How to Cite:
Tounsi, M. (2024). The metaphysics of physics: When the boundaries of science and metaphysics intertwine. *International Journal of Health Sciences*, *8*(S1), 515–530. https://doi.org/10.53730/ijhs.v8nS1.14846

The metaphysics of physics: When the boundaries of science and metaphysics intertwine

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***Abstract*---**The evolution of contemporary physics proved that science cannot abandon metaphysics, there is evidence that there are theories that engage in metaphysical topics or offer metaphysical solutions to scientific problems, there were many concepts and theories that were not based on experience because of the difficulty of testing them. This is the result of the great theoretical progress achieved in physical research, The evolution of contemporary physics has shown that the Positivism call for excluding metaphysics from science cannot be achieved, Metaphysics is found in the principles of science as we rely on postulates that cannot be demonstrated, such as the stability of the laws of nature, The necessity of metaphysics arises from the fact that the development of physics has proven the limitations of scientific experience, The theoretical aspect must advance because cognitive curiosity will not stop the human from asking questions, Metaphysical ideas can play a guiding role in theoretical research in physics, The rejection of all that cannot be ascertained by experience under the pretext of excluding metaphysics will lead to the cessation of discoveries that must be made of imagination and mind, Metaphysics can also benefit from physics in the use of scientific discoveries to build a comprehensive vision, and the results of many sciences may combine to build more comprehensive perceptions and provide a general view through which to address big questions.

***Keywords*---**metaphysics, physics, positivism, logic, experiment.

Introduction

In the beginning of the twentieth century, physics entered a new phase, where theories emerged that greatly changed the human view of nature. These theories realized experimental and applied successes, and with successes of experimental

science the Positivism spread, it called for focusing on the experimental aspect and excluding metaphysics from science, which has long been an obstacle to the progress of science, as the history of science reveals that many of the experimentally unconfirmed ideas that scientists have adhered to for decades or centuries have played an obstructing role in the progress of science. But on the other hand, is the positivist call to exclude metaphysics is possible to apply? Especially when we talk about the foundations upon which experimental sciences are based. In addition to this, there are many contemporary theories that contain ideas that are not experimentally proven, and there are also metaphysical explanations for scientific problems raised in physics. Contemporary physics has also delved into deep topics that were the domain of metaphysics, and Physicists began to talk about it in scientific terms and mathematical symbols. All of this raises a question about the boundaries between physics and metaphysics. Can physics be based on purely experimental concepts and completely get rid of any metaphysical concepts? Or is the intersection of physics and metaphysics inevitable and we must invest in it positively?

The call to exclude metaphysics from science

Some believe that metaphysics has no value because its ideas are not real. Physics is concerned with matter and the phenomena resulting from it ,it is concerned with what is objective and present to the senses. As for metaphysics, it is concerned with what is beyond matter and what is Non-sensory. Metaphysics faces opposition from materialists and empiricists, they defended the idea that reality is what produces thought; Ideas are abstracted from sensual things, while other ideas are unreal and have no value. Therefore, metaphysics and speculative philosophy is not linked to reality, so why do we need them then? .Interest in the material world and the use of senses and experiences in it formed an important basis in the European scientific renaissance, Nature became a subject of discoveries by searching for its laws. A major shift occurred, the human became interested in earth rather than heavens. Francis Bacon's experimental philosophy was considered an attempt to reconsider the concept of truth in its ancient sense. For Bacon, truth no longer existed outside this world, it is no longer reached by intuition, inspiration, or purely rational thinking, the word science has come to refer to experimental science, as experimentation is the only way to scientific study, and without it science remains empty of any material content. We study matter and we have to subject it to observation and experience. David Hume considered that ideas derived from sensory experience are worthy of attention, while other abstract concepts what is contained in the books of metaphysics is worthy of burning. Beginning in the nineteenth century, metaphysics faced an acute attack by the positivist trend and was questioned about its usefulness to science. Science cannot include what does not fall under the senses and cannot be tested experimentally. The positivists who call to exclude metaphysics from science refuse to project ideas that have no connection to sensory experience onto reality and attach them to scientific theories. They believe that we study

matter and must subject it to observation and experimentation, as physical theory will be meaningless without experimentation.

Auguste Comte considered metaphysical thinking to be a past stage that human thinking had surpassed. Comte presented phases of the development of human thinking: the theological Phase, the metaphysical Phase, and the positivistic Phase. In the first stage, the human mind was thinking about phenomena based on theological explanations. After that, he began to think from a metaphysical point of view, where he based his thinking on abstract concepts and justifications far removed from sensory experience, As the human mind matured, it began to view natural phenomena from a positivistic, materialistic point of view, and therefore the correct approach to natural phenomena depends on excluding everything related to metaphysics, Science in which metaphysical ideas "infiltrate" will provide us with a wrong understanding of the phenomenon, and It takes time for us to discover that this type of idea is the cause of the wrong understanding.

Mach was one of those who called for the necessity of excluding metaphysics from science. Mach's view of science and physics in particular was a critical, experimental view. He sought to establish the vision of the necessity of building science by relying on the description of the facts provided by the senses. Science, in Mach's opinion, is a conceptual reflection of the facts, and therefore every a priori or metaphysical element in the synthesis of scientific knowledge must be excluded, and thus science derives its perceptions from observation and experience alone. Mach saw scientific theories as tools for synthesizing and analyzing facts and things. In his book "The Science of Mechanics," Mach criticized Newton's physics and the concepts on which it was based. He tried to re-establish physics on experimental foundations without resorting to metaphysical concepts, such as absolute space, absolute time, and absolute motion. Mach saw that these perceptions are not justified by experience and cannot be relied upon in our study of physical phenomena. Mach refused to accept the idea of absolute space and absolute time, and he saw that physical reality only reflects relative time, relative space, and relative movements to us. The physical world can only be understood through relative references. Mach believed in the necessity of scientific research focusing on topics that are subject to observation. As for those interested in metaphysical topics, there is no point in making assumptions that aspire to explain what is behind phenomena, because there is nothing that can be proven and therefore thought about.

Henri Poincare saw the necessity of paying attention to metaphysical ideas in physical theories. He saw that the problem of classical mechanics is that it does not differentiate in its constitutions between what is experimental and what is mathematical, between what is a convention and what is a hypothesis, Classical physics was founded on fragile ideas without attempting to review their nature, and among these ideas is what is called absolute space and absolute time and the absolute movement that results from them. Poincare saw the necessity of abandoning these ideas because there is no experimental evidence to support them, and he saw that the call to subject hypotheses to experiment is not sufficient because "there are still dangerous hypotheses first and above all those

which are tacit and unconscious Since we make them without knowing it we are powerless to abandon them"1

In his day, Pierre Duhem rejected Maxwell's atomic physics because it describes intangible essences and entities and brings them into the field of science. Science does not need to adopt the atomic hypothesis in order to understand and think about nature. Duhem categorically rejected metaphysical hypotheses, and believed only in ideas that can be verified by experiment. According to him, we should not follow the path of those who worked to establish physics on metaphysics, as the old theories that have become part of the history of science are theories that mostly suffer from the fact that they were built on metaphysical ideas. Duhem called for a scientific project that completely distinguishes between physics and metaphysics, whereby limits are drawn for physical theory and everything that we cannot verify is excluded from it . Physical theory, according to Duhem, would be under the guardianship of metaphysics if it did not depend on principles derived from experience.

In the history of science, there are many theories that fell into contradictions and failed to give a correct explanation for natural phenomena, as the theoretical model conflicted with experimental data, which led to these theories entering into crises, and after that, either the fabrication continues as an attempt to preserve the old model, or a break is make with The concepts that caused the crisis, and these concepts are metaphysical concepts that have nothing to do with any experimental support, and examples from the history of science are many: such as the concept of "Earth centrism" in Ptolemy's theory, or the Aristotelian idea to explain the rise of liquids, "nature abhors a vacuum", Or the concept of "phlogiston" which explains combustion processes in chemistry, or the concept of "ether" in classical physics, or the Aristotelian explanation for the variation in the fall of bodies... ,All of these conceptions failed to maintain a theoretical models that explains everything that falls within its circle, and the reason for this is that the mind treated them as if they were the keys to solving all the problems related to that science, without asking about evidence proving their existence or conducting experiments to review their feasibility. Scientists who adopt this type of perception may open the way to imposing an explanatory model on an incomprehensible reality, and we will be deceived for decades that that model is correct. The lessons provided by the history of science call us to be cautious in adopting perceptions to build an explanatory vision or solve a scientific problem.

Logical positivism concerned analysis at the expense of overall meanings. They rejected metaphysics and worked hard to clarify its worthlessness. The logical positivists formed a charter known as the Scientific Charter of the Vienna Group, and one of its goals was to purify science from the metaphysics, and forming a scientific basis for science. To achieve this goal, it is necessary to use a new method of analyzing issues from both the formal and semantic aspects by applying the method of logical analysis of language, and working to prove the invalidity of metaphysics by logical and experimental means. Philosophy has become just a method that has no right to formulate experimental issues,

[1] -Henri Poincare, Science and Hypothesis, TRANSLATION BY GEORGE BRUCE HALSTED, NEW YORK THE SCIENCE PRESS .1905,p108

because that is the prerogative of the sciences, just as it does not fall within its scope to formulate mathematical issues, because that is the prerogative of mathematicians. Thus, the mission of philosophy has been reduced to a mere logical and analytical method without having field of research related to existence.

The Vienna group based its rejection of metaphysics on the principle of verification, to which Widgenstein and Schlick contributed to its formulation. They divided the issues into analytical issues, such as issues in the formal sciences; logic and mathematics. In these issues, the criterion of truth is the consistency of thought with itself. And synthetic issues, such as issues. Experimental sciences and the criterion of truthfulness include their consistency with reality. A term is meaningful and scientific if it falls within these two types of issues. As for metaphysical term, since they are neither analytical issues nor synthetic issues, they are not meaningful because they are outside these two types, and there is no way to prove their truthfulness, or not, and based on this, metaphysical issues are empty, meaningless, and do not deserve attention. Carnap believes that metaphysical ideas are merely imaginary ideas that must be rejected based on the scientific point of view, and we should not care about the great value that the ancient heritage gives to these metaphysical ideas, because they are just words devoid of meaning.

Metaphysics within the postulates of physics

Bertrand Russell saw that the scientific method must be based on some assumptions whose truth is not derived from any experience, but rather we believe in them from the beginning, and he gives examples of these assumptions: the principles of causality, the continuity of events, and uniformity of nature. There are assumptions from which he starts. Scientists build their theories, and one of these assumptions is their belief in the stability of natural laws, as these laws stay the same in every time and space, so the cause will lead to the same result under the same circumstances. These beliefs which form the basis for formulating scientific theories, we have no way To prove it in one way or another, we do not have any sensory or rational guarantor that would make us convinced of the stability of the laws of nature. If scientists had not assumed certain unprovable philosophical assumptions, it would have been impossible for them to even understand the phenomena they observe in the natural world. For example, it would be impossible for them to do any physics if they did not assume that these laws always stay the same. There is no way of proving that the laws of physics must be exactly the same in distant galaxies as in our own region of space. [2]. Even positive philosophy, which demands the necessity of proving the idea through sensory experience, cannot prove the stability of laws of nature in the way it sees it. Karl Popper criticized the positivists on this point, saying: “positivists in their anxiety to annihilate metaphysics annihilate natural science along with it. For scientific laws, too, cannot be logically reduced to elementary statements of experience”[3].

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[2]- Richard Morris, The Edges of Science: Crossing the Boundary from Physics to Metaphysics, Prentice Hall Press,1990,p210

[3] - Karl Popper, The Logic of Scientific Discovery, Rutledge, London, USA,2004, p13

There is also another idea about stability of nature's laws, causality; causality indicates that every event has a cause or that every effect has a cause. Events follow or coordinate in a series in which the previous is linked to the subsequent. This causal sequence that we observe in nature is based on physical theories in constructing their laws and explaining natural events. David Hume - who is classified by the positivists among their philosophers - doubted causality because it does not exist as a relationship independent of us between natural events, there are no causes, but there is only a succession of phenomena, and the mind resorts to adding a link between phenomena that we call causality, and on the basis of this relationship invented by the human mind, we call the previous event a cause and the subsequent event a result. Hume saw that adding a causal relationship is due to our habit only. Since this relationship does not exist in our physical world, as we have no evidence to prove the continuity of this link between events that we call causality, Hume thinks that we know from experience that the cause as one thing followed by another thing, and if the first had not existed, then the second thing could never have existed, and the appearance of the cause always moves the mind to the idea of the result, and this is something we have also experienced. Without belief in the causal consistency between physical events. The theory refers to causal relationships through which phenomena are explained, and links, through its laws, between certain factors and the consequences that result from them under certain conditions. Causality, despite the lack of evidence for its stability and its continuity, however, is a necessary principle for the start of any research in nature, causality is in fact one of the metaphysical requirements of the Scientific theory.

Physical concepts and theories closer to metaphysics

There are concepts in contemporary physics that do not adhere to a solid experimental basis, as there is no experimental evidence to prove them. For example, the speed of light constant is considered one of the principles on which relativity is based. Therefore, we find that the speed of light constant "c" is present in all equations of relativity. The theory of relativity has been considered the speed of propagation of light in a vacuum is a constant speed, and there is no speed in the universe that can exceed the speed of light. The speed of light as the greatest speed in the universe, it cannot be proven by experiments. On the other hand, nothing that contradicts it has been clearly demonstrated, at least not yet. The theory of relativity stated an idea that is not experimentally proven, since we do not have any experimental evidence that proves to us that the speed of light is the ceiling of speeds in the universe. According to the law of relativity of mass, there is no body with mass that can move at the speed of light because with increasing speed, the mass increases, and then this body needs more energy to move this excess mass, and for its speed to reach the speed of light, it will need a quantity Infinite energy and its mass will be infinite, and for this reason we find that the rest mass of particles traveling at the speed of light is Almost non-existent. In light of this, we do not have any experimental evidence to prove that there are no speeds in the universe that exceed the speed of light. In recent decades, talk has begun about experiments with particles exceeding the speed of light. Although scientists differ in interpreting the results of these experiments, this indicates that the concept of the speed of light as the final speed does not

derive its validity from experience. According to the positivists' standard, this concept is more metaphysical than scientific and experimentally proven.

Quantum theory is considered a complex mathematical conceptual structure rather than a theory with concepts that are clearly and objectively reflected in experiments. This is due to the difficulty of observing the microscopic world objectively. This theory has overturned the perception that was believed that physics studies an objective nature that has an existence independent of human, Heisenberg said; "The natural laws that we formulate in quantum theory in mathematical terms no longer pertain to the elemental particles themselves, but rather pertain to the information that we derive from them. The question of searching for whether these particles exist in space and time can no longer be presented in this form."[4] We cannot prove the existence of the components of the microscopic world in the manner of the positivists and convey it in theories "as it is." Also, the logic of microscopic transformations is very different from the logic we are familiar with, Heisenberg saw that there is no longer pure research into nature, but rather human research into nature. The atomic world that we describe in our theories is largely a world of our own making, this shows that the position that clings to the sensory perception of the physical world for the sake of objectivity is no longer useful, and perhaps physics would have continued to adhere to this belief if the electron that the physicists observed behaved as they had assumed.[5]

Niels Bohr saw that particles are nothing but abstractions created by us, and their properties can only be determined through their interaction with other entities. We must understand that there are no physical elementary particles in the traditional sense. Scientists do not treat them as things, but rather as events[6], and that is why they called them "quantum." What it means is quantity, not quality. They are not material basic structures as much as they are amounts of energy that we call quantities that are studied in the overall context within the framework of relationships and probabilistic patterns. Quantum physicists disagreed about the nature of the wave. Is it of a realistic nature or is it a mathematical abstraction? Some physicists have interpreted the nature of the wave that accompanies a photon or an atomic particle as being a wave of probability and not a real wave. Physicists such as Niels Bohr, Heisenberg, and Max Born saw that what we are referring to is not a wave in the natural sense, but rather a wave as a mathematical entity, and it is a wave of probability. In an abstract conceptual space, Heisenberg says in his criticism of those who imagine that waves are realistic: "configuration space is a space of many dimensions referring to the different co-ordinates of all the particles belonging to the system. Here we meet a first difficulty: What does it mean to call waves in configuration space real? This space is a very abstract space, the word "real" goes back to the

[4]- Werner Heisenberg ,La nature dans la physique contemporaine, Gallimard, 1962,p18
[5] - James H. Jeans, Physics and Philosophy, Dover publication, Inc, New York.p202
[6] -Erwin Schrödinger , Physique Quantique et représentation du monde, paris, édition de seuil, 1992 .p47

Latin word which means “thing”, but things are in the ordinary three-dimensional space not in the configuration space.” [7]

Superstring theory has generated widespread controversy about the method of proving the new and strange concepts that it has proposed. String physicists believe that this theory - or rather a hypothesis - is considered a coherent mathematical formula that has succeeded in unifying laws of quantum and relativity theories, but the price of unification is that this coherent mathematical formula required the assumption of Extra dimensions, and assumed that final structure of matter is a string of energy vibrating in an infinitesimal world. Also, this theory requires enormous, if not imaginary, energies to test it. Sheldon Glashow has strongly criticized the superstring theory because it requires Enormous energies that are not available for experimentation, as he says: “I know that they are not going to say anything about the physical world that I know and love... And yet some of us are still trying to follow the upward path, to go from experiment to theory, rather than pursuing the superstring vision, which requires the highest inaccessible dream-like energies to build a theory that deals with the dawn-to-earth world under our feet.”[8] Richard Feynman also criticized the idea of Extra dimensions, especially due to the lack of any experimental evidence to prove its validity, the theory requires ten dimensions, but perhaps there were six of them somehow wrapped, yes, this is mathematically possible, but why not seven? They set their equations and leave the equation to decide the number of things that have wrapped, not the desire for harmony, It is a matter of putting ideas to the test of experience and knowing how accurate the theory is[9]. Richard Morris commented on this theory ; it speaks about the physical world on the one hand, and on the other hand is unable to provide empirical evidence to prove what it claims. the boundaries between physics and metaphysics have become blurred... There are theories that include everything is posited and results in conclusions that cannot be verified and appear similar to metaphysical doctrines.[10]

Boundaries of science are expanding to enter the circle of metaphysics

In its progress, science seems as if its circle is expanding and taking over topics that were previously purely metaphysical. Since ancient times, Human has wondered about the universe: Did the universe have a beginning or was it ancient? And did time exist with the universe or before it? There were many philosophical visions as attempts to answer these questions, With the development of science in the twentieth century, these issues began to be raised in the field of scientific research, and physicists began to discuss them, using physical laws, symbols, and mathematical structures, a theory called the Big Bang Theory has been formulated, indicating that the universe had a beginning that was like the Big Bang, its scientists believe that it provides a physical

[7] - Werner Heisenberg, Physics and Philosophy: The Revolution in Modern Science, HarperCollins, 2007,p104

[8] - Paul Davies ،Julian Brown, Superstrings: A Theory of Everything, Cambridge University Press,p191

[9] - Ibid, p194

[10] -Richard Morris, The Edges of Science: Crossing the Boundary from Physics to Metaphysics,p221

description of the first moments of the creation of the universe. Richard Morris opined that it was no longer possible to conduct research on the boundaries of science without confronting questions that were once considered Metaphysical questions, and physicists found themselves asking questions such as: Does it make sense to talk about a time before the universe began? Did the universe have a beginning? And if it had a beginning, is there anything that can be said about it that it existed before it? And that time came into existence with the universe itself?[11]

The big bang theory has been criticized for being a theory that describes the origin and development of the universe from the first moments - or, if we want to be precise, from the first parts of a second - while we have only known a small part of this universe. So how can we establish a theory about the origin of a universe that we do not know in its entirety ,and do not know all the material structures, phenomena, and laws it contains, Are our "local" laws to be found anywhere in the universe? Who gave us the right to generalize what we discovered on Earth to all universes? Moreover, we are trying to formulate a theory that describes the beginning of universe that we do not know completely. Cosmology relies on axioms to formulated its theories. Among these axioms is the so-called cosmological principle, which states that we are not in a preferred location in the universe, and that the Earth does not occupy any distinct position in the universe, as was the case in past centuries, and that the properties of matter itself must appear in all directions, this axiom is an extension of an implicit axiom, which is unity of nature. This axiom extends to the roots of scientific thinking itself. The constancy of the laws of nature in the universe indicates that the laws we deal with it is universally.

The big bang theory did not stop describing the beginning of the universe. Rather, it added scenarios to it, one of which indicate that the universe emerged from “nothing.” If we want to express it in terms other than their terminology, we say it was created from nonentity. Alan Guth suggested that the entire universe may have come from nothing. As a result of “the fluctuations of the void by chance,” and this resulted in an explosion that led to the creation of our universe and perhaps other universes besides it, this talk raises many questions: The idea of “creation from nothingness” or “creation from void” is a metaphysical idea, because it is unobservable, while we do not know anything about what existed before the universe in order to determine that the universe arose from it. Science does not lack the ability to explain, but we always explain something in terms of other things, But now we are faced with “nothing,” so if We asked Guth about nothingness. Does he see it as different from the physical void that we know? He doesn't see any difference. But what we know about the physical void is the complete emptiness of all forms of matter and energy, while nothingness is the complete emptiness of matter and energy, and more than that is the inability to contain physical existence as it is “no space” The physical void can be within our reach, while nothingness cannot be within our reach. If Guth sees in the void an activity, then the nothingness that precedes the universe is supposed to be negative. What we would like to ask is how the Nothingness - which is negative -

[11] - Ibid, p171

can be an “activity” that results in the universe by chance, and is this even within the scope of science?

For the idea of multiple universes, there is no way to confirm it. This idea is nothing more than speculative aspects that do not deviate from metaphysical aspects. These hypothesized universes are more metaphysical topics than scientific topics, and even if the idea is based on physical and mathematical considerations, this does not mean that it has scientific validity. How can we study these universes and prove their existence observationally when they are causally separated from each other?, and without having any effect through which they can be understood? Scientists saw that Guth's scenario did not provide predictions that could be tested experimentally, and was proposed to solve problems, creating other problems that had no way to be proven. If we apply Popper's criterion of falsifiability, this model hardly seems scientific. the idea of multiple universes did not only appear within the framework of the big bang theory, but was also proposed in some philosophical interpretations of quantum mechanics to explain the probabilistic picture that it produces. Some have imagined the existence of multiple parallel worlds that express all the possibilities according to which quantum events can behave. Everett saw in his theory, which he called many-worlds theory, that all the possibilities proposed by quantum theory actually occur at the same time in a number of independent and parallel worlds.

Metaphysical solutions for physics problems;

With the deepening of physical research and the emergence of new experimental data, new problems have been appeared, especially if the new experimental data contradicts physical laws or contradicts the logic that humans are accustomed to thinking with. Therefore, the physicist community resorts to proposing solutions to resolve these contradictions, and some of these solutions may be metaphysical. So that metaphysical thinking plays a role in solving physical problems produced by experimental laboratories. For example, quantum scientists encountered a strange microscopic phenomenon, where it seemed to them that particles far apart from each other interacted as if they did not give any consideration to the distance separating them, the instantaneity of their effect was with Some of them exceed the speed of light as if they were adjacent to each other. This strange behavior of particles has been called “quantum entanglement.” It states that there is no need for two particles to be close in one place for them to affect each other, and experiments have proven that particles communicate. With each other, they participate in reactions even though they are spatially far apart from each other. If, for example, we influence the spin of a particle, the second particle entangled with it will also change its spin. The particles interact as if they occupy one position, even though they are separated by large distances, and according to this they are called the phenomenon of nonlocality. Roger Penrose describes this phenomenon by saying: “Quantum relationships are something very strange, as they exist somewhere between two particles that have been separated and are still in contact with each other.”[12]

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12 - Roger Penrose - Abner Shimony - Nancy Cartwright And Stephen Hawking, The Physics Of The Human Mind And The World In Two Perspectives,P13.

As the effect is transmitted from one particle to another particle far away from it. One of the metaphysical solutions that has been proposed is to say that the hidden effects between two Particles may be caused by us, as the observed human consciousness influences the microscopic phenomenon. It is clear that this vision is not based on a serious theory about consciousness to know its effect on particles. Among the proposed metaphysical solutions, the idea of American physicist David Bohm, he explained the phenomenon of non-locality by finding an interpretation based on the idea of pantheism, whereby the universe as a whole is connected in a single and common fabric, where its parts are connected to each other, and any influence affects One particle affects another, regardless of the distance between them, as there is an implicit order in the scene of minute accidents that extends far beyond the capacity of scientific devices. There, at the deep bottom, everyone shares the fabric of this universe, as there is an interconnected implicates order[13]. The human mind has become accustomed to Patterns of connection and separation between things and to give a causal link. Things were viewed as being composed of smaller and then smaller things that could be dismantled into small units that stay subject to the same logic. David Bohm's point of view reminds us of a similar statement made several centuries ago by great philosopher ; Leibniz. Although the starting point of the two views is different, they share a vision of interconnected existence. Leibniz says: "all matter is connected together and in the plenum every motion has an effect upon distant bodies in proportion to their distance, so that each body not only is affected by those which are in contact with it and in some way feels the effect of everything that happens to them, but also is mediately affected by bodies adjoining those with which it itself is in immediate contact. Wherefore it follows that this inter-communication of things extends to any distance, however great And consequently everybody feels the effect of all that takes place in the universe, so that he who sees all might read in each what is happening everywhere, and even what has happened or shall happen, observing in the present that which is far off as well in time as in place [14]".

The importance of metaphysics for physics

Karl Popper spoke about the positivists and how they excluded metaphysics. They did not deal with it because it had ideas that could not be proven or denied, because it had no meaning and did not deserve attention. Popper criticized the positivists because they unjustifiably described metaphysics., Popper says in his comment on the positivists: "They are constantly trying to prove that metaphysics by its very nature is nothing but nonsensical twaddle sophistry and illusion, as Hume says, which we should commit to the flames, if by the word (nonsensical) or (meaningless) we wish to express no more, by definition, that not belonging to empirical science, then the characterization of metaphysics as meaningless nonsense would be trivial; for metaphysics has usually been defined as non-empirical, but of course the positivists believe they can say much more about

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13 - David Bohm ,Wholeness and the implicate order, 2Edition , London , New York ,Rutledge , 2005 ,p186

14 -Gottfried Leibniz, The Monadology and Other Philosophical Writings, TRANSLATED BY ROBERT LATTA, Oxford AT THE CLARENDON PRESS ,1898,p251

metaphysics than that some of its statements are non-empirical[15]". Karl Popper criticized verification principle established by the positivists and saw that it is not possible to achieve complete truthfulness in experimental experience, as experience can bring us closer and closer to truthfulness, and for this reason Popper established the principle of falsification, Since the scientific issue is the issue that can be falsified, it can be refuted by a basic assumption. If this assumption is consistent with an experiment, it will be considered a valid refutation. The principle of falsification shows the negative side of the issue at hand. If this side does not find anything to refute it, this is an indication of the issue's resistance to falsification and therefore its truth. The importance of falsifiability in contrast to the verification principle appears in its effectiveness, as hundreds of supporting facts do not fully prove the truth of the theory, while a single fact opposing the theory can falsify it.

Science cannot be distanced from metaphysics, as the positivists see, because metaphysics is found in the principles and postulates of science, such as our belief about stability and generality of laws of nature. These principles cannot be abandoned because science will not exist without them, and metaphysical ideas may play a guiding role for new discoveries. What is important is that we know its role as a hypothesis and not treat it as an experimental fact, after which there may be means, even indirect ones, to confirm its validity. Karl Popper criticized the positivist point of view that works to abolish metaphysics and described it as having no value for science, and he saw that ideas Metaphysics cannot be completely separated from science. In addition to the fact that it may play an auxiliary role to science, Popper says: "I do not even go so far as to assert that metaphysics has no value for empirical science, for it cannot be denied that along with metaphysical ideas which have obstructed the advance of science, there have been others- Such as speculative atomism - which have aided it. And looking at the matter from the psychological angle, I am inclined to think that scientific discovery is impossible without faith in ideas which are of a purely speculative kind, and sometime even quite hazy ; I faith which is completely unwarranted from the point of view Science, and which, to that extent is metaphysical"[16]. Max Planck also saw that the positivist call for experimentation alone would lead to the demolition of physics and its objectivity, he believes that "the mind is a fundamental thing and that matter is derived from the mind.

Popper proposed the idea of a "metaphysical research programme" where he spoke about the importance of the metaphysics ideas as a precursor and guide to science, since untestable metaphysical theories outweighed the degree of their influence on science as testable theories of science. Similar to the atomic theory, where Dalton developed his hypotheses in light of the metaphysical ideas of the atomic doctrine, Popper says: "Each of these metaphysical theories served, before it became testable, as a research programme for science. It indicated the direction of our research, and the kind of explanation that might satisfy us, and it made possible something like an appraisal of the depth of a theory."[17] This demonstrates the importance of metaphysical ideas as a guide to science, as

15 - Karl Popper, The Logic of Scientific Discovery, p12-13
16 -Ibid, p16
17 - Karl Popper, Realism and the Aim of Science, Rutledge, London, New York,p192-193

metaphysical contemplation motivates scientists to devise solutions and then treat them as scientific hypotheses that can be tested. Logic, as it is known, provides evidence and proofs, but it does not reveal anything. This is while science is in need of creative imagination as much as it needs logical rigor. Neglecting what cannot be verified experimentally under the pretext of chasing metaphysical ideas could lead to the cessation of science by stopping discovery, in which the creativity of the imagination and mind is necessary.

Contemporary physical and cosmological theories, which have been described as metaphysical, are distinguished from previous theories in that they study deeper physical levels than experimental techniques can reach. What distinguishes today's physics is that it attempts to understand situations that do not exist in physical reality. The physical forces that string theory has worked to unify theoretically They exist in reality separately, and in order to understand and test the state of their unification, it certainly requires more exceptional conditions. Likewise the big bang theory, it describes the beginning of the universe, which does not exist now. The development of technology and means of experimentation in contemporary physics is not sufficient to achieve the theoretical development of physical research, and we must consider this as a result of the scientific curiosity of human who is always aspiring to uncover the secrets of this universe. Richard Morris comments that physics in our day will become a science less characterized by experimentalism, and speculation that should sometimes take on a metaphysical character, and the attempts being made to probe the structure of matter deeper and deeper must stop when a certain point is reached, and then experimentation reaches its maximum limits, only endoscopy can advance further [18].

Despite the progress of science and its research on topics that were considered metaphysical, this does not mean that science has covered everything about these topics. For example, the theory of relativity provided important insights into the concept of time, and completely changed the view that was prevalent about this concept. It revealed that time is a variable amount from one system to another, but the theory does not explain the nature of time, and if it has linked it to matter and acceleration through its laws, this does not mean that it has provided an answer about the nature of time. Arthur Eddington said that the issue of time is summarized by two questions. The first: What is the true nature of time? Then what is the nature of that quantity that was placed under the name of time and became an essential part of the structure of physics? The theory of relativity does not answer the first question directly, because it does not say anything specific about the nature of time at its essence". The question of time is considered one of the ancient questions asked by human, and he cannot stop asking such questions. This shows the necessity of metaphysics even if the circle of science expands. In our talk about the big bang theory, we saw how some justifications ignore the fact that science has limits and invent terms such as "quantum vacuum fluctuations" by chance until the universe began from it. We must consider the big bang theory to provide a description of the beginning of the universe, and the beginning, regardless of its details, must have preceded it

[18] -Richard Morris, The Edges of Science: Crossing the Boundary from Physics to Metaphysics,p222

something that is not subject to scientific research and outside of physical existence. In their talk about the origin of the universe, they resort to coincidence to justify what happened, and this is in order to create the illusion that they are talking about a scientific topic instead of acknowledging that there are matters outside the boundaries of science.

It can be said that there is a mutual influence between science and metaphysics. Every progress in science affects metaphysical thinking, and metaphysical ideas are important in influencing science. A.E. Taylor saw that "Every great metaphysical conception has exercised its influence on the general history of science and in return every important movement in science has affected the development of Metaphysics... Every fundamental advance in science thus calls for a restatement and reconsideration of the old metaphysical problems in the light of the new discovery" [19]. Physical science, at every stage of its development history, produces new concepts that change our ways of thinking, and new principles may result from them, and mentalities that prove to be useless may collapse. Bertrand Russell spoke about this when he said about relativity: "When the ideas involved in Einstein's work have become familiar, as they will when they are taught in schools, certain changes in our habits of thought are likely to result, and to have great importance in the long run." [20]Physics is the science that studies our material world in terms of its structure and laws, as it studies the matter from which the entire universe is made. By virtue of its generality and comprehensiveness of its subject, it has a close relationship with ontology. It is the experimental science related to philosophy, as it provides it with great equipment for theorizing of existence. There are philosophies that combined science and metaphysics and did not see any dissonance between them. We find, for example, the philosophy of Alfred Whitehead, which combined science and metaphysics, where the latter depends on the results of science. Whitehead saw that science is considered a precursor and guide to more comprehensive issues discussed by metaphysics, where speculative thinking is about comprehensive theories that are not discussed in the details of science, bringing together opposite and divided parties, such as subject and object, thought and reality, events and topics..., and thinking about this comprehensive view brings together an enormous network of relationships and variables, as it includes the logical possibilities that contain the development of realistic entities. It can be said, then, that "metaphysics investigates the ultimate foundations of the nature and existence of the subjects of all the partial sciences that fall within the scope of its interest. Then we can say that Metaphysics investigates the final foundations of the nature and existence of the subjects of all the partial sciences that fall within its scope of interest, and therefore we can say that metaphysics is a comprehensive explanation about Metascience questions

It is clear from the above that the positivist call to exclude metaphysics from science is not possible to achieve, because metaphysics exists in the principles of physics and science in general, as we rely on confiscations that cannot be proven experimentally or even intellectually, such as accepting the consistency and constancy of the laws of nature and the universality of the laws, in addition to

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19 - A.E. Taylor, Elements Of Metaphysics ,METHUEN , LONDON 1903, p13

20 - Bertrand Russell, the A B C of Relativity, published by good Press.2022.P149

causality, the uniformity and symmetry of the universe, physicists have no choice but to accept unproven and experimentally unproven postulates. It also seems that the progress of theoretical physics produced more metaphysical concepts than physical ones. Some have justified this by saying that physics has reached deep limits that experimentation may be unable to fathom. There is no way to discover it except through theoretical research, and physicists have circulated strange concepts that are far from experience, such as the concept of strings, extra dimensions, and other theoretical concepts. These concepts have raised the question of experimental evidence by virtue of the fact that they are circulated in an experimental science in the first place. It seems that physics Contemporary, in its development, raises more general and comprehensive questions, such as unifying the laws of the forces that make up physical existence, the question of beginning of the universe, parallel universes, the origin of matter, and the deep structure of space-time. What is observed from this is that physics, in its continuous progress, is expanding the scope of its research to include questions that were previously the specialty of metaphysics. Contemporary physics has begun to delve into deep and comprehensive fields with scientific concepts and mathematical symbols. However, on the other hand, it seems that no matter how advanced contemporary physics and science in general, there are questions that remain raised as major questions that science's symbols and equations cannot encompass.

It is also clear that discovered physical phenomena raised logical problems and contradicted physical laws. Physicists have resorted to proposing solutions to resolve these contradictions, and what can be said about some of these solutions is that they are more metaphysical than physical. Through the examples that we have cited, it seems that contemporary physics to be going against the positivist call to rid science of metaphysics. It seems that it is not possible to implement what the positivists were calling for, but rather to know the status of every idea within the theory, whether an assumption, an experimentally confirmed idea, or a philosophical interpretation of a physical theory, so that we do not deal with hypotheses or metaphysical ideas as if they were facts, and we go to deduced other ideas on them, and in order for experimental discovery to keep pace with the theoretical development of physics, physicists must strive to search for new ways to test their ideas so that they are linked to material reality. The necessity of metaphysics arises from the fact that development of physics has proven the limitations of experience, and this can make metaphysical ideas play a guiding role for theoretical research in physics, as some discoveries came in the light of metaphysical ideas, and a metaphysical idea can become a concept for a scientific theory after it is experimentally proven. Metaphysics can also benefit from physics in employing scientific discoveries to build a comprehensive vision, and it may combine the results of many sciences to build perceptions more comprehensive, and provides a general vision through which major questions are discussed. These are questions that human has asked for thousands of years and is still being asked because he is a metaphysical being and cannot be otherwise.

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