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Review Article

The Tensions Between Scientific Theories and Reality as a Knowledge Mechanism

Physics may be locked in the ivory tower of theories and must return to nature.

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Abstract
In this paper the relation of scientific theories to reality, as a tension for achieving the knowledge of nature, will be elaborated. The focus is on physics, with emphasis on gravitation. Despite continuous successes, it is gravitation that leaves science ununified in explaining the macro- and microcosm. The paper will list the core efforts toward the unification. The main argument raised is about the assumption that perhaps the path being followed is not right. There is no linear direction in science, no predetermined way of development. It should be remembered that Albert Einstein, although not a member of the scientific community of physicists and who did a simple administrative job, was the one who rejected the famous Newtonian theory and caused a revolution in physics. Maybe some brilliant scientist is needed to get physics out of this state and unify it. This will bring about a new revolution in physics. As well in the knowing of reality.

Keywords: *relations between theory and nature, physics, non-unification of macro and microcosm's explanation, Albert Einstein, a new revolution in physics*

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Introduction

It is already known that there exists among scientists a tension between belief in theories and reality itself, which inadvertently functions as a triggering mechanism to research reality according to theories, on the one hand, and control theories themselves through reality on the other.

While scientific theories are believed to be true, in the sense that they are consistent with reality, explain it and derive laws from and for it, in fact all scientists know that their theories are never completely true, as usually their authors themselves know some serious riddles of their theories. Karl Popper was distinguished precisely because he emphasized the fact that science progresses when a scientific theory believed to be true is falsified, so it turns out to be erroneous, and therefore the task of scientists, according to him, was to find these errors and on that basis reject scientific theories (Popper, 2003, 18, 55-56; Popper, 2099, 90). But it is not easy to find out where the untruth lies, since the new theory brings new data and phenomena and opens opportunities for exploration, makes scientists able to solve the scientific problems they face, and thus gain the confidence that other problems that are known will be solved.

However, after Popper, almost all scientists have reservations about the veracity of theories and no longer believe them, as, say, they once believed in Isaac Newton's theory of gravitation. His theory was considered a paradigm, in the sense that theory and reality were compatible. But although the theory of gravity is believed by most scientists to be the best one science has so far, nevertheless it has a shortcoming – it is not valid for both macro and microcosm, and all physicists admit it to this day. In the efforts to solve this problem, physicists have put forward new alternative theories, but none are yet acknowledged to have met their intended objectives.

The purpose of this article is to present the problems and challenges associated with the theory of gravity as it is known today, as well as the efforts to find an adequate solution. All this will be accompanied by a critical elaboration, trying to shed light on something that does not go into today's physics.

However well modified, gravity alone cannot explain the universe

Gravity is considered a natural phenomenon which, since antiquity, has been noticed and people attempted to understand it. For example, Archimedes (288 BC - 212 BC) of Syracuse in Italy, was a physicist, mathematician, engineer, astronomer and innovator, who, in his work *Method*, first published at the beginning of the 20th century, states that there is a gravitational center between the two points (Netz & Noel, 2011, ch. 6), or that the cylinder rests where the center of gravity is between the points (Gould, 1955, p. 427).

An attempt to explain the phenomenon of gravity was by Aristotle (384 BC - 322 BC), a philosopher and founder of many sciences including physics itself (Aristotle, 1984, p. 699-978). His explanation, for nowadays, seems very simple: things are weighted down, the time elapsed is proportional to the body weight. Aristotle had tried to understand what is called gravity.

An alternative idea to Aristotle's was put forward by Marcus Vitruvius Pollio (80-70 BC - 15 BC), architect, civil and military engineer, and Roman author. He emphasized that "the gravity of a substance does not depend on the amount of weight but on its nature" (Vitruvius, 1914, p. 215), indicating that it is something more essential that affects the attraction of substances without getting inside. There have also been other scholars who have rejected Aristotle's theory, such as John Philoponus (409-570) who called it "totally wrong" (Cohen &

Drabkin, 1948, 220), as the change in time of two bodies with large differences in weight is very small. This view, though ignored for centuries, seems to have been known by Galileo Galilei (1564-1642).

Galilei made a great contribution to the modern science of physics. In 1638 *Dialogue on Two New Sciences* (2005), he talks about an experiment he did at the Tower of Pisa (Ball, 2005), from which he found that things, regardless of their weight, withdraw equally from the earth, thus rejecting Aristotle's postulate. From Galileo to Einstein, this view has dominated, in the sense that the speed of the fall of bodies depends on acceleration and deceleration.

However, no one had provided a scientific explanation for gravitation, none before Isaac Newton did it in 1687 when he published his *Principia* (1846, pp. 87-114, 397-452). He wrote the inverse square law of general gravity: "I conclude that the forces that keep the planets in their orbits must be reciprocally like the squares of their distances from the centers around which they orbit", whence he derived the well-known "gravitational constant": $F = G\frac{m_1 m_2}{r^2}$ (where *F* - is the force, m_1 and m_2 are the masses of the objects drawn, *r* is the distance from the center of mass and *G* is the gravitational constant).

When Newton discovered gravity, science experienced a revolution because, among other things, it was possible to explain the orbiting of planets around the sun, which fulfilled the basic puzzle, marking the triumph of Nicolaus Copernicus' heliocentrism astronomy.

But, however well it was mathematically calculated, something went wrong. It couldn't match reality: there was a mismatch of Mercury's orbit. Although this anomaly was known, not having a better theory, Newton's theory was embraced by the community of physicists – of course, because they believed it matched other aspects of reality and the scientific community accepted it.

The anomaly of Mercury's orbit more than two centuries later was solved by Albert Einstein (1920) in 1916 with the publication of *Theory of General Relativity*. He showed that the discrepancy was with the advance (for 42.98 arcseconds for a century) of Mercury's perihelion. Moreover, Einstein changed the meaning of gravity: he showed that time and space were not separated and absolute like Newton's, but were one, it was *spacetime* which was relative. And instead of force, he brought the curvature of spacetime. But even this postulate seems to be inconsistent with nature, since, as physics professor Chris Prassnacht says, the Hubble constant (the unit of measure to describe the expansion of the universe) although "constant everywhere in space at a given time, it is not constant in time" (Daily Galaxy, 2019).

Albeit it surpassed Newton's theory and expanded the horizon of scientific knowledge, Einstein's theory of gravity caused a chaotic state in physics but not only. While for the macrocosm it was recognized by scientists that Einstein's gravity was adequate, it did not apply to the microcosm. So, the physics split in two and went in separate directions.

This fact itself indicates that something is erroneous with Einstein's theory. There are many criticisms that have been directed against him (Israel, Ruckhaber, Weinmann, 1931; Adrian Ferent 2019). Moreover, computer experiments have led to the conclusion that "Einstein's Theory of General Relativity may not be the only way to explain how gravity works or how galaxies form" (ScienceDaily, 2019). There is also the opposing viewpoint like Erik Verlinde who says, "At large scales, it seems, gravity just doesn't behave the way Einstein's theory predicts" (The Daily Galaxy, 2019). And Erik Verlinde attempts to find a solution through a radical modification of the theory of gravity assuming "emergency gravity" (Verlinde, 2016, pp. 2, 43-44).

Yet the fact remains that Einstein's concept of gravity does not apply and does not work in microcosm, and this is its greatest inconsistency with nature, signaling that something fundamental is wrong. This raised the dilemma whether science got any basic principle. (Abazi, 2017).

Most likely, even in the macrocosm something is generally erroneous with the theory of gravity. Just in appearance it explains capitally, for example, the solar system, i.e. the planets orbiting the sun, but logically it contains a shortcoming that is unnoticed. If gravity pulls bodies toward each other, then such pull must continue until something stops that. For example, if Newton's apple was stopped by the earth, then what stops, for example, the Earth from approaching endlessly, until it collides with the Sun?

Nothing from the point of view of gravity theories. In principle, according to today's physics, the sun would not allow any planet to be created because it would attract them to itself. Even if it is assumed that they were nevertheless created, then they should not exist, for the Sun must also have swallowed them up. Herein lies a contradiction.

Theories of gravity in physics are vague and do not have a consistent explanation of *how and why* ***celestial bodies stay at certain distances*** *and are not attracted by the larger body itself,* for example *why the Sun does not attract planets until they crash into it*. In this context, judging according to the current developments, it seems that theories of gravity, however well modified, will not suffice to explain the existence of the universe.

The lack of this explanation is the Achilles' heel of all gravitational theories. They are not and ***they cannot be*** *complete*, because no one of them can explain in a sustainable way the staying of celestial bodies at certain distances from the sun.

Despite achievements, unification is lacking

Where does the main problem of physics lie?

As mentioned above, the problem is known, and I will not say anything new about it, but I will only raise some arguments that perhaps the path to the solution, namely the unification of physics as well as a better and closer explanation of reality, may not be appropriate.

It should be noted that although Einstein's general theory of relativity advanced physics for some decades, the division of physics in two parts remains real. Physics rests on the General Relativity Theory (Einstein, 1920, p. 54-71) and Quantum Field Theory (Kaku, 1993, pp. 3-255). Finding a theory that would unify both of them has for three decades was an effort that Einstein tried to achieve himself (Ellis, 2005) but failed, an effort that was figuratively called the "Einstein's Dream" (Bagger, 2014; PhysOrg. 2013). And this is still a challenge.

The development of physics has moved forward in both directions, but the focus, however, seems to have been on the concern with the quantum world, which, as scientific knowledge expands, is becoming ever more mysterious. In these efforts, in the 1960s, string theory was born. This is a theoretical framework in particle physics. Here the point-like particles are replaced by one-dimensional objects called strings, where one of their vibrational states corresponds to graviton, a particle in quantum mechanics that carries gravitational force. Hence, string theory is a theory of quantum gravity (Becker, Becker, & Schwarz, 2007, p. 6-7).

Within this theory, one hopes to find a solution to the problem of the cosmological model, among other things to explain the expansion of the universe, for which there have been and are many different theories (Alles, 2013). One of them, considered the most widespread, is what Fred Hoyle called in 1949 the "Big Bang" (Kragh, 2013), in the sense of "the existence of an initial singularity (e.g. type "big bang”). This theory was embraced and developed, among other scientists, even by Steven Hawking and Roger Penrose (Hawking & Penrose, 1970, 530; Hawking, 1988). Our universe begat at that explosive moment and it continues to expand to this day. Many scientists believed this explanation and considered it a solution.

But although at first science seems to enjoy a breakthrough, once the problem-solving needs of a theory are satisfied, inadequacies and inconsistencies seem to be detected, which necessitates a different approach, demanding even more because questions are added and answers to them are requested. Something similar happened with the Big Bang theory: its rival did catch up, and an alternative explanation emerged.

In the 1980s, physicist Alan Guth (1981, 1997) formulated a new theory on the cosmic inflation, according to which a particle called "inflation" caused the initial rapid expansion of the universe, which must be explained by string theory (Becker, Becker and Schwarz, 2007, p. 533) as this inflation-theory itself is still in its infancy (pp. 539-543). During this time, several superstrings theories known as Type I, Type II (IIA and IIB) (Green and Schwarz, 1982), heterotic strings, and X8xE8 have been formulated (Gross, Harvey, Martinec, Rohm, 1985). Initiated by Edward Witten, the unification of all strings theories was termed M-theory, where "m", according to Witten (Duff, 1996) has the meaning "magic," "mystery," or "membrane."

In further developments in physics, Edward Witten, in the 1980s, understood that Type I of string theory was inconsistent, but then, influenced by Michael Green and John H. Schwarz, Witten, considered the most brilliant physicist of his generation (Schwarz, 2008), became a proponent of the string theory; hundreds of other physicists joined this trend, achieving what is known as the first superstring revolution (1984-1994). Scientific research has highlighted the fact that different superstring theories were different limitations of the 11-dimensional theory (Witten 1995), which, as summarized by historian and philosopher Dean Rickles (2014), received a common denominator M-theory. Much knowledge has been achieved, leading to a second superstring revolution (Schwarz, 2008), through theories such as S-duality (which indicates a relation according to which a choice of strong interaction particles in one theory may appear as weak particle interactions in a completely different theory), T-duality (according to which a string propagating around a circle of radius R is equivalent to that of a radius $1/R$, in the sense that all the quantities observed in a description are identified with the quantities in the dual description), supersymmetry (the principle which postulates a relation between two basic classes of elementary particles: bosons having an integer-valued spin and fermions which have a rotation with half rotation), then supergravity and beyond the Standard Model (Dine, 2007).

The Standard Model (SM) (Gaillar, Grannis & Sciulli, 1999) is also highly valued by CERN (2019), and by some, such as Robert Oerter (2006), is regarded as the Theory of All Things. (This SM theoretical is considered by the physicist Glenn Starkman as "The Absolutely Amazing Theory of Almost Everything. That's what the Standard Model really is", because, according to Starkman, it answers what everything is made of and how it is held together (Starkman, 2018). But through experiments it has been shown that neutrino has mass which was forbidden by the Standard Classics Model (CERN, 2010), and with all modifications to explain this, 7 or 8 constants are required to be added (Strumia & Visani, 2010). SM cannot consistently explain gravitation according to general relativity in terms of quantum field theory (Blumhofer & Hutter, 1997). It is also incompatible with the Lambda-CDM model (cold dark matter), a parameterization of the Big Bang's cosmological model that first includes a cosmological constant denoted by Lambda (Greek Λ) and associated with the black energy; second, it postulates cold dark matter; and third, regular matter.

Despite the numerous theories and large numbers of physicists involved, it seems that the landscape of the string theory (Douglas, 2003) poses more serious problems, such as the fact that there are a large number of false inequivalent vacua - near 10^{500} (Douglas, 2003) which has led to numerous discussions on how this theory could make predictions (Rickles, 2014, pp. 230-235). Co-authors Sujay K. Ashok and Michael R. Douglas (2004, p. 2-3) highlighted that “it is very important to bound the number of string vacua which resemble the Standard Model and our universe, because if this number is infinite, it is likely that string/M theory will have little or no predictive power”.

It is interesting to note that although all these theoretical and experimental efforts mark some plausible achievements in realizing some aspects of the microcosmic reality that help even better to explain the macrocosm, they do not achieve the primary goal: *the unification of physics so that it can explain reality in its entirety with the same valuable references to both the macrocosm and the microcosm*.

The way of attempting to unify physics may not be the proper one

Albert Einstein's dream of a Theory of Everything, that is a hypothetical framework, that explains all the physical phenomena of the universe remains. Because though quantum mechanics and relativity theory describe “its respective area of inquiry — the very smallest and the most massive things in the cosmos — with astounding accuracy, but both quantum mechanics and relativity fail when applied to each other's subject matter". In other words, although physics succeeds in acknowledging the microcosm and macrocosm, it fails to unify itself. It is known that "Albert Einstein spent the last thirty years of his life on a fruitless quest for a way to combine gravity and electromagnetism into a single elegant theory" (APS Physics, 2005). The failure to achieve this goal for a century seems to have aroused mistrust of such possibility: "So far, an overarching theory of everything has eluded scientists, and some believe the ultimate goal is unrealistic." (APS Physics, 2005).

Main efforts and explanations are derived from theoretical approaches, clinging to a segment, making gaps there as well as multiple contributions, but remaining in the same environment - theoretical explication, experiments based on certain theories, different findings (such as the Higgs boson, gravitational waves, etc.). This range of failed attempts over the decades may perhaps be a sign that we are not on the right track looking for a solution. Something absurd is happening: the more discoveries are being made, the more we are moving away from the unifying explanation. Let us remember that scientists in their research have introduced the concepts of antimatter, bigravity, agravity, black matter, black energy, etc., but which, however, appear to be incomplete and deficient.

All those efforts seem to make the following question meaningful: has physics been locked in the "ivory tower" that does not allow it to see beyond itself? In other words, is physics researching in a non-proper way? Are solutions being sought where they are not?

Perhaps we have sunk deep into the theoretical ocean and, in some way, forgotten the nature. In such an allusion, the physicist Marcelo Gleiser suggests that nature must be heard, because the purpose of physics is to explain nature. It sounds like an appeal to go back to nature, to listen to it, maybe to have a look at nature itself and see if it has something else to say to us, something that science for about a century cannot find. Gleiser writes: "Instead of the traditional view that Nature's secrets are encoded in a Final Theory, which is at the core of superstring theories and other searches for a unified description of Nature, I argue that this age-long search for perfection is misguided…" (Gleiser, 2019.)

Sometimes, even inadvertently, theories, while intended to help us understand and explain the reality, can turn into a hindrance precisely to what they aim to clarify. Maybe we are not understanding something, we are not listening to nature properly?

Nature can sometimes reveal something new to us, and we may not detect it. One must have sharp eyes to distinguish it. This is what, to mention a case, Rontgen's discovery suggests: *nature contains much more than theories say*: no theory predicted the existence of X-rays, but Rontgen occasionally faced them and then, after a lot of experimentations and analysis, constituted them theoretically as scientific fact referring to a given reality – to the X-ray.

To get out of the labyrinth, sometimes the approach needs to be changed. This suggests that *the Book of Nature may not always have been written by its creator in the language of mathematics. This book may have been written in another language that we do not yet know. It may appear to us, but we do not understand it. Therefore, physics may have to start by re-reading the Book of Nature, trying to look at nature in a different way, to see what is there that we cannot distinguish.*

Conclusive Remarks

This paper will conclude with an allegory by Albert Einstein, who in 1954 stated: "I must seem like an ostrich who forever buries its head in the relativistic sand in order not to face the evil quanta" (APS Physics, 2005). This may perhaps be slightly modified to suit the situation and say that *physics looks like an ostrich that has buried its head into the theoretical sand and can no longer see nature*.

When the ways (different theories) that we have been trying for a century do not get us anywhere, then perhaps we should try other ways out, meaning *to set all theories aside for a while and return to nature, requesting answers from nature itself*. Nature is like a chameleon that can conceal itself, camouflage itself so that we cannot discern it, of course giving us hints that something is missing and does not match reality. When René Descartes (2006) made the major turning towards the scientific method (which was in the modern scientific spirit revolution) with his masterpiece *A Discourse on Method* published in 1637, he once threw away all theories without exception, which is a metaphor that he wanted to strip away all theoretical influences and see reality unaffected by them. He did so because he had realized that all authorities hitherto were unworthy to the new science and requested a different basis. And he was right: he discovered a new foundation, a new principle that helped him see things more clearly and better than his ancestors as well as many contemporaries. Cogito, ergo sum – I think, therefore I am. The foundation of judgment was the human mind, also methodological rationality. Even physics seems to require a temporary abandonment of all theories (but keeping them in the background of the mind), *to change the way of understanding and to approach the nature itself. It has a lot to say, revealing quite unknown things so far*. *New things. Things that can even get physics out of the endless way where it has gone.* Then, on the new basis, all knowledge to date must be reviewed, reassessed, restructured, some theories have to be retrieved and some others to be removed. But to do all this, first and foremost, the right way must be found.

In conclusion it should be noted that what has just been said doesn't have to sound weird, since it is known that the history of science shows that there is no linear path, no predetermined development and *not always solutions are found within a given scientific community*. Albert Einstein himself, for example, came to physics from outside the scientific community, and it has been a century since his theories that revolutionized physics still govern this science. *Again, physics now seems to be waiting for some brilliant scientist, one with a keen eye and mind to see nature in a different way and to distinguish something extraordinary, to bring physics out of this state and to unify it.* This will bring about a new revolution in physics. And, most importantly, in knowing the reality. But for these deep changes to occur, the ostrich must raise its head from the theoretical sand and see nature itself.

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