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BASIC PHILOSOPHICAL AND METHODOLOGICAL IDEAS IN THE EVOLUTION OF PHYSICS IN THE CREDIT-MODULE SYSTEM

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Anatation. The purpose of this study is to share with science students my research and experiences on the topic of "Philosophy and Methods of the Physical Sciences", one of the main topics of the "Philosophy of Science" course, which I am interested in as a hobby. I have been giving it to physics students as an elective course for a quarter of a century and I share it with science students in the process of developing the science of physics. To introduce the philosophical and methodological ideas that play an active role and to clarify for those who want to do research on this topic.

Keywords: Science, philosophy, physical sciences, philosophy and methodology of physical sciences, classification of sciences, physics

Introduction: Akut Gence, the translation editor of the book “The Five Biggest Ideas in Science”, in his “introduction” article; Unfortunately, the level of scientific literacy in our country is quite low... Of course, there are circles that especially want it to be so. That is why, according to a survey covering 34 countries of the world and published in the journal Science, one of the most prestigious science journals in the world, it ranked last in terms of coverage of science and evolution. Most of our people prefer nonsense to scientific explanation, dogmatic thinking to scientific thought. People, especially if they have not received a scientific education, easily confuse science with pseudoscience and prefer pseudoscience to real science. Since pseudoscience is easier than real science, it does not require much thought, and it does not provide explanations that contradict the common thinking patterns of people for hundreds of years. But real science can shake up our millennia of ideas and beliefs with new explanations that must be tested through constant questioning, experimentation, and observation. No explanation in science is the final explanation. When research on one question is finished, new questions arise that need to be explored. The scientific method always raises new questions. This is where science differs from dogma. Dogma cannot be questioned. Nothing in dogma can be the subject of research and therefore cannot be tested by the scientific method. Scientific explanations are constantly changing based on new findings. There will always be a better, more consistent explanation for a natural phenomenon. We see this very well in the development of physical science. The real problem here is how to communicate new developments in science to the public without distorting them, so that the public is freed from false and dogmatic ideas. This problem is especially important from the point of view of the physical sciences.

The problem of communicating developments in this area to a wide readership, ignorant of the method and philosophy of the physical sciences, is of great importance today, and it has become clear that this task requires very deep study. We say that the public must fully understand the greatness of achievements in the physical sciences, their intellectual value, what a great influence they can have on the future of peoples and the evolution of civilization. On the other hand, we said that this requires a very detailed study. Because scientific knowledge is increasing day by day and becoming more complex. As a result, it becomes very difficult to present this information to other interested readers, especially science students and scientists, without distorting it. Then a conflict arises between the sincere desire, properly directed, to convey to the reader the findings of science in general, and of the physical sciences in particular, and the duty imposed on the conscience of each scientist. forward without distorting the truth beyond what has been scientifically established. Therefore, true scientists who understand their place in modern society should not remain indifferent to their efforts to bring scientific progress to the general public. Because only such research can teach these strata the intellectual superiority of scientific achievements and the extremely important results that can arise from them in the practical sphere.

There are many valuable scientists who have successfully presented science to the general public through public lectures and works. For example, the famous British experimental physicist Faraday, the American physicist Richard Feynman, the Nobel Prize laureate in physics, the famous British scientist Roger Penrose, one of the most knowledgeable and creative mathematical physicists in the world. Today, there is not enough interesting research. about the philosophy and methods of the physical sciences. However, many revolutionary discoveries have emerged from the philosophical thinking mechanism of the physical sciences. This is undoubtedly a very interesting and extensive topic that needs to be studied in detail by famous scientists such as philosophers, naturalists or philosophers of science. In order for him to do this properly, new theses may need to be conducted on these topics. For example, you can think of a basic historical aspect; It is not about how the philosophy and methods of the physical sciences have developed in the last century, but also how they have influenced the development of science. Furthermore, it is conceivable that a philosopher, scientist, philosopher of science, or physical philosopher could study the subject of the method and philosophy of the physical sciences from a completely different perspective, seeing it from their own perspective. Another question that needs to be answered in this regard may be; What kind of research can be conducted on the philosophy and methods of the physical sciences in our country today? It is expected that philosopher-physicists and philosophers of science will be interested in this issue.

As a theoretical physicist, I have gained knowledge from my lectures and national research on the topic of "methodology and philosophy of physical sciences", which is one of the subjects of the "Philosophy of Science" course, presented at conferences, seminars, physics congresses. It has been a hobby of mine for almost a quarter of a century and has been taught as an optional course from time to time. I got this impression from the feedback and burning questions I received from my articles published in scientific journals. This topic is not very well known to the public, and has not received sufficient attention and research among philosophers of science and physical philosophers. The purpose of this research is to present to the public my extremely interesting research and experiments in this area. to share with students of valuable science and to introduce them to the research methods and philosophical ideas that play an active role in the development of physical science, and to clarify them for those who wish to conduct research in this area. After this introduction, I will discuss topics such as philosophy, science, classification, before presenting a synthesis of various views and ideas presented in the literature on the topic of “the main philosophical and methodological ideas that played a role in the evolution of the physical sciences”. I believe that it will be useful to identify the main scientific concepts that are closely related to the topics of the sciences, philosophy of science, physical sciences, philosophy, the relationship between science and physics for a better understanding of the subject. In this regard, based on the specific philosophy and methods of classical physical sciences, which are an integral part of philosophy and science, various opposing philosophical views have been evaluated in the development of classical physical sciences since the 17th century. Philosophical interpretations of quantum theory are presented. Finally, the research methods used by theoretical scientists working in physics during the development of modern physical sciences in the 20th century, how a scientist should work to understand the laws of nature, success through method, Einstein's method, the impact of the theory. The theory of relativity, opposing views and opinions in the development of modern physics. " The main philosophical and methodological views and ideas that played a role in the evolution of modern physical sciences", strategies adopted in the study of physics, etc. were examined. .

In Meydan Larousse, philosophy is defined as follows: a set of views on the principles of being and objects, the place of man in the universe, God, history, and in general, all the main problems of metaphysics. A system of thought aimed at revealing the basic principles of science (philosophy of science, philosophy of history, etc.). The doctrine and system of a philosopher, school, era (Aristotelian philosophy, German philosophy, philosophy of antiquity, existential philosophy, etc.). Some believe that philosophy is a means of seeing, understanding and interpreting the world and life, guiding and supporting behavior, based on the concept that “everyone has their own philosophy”.

Science is a concept that has been used in various senses throughout its historical evolution. In general, ancient people called prescription theory "science". Today, we see that the concept of science has changed significantly. For example, philosophers of science have developed criteria for what is and is not part of the scope of science. According to Prof. Feigl, these criteria should be:
(i) they must be examined subjectively against each other;
(ii) must be reliable,
(iii) It should be clear and precise,
(iv) must be of a systematic nature,
(v) it must be comprehensive,

Based on these criteria, how can science be defined?

According to the definition given in the encyclopedic dictionary, science is “a coherent whole that unites knowledge about a certain category of facts, subjects or phenomena, confirmed by legal and experimental methods.” According to the mathematical philosopher Henri Poincaré, science “is like a building whose building blocks are facts; this building has many rooms, each of which represents a field of science. A. Einstein once said; Science is not just a catalog of unrelated facts, a collection of laws. Science is the greatest work created by the human mind with its free thoughts and concepts. Physical concepts try to reveal reality and establish a connection between widely perceived impressions and these facts. The correctness of our logical structure depends only on how and in what way our theories realize this connection.” According to many philosophers of science, a favorite definition of science is as follows; Science is the process of deriving logical meanings from experimental observations to arrive at truth. However, there are those who argue that science cannot be fully defined. They argue that each definition can only explain one aspect of science. Philosophers of science do not yet seem to agree on a full definition of science. There is no consensus among them on the classification of science.

Method: Philosophers of science usually divide science into two classes: applied and experimental sciences. Applied sciences; These are the sciences that produce and use technology. For example; such as engineering, medicine, agriculture, aviation, and marine sciences. Experimental sciences; It is divided into two: formal sciences (mathematics-logic) and real sciences based on phenomena. Real sciences based on phenomena are also divided into two; social sciences that discover reality (sociology, economics, history, language, etc.) and natural sciences (theoretical sciences), which are called rule sciences. It divides natural sciences into two subgroups: physical sciences (physics-chemistry) and life and behavioral sciences (biology and psychology). The main goal of applied sciences is to develop tools and machines that are needed by people, using the discoveries of both experimental and applied sciences, and to put them into service. In short, it is to produce technology. The main goal of experimental sciences is psychological. It is the observation, search and investigation of data to arrive at facts . It is the psychological satisfaction given to us by the extraordinary abilities of our minds to predict and explain reality. It is the satisfaction of the artistic feelings of scientists such as increasing competition among themselves, increasing their country and their own prestige, and receiving awards. The second goal is logical. It can be explained by three concepts; description, explanation and prediction.

Description; is the formulation using mathematics.

Explanation; This is to show under what conditions our observations are valid. to predict; to predict an event. A theory that can make predictions and confirm these predictions through experiments is a good theory. It is known how important the physical sciences, especially physics, which is a theoretical science among experimental sciences, play in the development of philosophy. , technology and many other sciences. One of these is his contribution to the philosophy of science.

This is a philosophical movement that emerged in the 19th century. In this century, the development of physical sciences opened up very broad horizons for philosophers. The abundance of technical inventions is accompanied by an abundance of logical analysis. A new philosophy is built on the basis of new science. This new philosophy began as a by-product of scientific research and developed along with positivism. This philosophy aims to provide thought with greater coherence, bring it closer to material or concrete reality, and at the same time open an inclusive perspective to it. In short, the main goal of the philosophy of science or positivist philosophy is to process the data obtained in various areas of natural phenomena within the framework of a coherent doctrine.

Physics, the most basic science of nature, consists of the branches of science that study, investigate and investigate the basic principles, properties, how they work, inanimate objects, the interactions and phenomena of the world that are naturally encountered and perceived by humans. through laboratory, experiment and theory. It is a whole. A wide field that covers all phenomena, from the most basic particles that make up the structure of matter, such as electrons and quarks, to the behavior of stars and galaxies in the universe, falls within the scope of physics. However, physics is limited to the most general and basic manifestations of these objects and phenomena. Physics, like mathematics, plays not only a descriptive, but also an integrative role between theory and experiment. We can divide physics into two periods: classical physics and quantum physics. The period from the beginning of the 17th century to the beginning of the 20th century is called the period of classical physics. During this period, five major revolutions occurred in physics.

These revolutions in turn; The Classical Mechanical Revolution (Newton, Galileo, Kepler, Copernicus) was the first revolution that allowed us to move from the chaos of the Earth-centered Ptolemaic astronomy to a heliocentric planetary system, and began with the Copernican Revolution, continued with Galileo and Galileo. Kepler and was largely completed by Newton. The Classical Mechanical Revolution rescued mechanics from the dead end it had been in since Aristotle and brought its basic laws, principles, and the concept of universal gravitation. The Thermodynamic Revolution (Carnot, Mayer, Joule, Helmholtz, Thomson, Clausius, Gibbs, Nerns) was the second revolution, initiated by Carnot and continued by Mayer, Joule, Helmholtz, Thomson, Clausius, Gibbs, Nerns. This revolution was the driving force behind industrialization. “The electromagnetic revolution (Maxwell, Faraday, Coulomb, Ampere, Ørsted,..) began in the 1600s with William Gilbert and was based on the work of many physicists such as Charles Francois Du Fay, Benjamin Franklin, CA de Coulomb, A. Volta, L. Galvani, HC Oersted, JeanBaptiste Biot, F. Savart, AM Ampere and Faraday, and was largely synthesized by Maxwell.

The most important aspect of this revolution is that it shows that all interactions occur through a field and that light is an electromagnetic wave. This revolution gave people greater technological power than people had ever imagined.

The statistical mechanics revolution (Boltzmann, Maxwell, Clausius, Gibbs) was the fourth revolution, and the works of Clausius, Maxwell, Boltzmann, and Gibbs opened the door to atomic and molecular physics and allowed for a better understanding of gas dynamics. The fifth and sixth revolutions left their mark on the century as the most important scientific revolutions of the early 20th century. These are the special and general theories of relativity developed by A. Einstein, and quantum theory, the work of a group of prominent physicists. These are real revolutions in science, because one of them resolved the internal contradictions of classical physics and the extremely high-speed motion of particles on the order of the speed of light, while the other completely solved all the problems associated with atoms. Discussed for 2400 years. At the same time, these revolutions not only allowed us to look at nature with new eyes, but also brought new theories and principles. New research methods and philosophical views played an important role in the implementation of these revolutions. These revolutions also gave rise to new technologies. Under their influence, all branches of science, in particular, social, science and engineering, philosophy and logic, have made great progress. This section examines the research methods and philosophical views that play an active role in the development of physics and the physical sciences in general. The relationship between philosophy, science and physics The classical period of philosophy begins at the end of the 16th century. According to the famous philosopher and mathematician Descartes (1566-1650), who left his mark during this period, philosophy is like a tree with metaphysics as its root, physics as its trunk, and medicine, mechanics and ethics as its branches.

Descartes argues that morality is the highest science, because it requires the knowledge of other knowledge. He considers philosophy to be the most perfect expression of metaphysics and physics, says “God is the one who determines all physical foundations,” and in his opinion, knowledge of God is a necessary condition for all other knowledge. Descartes, who was methodical and said “I think, therefore I am,” and who gave priority to mathematics due to the clarity and clarity of his proofs, wants to restore metaphysics and prove the clarity of the statement “God exists.” The reasoning is 2+2=4. Leibniz (1646-1716) is the author of many misconceptions. In opposition to the principle of clarity, which Descartes saw as his source, he proposed the principle of causality, expressing it negatively as “nothing exists without a cause” and positively as “everything has a cause.” He dreamed of a general science and a universal nature.

Philosophy and science are inseparable; Methods and philosophy of classical physical sciences: Methods of classical physical sciences; It is mainly derived from "practice", as well as from philosophical views. Some philosophical views are very general, while others are related to nature. The philosophy and methods of physical sciences do not offer a single solution from the very beginning, but rather offer diverse and often contradictory, but increasingly complementary forms. For a long time, a priori and theoretical attitudes prevailed over empirical knowledge. In ancient Greece and the Middle Ages, when Aristotle's views prevailed, it was believed that it was enough to have a few directly perceptible data to unite physics into a system inspired by metaphysical views. This theoretical dominance can be seen in Descartes at the beginning of the 17th century, as well as in G. Galileo, one of the first founders of experimental physics. But these physicists developed a new concept of physics based on mathematics, which contradicted Aristotle's qualitative physics. On the other hand, in the same period, the experimental physics movement began, initiated by the English scientist Francis Bacon (1561-1626). Bacon gave knowledge a practical purpose. It was not only about knowing nature, but also about influencing it. His distrust of reason (reasoning) suggested using experience and observation of phenomena as a criterion of truth, and the method of induction as a method of elimination. Because facts were hidden behind various "idols" (false ideas, idols), they had to be hidden.

Conclusion: In this section, I will try to give a detailed explanation of how a scientist works and what strategies he should use, trying to better understand the laws of nature using the methods and philosophy of the physical sciences. How does a scientist work to better understand the laws of nature? To answer this question, it is enough to pay attention to what working methods they followed in the past to bring science to the current level. We can learn a lot from the working methods of these great scientists. We can use their experiences. Because there are many commonalities between the problems that interested scientists in the past and the problems that we are trying to solve today.

The methods used by theoretical scientists working in physics can be divided into two categories:
1-experimental method,
2-Mathematical method,

Theoretical scientists who use the experimental method use experimental data in their research. Therefore, they are in constant contact with the experimenters and constantly monitor the results obtained. They subject the results of interest to a comprehensive analysis and satisfactory evaluation. A scientist who conducts theoretical work using mathematics first of all examines and criticizes existing theories. He tries to reveal their shortcomings and shortcomings. By cleansing these theories of their shortcomings, he tries to expand their scope or examines the possibilities of development. The important point here is that one should take care to correct the theory without destroying its great achievements. It is difficult for scientists to clearly distinguish between these theories. two existing methods. While there are those who use these methods separately, there are also those who use both and benefit from these methods in their work. In other words, a ranking of other methods can be made between these two methods. The method that is adopted is closely related to the subject under study. In order to find a solution to a problem about which little is known, it is advisable to use an empirical method. The first thing that a person who wants to work on a new topic should do is to collect and classify all the data published by experimental physicists on the subject. For example, consider how our knowledge of the periodic table in chemistry has developed over the past century. First, experimental data were collected and organized. As the system gradually became established, confidence in it grew. Finally, when the periodic table was more or less filled in, other previously unknown elements were discovered, using the gaps between them. All the elements predicted to exist in this way were subsequently found in nature one after another. A similar situation has recently occurred in high-energy physics. A periodic table-like systematics of all observed elementary particles was established. All the properties that a particle should have in the spaces between them were predicted and then tested to see if they existed in nature. Over time, many of them could be observed in the laboratory.

Discussion: A scientist working in a poorly understood field of science should focus on the results of experimental studies, even if he does not want to speculate too much, even if it may be wrong. But this does not mean that there should be no speculation. Sometimes, even if the result of speculation on a topic is wrong, it can be indirectly useful and interesting. Such views are considered extreme ideas among scientists. In fact, we should keep our minds open to new and interesting ideas. In conclusion, we should not be completely against speculation, but we should not give it too much importance either. Another area of research where there is a lot of speculation is cosmology. Although there are very few facts to go on, theorists have tried to create various models for the universe based on some assumptions. One of the fundamental assumptions on which these models are based is that the laws of nature have always been the same since the beginning of the universe. This assumption is one we have no evidence for. Therefore, these models could be wrong. How do we know that the laws of nature, especially the fundamental constants of nature, remain unchanged over cosmological time? The idea that such changes could occur is undoubtedly very disturbing to modelers.

A basic scientist should have a specific strategy for studying a physical system. However, this can vary from subject to subject and from scientist to scientist. If we look at the work of scientists who have made great discoveries and made significant contributions to fundamental science in the past, we can summarize the basic research strategies they adopted, which we generally use as a guide today:

1. Theoretical scientists should pay close attention to the results of experimental studies. They should be closely interested not only in the one set of experiments on the subject they are studying, but also in the developments of all other experiments. Only then will it be possible to develop theories that are consistent, have a wider scope, are consistent with experimental data, and can even make new predictions. A truly good theory, developed in this way, can offer new and interesting experiments to confirm its predictions. Theorists should pay close attention to the results of experimental studies.
2. A scientist may be somewhat skeptical of the work of others, but should not be completely uninterested in research in the same field.
3. Scientists should be open to new ideas. Conservatism in science is not a good thing. It hinders the progress of science.
4. In physics, when analyzing a system, we can always use the properties of simple systems. When investigating a system, the researcher wants to consider separately each factor that affects its behavior. Each of these factors is somehow related to the real system. However, the effect of only a few of them on the behavior of the system is of vital importance. In simpler terms, the properties of these systems should be investigated using the properties of simple systems until they are fully understood. We can say that this is a way of studying a model of a physical system.

Conclusion: All these characteristic features of the strategy and research methods used in the study of physical systems are among the most powerful inventions of the human mind. Its fruits have completely changed the way of life, thinking, habits, philosophy, perception of the world and views on science. Over a long period of time, the use of the method and strategy of the physical sciences has spread to all branches of science. Indeed, some branches, such as psychology, economics and sociology, use a scientific strategy to some extent, so they are described as "scientific". Despite everything, the strategy is most successfully used in physics. This is especially appropriate, since it is relatively simple systems that physics is really interested in. In conclusion, we can say that physics is the simplest science, since it deals with the simplest systems. Therefore, physics forms the basis of all other natural and engineering sciences. Physics teaches us what we know about the world and the universe, how people know what they know today, and how they move towards new discoveries. Thanks to physics, we gain the power to deal with it, understand it, and predict it . We make new discoveries with what we learn from physics. Each new invention means the birth of new technologies. It gives people the pleasure of studying and understanding nature from a physical perspective. It teaches the laws of natural phenomena. It gives people a great power to understand the world they live in. Because in today's world, physics is behind important innovations, tools that create new jobs, and everyday problems that people face. That is why today physics is not only a field of interest for physicists, but also a field of science that interests everyone with its sciences. In short, we can say that physics is the systematic study of the fundamental properties of the universe. Each of these fundamental properties is closely related to the behavior of matter in the universe and the fundamental interactions between them. Physics is the greatest work created by the human mind, developed with scientific methods based on reason, observation, experiment, scientific skepticism and theory, free thought and concepts. It is no wonder that we say that "the queen of sciences is physics", "the queen of physical science is physics".

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