE LARGE SCALE UNIVERSE

Each of the segments in Fig. 1 has its own effective theory. But there is also a domain above or beyond the large scale universe: the category of all possible universes in existence. The difference in comparison with all the other domains mentioned before is that this category is not in one "space" because each universe has its own separate space, and there is no unique space for the multitude of all universes. The connection of the universes, in the category of all the universes, is rather phenomenological, through phenomenological neighborhoods.[6] If we think of an effective theory of the category of all universes, we then have to consider not only the inputs offered by the effective theories of all universes, but also by the phenomenological properties of the deep underlying reality (orthoexistence). If every effective theory for each segment of Fig. 1 has inputs from an effective theory at a smaller scale (as is the case for the universe, from the segment of stars and planets), in the special case of the category of all universes, ***the inputs are both up and down*** (Fig. 3). We now have alongside the structural domains, the level of deep reality, that is the source of all phenomenological processes in the chain of domains. The effective theory of the category of the universes has to be a structural-phenomenological theory. It depends on both the theory of a universe and the theory of the deep reality (Fig. 3). The category of the universes has as its main elements the phenomenological categories of the associated universes[7] and the main phenomena of possible interaction are to be expected primarily at the phenomenological level of the category of all universes. The category of all universes may influence the functioning of any universe and consequently the theory of a universe may have also "upper" inputs, not only "bottom" inputs, like in the purely structural case. And the chain of upper inputs may continue downwards. This is a first important perception that changes the principle of an effective theory which for the structural science established the condition to have only bottom inputs. In our view, Now, it has to be generalized or correctly developed as follows:

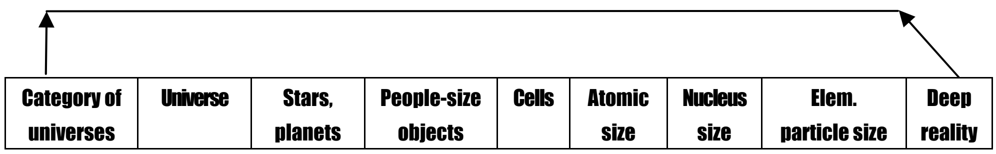

Fig. 3

An effective theory has, in principle, both bottom and upper inputs. It may be the case when either we neglect the upper inputs and, in that case the domain is strictly structural, or is considered as strictly structural; an effective theory of the type described by Gordon Kane may be developed and used if upper inputs and phenomenological effects can be neglected. Or, in our case, an effective theory has both bottom and upper inputs.

EFFECTIVE THEORIES FOR CONSCIOUSNESS AND LIFE

Let us examine the case of an effective theory of consciousness, following the work of Andrew Coward and Ron Sun.[8] They observe in their paper:

"The capability, at least in principle, to map phenomenological properties to neuron properties is an essential aspect of an **effective theory**. The ability of an intermediate **theory** to accurately model high level phenomena is a necessary but not sufficient condition for effectiveness.

The Definition of Consciousness. Even the concept of consciousness is controversial, because of the wide range of different phenomena to which the term "conscious" is applied, and because of the difficulty of objective measurement. A recent attempt at a definition was that of Block (1995) who distinguished between access consciousness, monitoring consciousness, self consciousness, and phenomenal consciousness. Access conscious was defined as the ability to report and act upon experiences. Block suggested that this ability is equivalent to the existence of some representation of the experience in the brain, the content of which is available for verbal report and for high level processes such as conscious judgments, reasoning, and the planning and guidance of action. Monitoring consciousness refers to thoughts about one's sensations as distinct from the sensations. Self consciousness refers to thoughts about self. Phenomenal consciousness refers to the qualitative nature of experience, for example why the experience of the colour red feels as it does and not like something else."

And further:

"The functional role of phenomenal consciousness has been regarded as a far more difficult question. The concept of 'qualia', referring to the 'phenomenal content' of conscious experience (Nagel 1974; Chambers 1993; Block 1995) presents difficulties for the view that the defining feature of a mental state is the set of causal relationships which it has with other states and with behaviour. Searle (1980) made the argument that a functional organization capable of generating behavior is not a necessary and sufficient condition for consciousness. It might then be argued that if cognitive functioning can occur without qualia, then qualia may not have a functional role. However, such a second logical step is not valid. There could be a range of different states at a detailed level which generate the same externally observed behavior, some of which correspond with phenomenal consciousness and others do not. For example, a wide range of different functions can be implemented in an electronic system using general purpose microprocessors. With the same transistor technology, most such functions could be implemented to run faster with special purpose hardware."[9]

In the conclusions of their paper they write:

"Firstly, a scientific **theory** of consciousness requires construction of a hierarchy of consistent causal descriptions from physiology through a series of intermediate levels to conscious phenomena. It is inadequate to only look for neural correlates of consciousness or to model cognitive data without reference to physiological plausibility or phenomenological analysis. Secondly, although the entire conscious processes could in principle be described end-to-end in detail in terms of the activities of large populations of neurons, such descriptions would not be comprehensible to a human intelligence. Scientific understanding depends upon the selection of key elements of conscious phenomena and the creation of intermediate models for such elements."[10]

In our view, there is much more (Fig. 4). Among the objects of existence, without examining in this paper the possible special role of the Fundamental Consciousness of Existence, there are living objects that have a *direct* connection with deep reality, with the phenomenological information as part of this domain of reality.[3,11] Also the nonliving objects have a phenomenological connection, but this connection is not direct, as is the case for living objects. A living being has both types of connections, direct and indirect, with the phenomenological processes of the deep underlying reality.

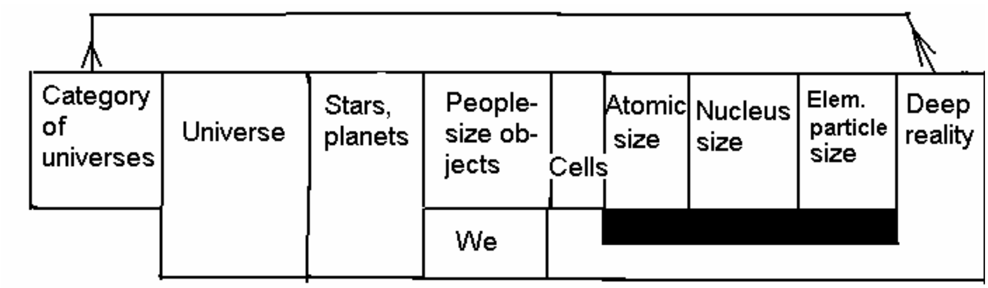

Fig. 4

In Fig. 4, the living objects are represented by the zone '*we'* of reality. It is a part of the zone of objects with the same range of dimensions as living beings. These objects are in the Standard Model zone if direct phenomenological processes are neglected, or are not present.

The theory of the zone '*we*' has inputs from the results offered by the atomic size theory, but also inputs from the deep reality. We emphasize that every living object (zone *we*) interacts with the deep reality.

Fig. 4 shows (as we have no knowledge of it) that there is no life at the atomic level, or at the nucleus level, or at the particle level. An atom, a nucleus, a particle is not a living being. A molecule may indeed be alive, as seems to be the case with biological cells such as the DNA molecule.

Concerning a universe, it may contain living organisms. These may influence the behavior of this universe. The inputs for the theory of the universe are both from nonliving and living objects.

The category of the universes has as inputs the data developing by its universes (or bottom inputs) and also the inputs from the deep existence (or up inputs) which might comprise also the Fundamental Consciousness of Existence.

It may be seen that on the segments of reality described by the structural effective theories, one has to add perturbations (smaller or greater) due to the role played by the phenomenological information in every part of these segments, but also to consider the direct connection under the Planck scale with the deep reality of living beings. The segment of the structural physics at the level of

Planck scale to the limit of deep reality, and of course also the connection of the category of all the universes with the deep existence constitute the new framework. How will all these influence the development of effective theories, even if they are seen extended for structural-phenomenological processes? May we use perhaps the notion of effective theory for the structural-phenomenological cases?

It seems that from the theory of a universe down to the theory of elementary particles, the background of structural effective theories may be used as the first approximation, and because the phenomenological processes do not play directly the main role, we may admit for these segments of reality the necessity of effective structural-phenomenological theories. Below the Planck scale, the phenomenological processes become predominant, and also this applies for the category of all universes. In such cases, effective theories are perhaps not possible.

UP-DOWN AND BOTTOM-UP WAYS. TRANSITION THEORIES

Brian Green in a recent interview speaks about the problems of the structural theories at the limit of the Planck scale and even under this limit:

> "One weakness of string theory is that it's so-called background-dependent. We need to assume an existing spacetime within which the strings move. You'd hope, though, that a true quantum theory of gravity would have spacetime emerge from its fundamental equations. They [the loop-quantum gravity researchers], however, do have a background-independent formulation in their approach, where spacetime does emerge more fundamentally from the theory itself. On the other hand, we are able to make very direct contact with Einstein's general relativity on large scales. We see it in our equations. They have some difficulty making contact with ordinary gravity. So naturally, you'd think may be one could put together the strengths of each." [[12], p. 51]

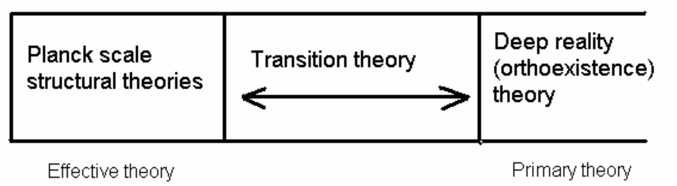

Fig. 5

In Fig. 5, we propose a transition possible theory between Planck scale structural theories and orthoexistence theory. The transition theory may show how spacetime is prepared, still with a structural formalism, in order to manifest itself beginning, to say, with strings or loops. It is not sure if such a transition theory will be fruitful or what form it will take, but such theories have begun to be considered, and might perhaps play an important role in the future.

Brian Green says further:

> For instance, even with background dependence, we've learned things like mirror symmetry – there can be two spacetimes, one physics. We've learned topology change – that space can evolve in ways that we wouldn't have thought possible before. We've learned that the microworld might be governed by noncommutative geometry, where the coordinates, unlike real numbers, depend upon the order in which you multiply them. So you can get hints. You can get isolated glimpses of what's truly going on down there. But I think without the background-independent formalism, it's going to be hard to put the pieces together on their own." [[12], pp. 51–52].
>
> "Noncommutative geometry is a whole new field of geometry that some people have been developing for years without necessarily an application of physics in mind. The French mathematician Alain Connes has this big thick book called *Noncommutative Geometry*. Euclid and Gauss and Riemann and all those wonderful geometers were working in the context of commutative geometry, and now Connes and others are taking off and developing the newer structure of noncommutative geometry." [[12], p. 52].

The mentioned interview with Brian Green (**BG**) of the Scientific American (**SA**) contains the following interesting discussion:

> **"SA:** It is baffling to me – maybe it *should* be baffling – that you would have to label points with a matrix or some nonpure number. What does that mean?
>
> **BG:** The way to think about it is: There is no notion of a point. A point is an approximation. If there is a point, you should label it by a number. But the claim is that, on sufficiently small scales, that language of points becomes such a poor approximation that it just isn't relevant. When we talk about points in geometry, we really talk about how something can move through points. It's the motion of objects that ultimately is what's relevant. Their motion, it turns out, can be more complicated than just sliding back and forth. All those motions are captured by a matrix. So rather than labeling an object by what point it's passing through, you need to label its motion by this matrix of degrees of freedom." [[12], pp. 52–53].

And further:

> **"BG:** Well, the big questions are, I think, the ones that we've discussed. Can we understand where space and time come from? Can we figure out the fundamental ideas of string theory or M-theory? Can we show that this fundamental idea yields a unique theory with the unique solution, which happens to be the world as we know it? Is it possible to test these ideas through astronomical observations or through accelerator-based experiment?
>
> Can we even take a step further back and understand why quantum mechanics had to be part and parcel of the world as we know it? How many of the things that we rely on at a very deep level in any physical theory that has a chance of being right – such as space, time, quantum mechanics – are truly essential, and how many of them can be relaxed and potentially still yield the world that appears close to ours?" [[12], p. 53]

As described above, the thinking of reality is a still up-down with a tendency of bottom-up vision, but neglecting the deepest reality. If we take the structural theories at the Planck scale (string theory and M-theory), it seems to be possible to find a transition from the effective theory at the Planck scale to a theory of the deep existence, also in a way as suggested by Roy.[13]

Perhaps this is the moment to think reality *not* from the structural domains towards the deep phenomenological reality, but inversely. The point of contact between the up-down and bottom-up ways is the Planck scale of reality. The problems raised by Roy[13] at the Planck scale and below Planck scale might be more convenient to be related to the phenomenological processes of the deep reality.

Brian Green considers that what is indeed needed is an understanding of how space and time emerge: "An understanding of how space and time emerge would take us a huge step closer to answering the crucial question of which geometrical form actually *does* emerge." [[14], p. 380] For him, in the big-bang, in the beginning, there is no surrounding space. [[14], p. 83] Space and strings emerge together, and strings are also space [[14], pp. 377–378, 388], a point of view presented in 1985 by Drăgănescu [[11], *Ortofizica*]. In fact, the difference between an elementary particle, accepted today as being a string, and space, is given only by the phenomenological information content of these particles. This last idea may be found also in a recent paper[15] by Drăgănescu and Roy, where a model for the birth of a universe is proposed.

CONCLUSIONS

The only primary theory (true fundamental theory) might be the theory of the deep existence (orthoexistence). This theory cannot be of the nature of an effective theory because the phenomenological information processes predominate in a direct way in the nature of the deepest existence. In fact, for most other main domains of reality the phenomenological information always predominates, although many times it is "hidden".

For the domains starting from the Planck scale all the way to the universe, the structural effective theories may be extended to a new type or effective structural-phenomenological theories, as was shown for the theory of life, mind and consciousness by Kafatos and Drăgănescu.[3]

In the case of the category of all universes of existence, again an effective theory is not possible, because the contacts between the universes are not directly structural, in fact they are phenomenological. The way of building a theory for this level of existence is an open problem. Only some hints about a possible form of such a theory were presented in this paper.

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