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Analysis of the Development of Physics as a Study and Its Relevance to Society

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Abstract: In a study done in UK from 1985 to 2006, it was found that there was 41 percent decrease in the number of entries to A-level examinations in sciences. This decreasing trend is similar in other countries. Despite this trend, physics remains an integral part of the educational system. It is through physics that new methodologies were developed that helped improve the quality of life, including things such as automobiles and modern construction. Society's reliance on technology represents the importance of physics in daily life. Many aspects of modern society would not have been possible without the important scientific discoveries made in the past. These discoveries became the foundation on which current technologies were developed. Discoveries such as magnetism, electricity, conductors and others made modern conveniences, such as television, computers, phones and other business and home technologies possible. Modern means of transportation, such as aircraft and telecommunications, have drawn people across the world closer together — all relying on concepts in physics. In 1999 during the World Conference on Science (WCS), the UNESCO-Physics Action Council considered physics an important factor in developing solutions to both energy and environmental problems. Physics seeks to find alternative solutions to the energy crisis experienced by both first world and developing nations. As physics help the fields of engineering, bio-chemistry and computer science, professionals and scientists develop new ways of harnessing preexisting energy sources and utilizing new ones. In the United Nations Millennium Summit held in 2000, it was recognized that physics and the sciences will play a crucial role in attaining sustainable development. Physics helps in maintaining and developing stable economic growth since it offers new technological advances in the fields of engineering, computer science and even biomedical studies.

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Introduction:

Finding new and improved methods to create and develop items in these industries can assist a country's economy grow because these fields are vital to a nation's economy. The International Union of Pure and Applied Physics (IUPAP) similarly claimed that physics will produce the essential knowledge that will result in the construction of engines to power the global economies. The mission of Rwanda's education ministry is to advance the nation's technical and scientific knowledge. The country profited from medical physics and information technology by creating a national nutrition programme and an epidemic surveillance system. Through the use of gravimetric techniques, irrigation methods, and rainfall gathering, physics and engineering assisted rural communities in obtaining clean drinking water. Even if there haven't been any major revolutions in physics in recent years like there were in the first quarter of the 20th century, the seeds that were planted back then are constantly bearing fruit and inspiring new research. Nature is unified and without boundaries, but human beings have created them out of necessity, giving rise to the fields that we now refer to as physics, chemistry, biology, mathematics, geology, and so forth. But as our understanding of nature expands, it becomes more important than ever to cross disciplinary boundaries. The formation of specialised groups is crucial because—From various scientific and technical fields—not necessarily huge ones—but with enough broad knowledge to be able to communicate with one another and work together to address new issues, whose very nature calls for such cooperation. There must be physics in these groups.

Almost every setting contains examples of interdisciplinarity, and atmospheric phenomena would be one of them. These cover a wide range of scientific topics, including energy exchanges and temperature gradients, radiation from the Sun, chemical reactions, atmospheric composition, the movement of atmospheric and ocean currents, the biology of animals and plants, which explains how different animal and plant species behave and react, industrial processes, social modes and mechanisms of transportation, and so on and so forth.

Similar data is provided by urban studies and architecture.

It is crucial to strengthen collaboration between architecture, urban studies, science, and technology in order to address climate change, energy shortages, atmospheric pollution, and agglomeration in massive cities, without neglecting the need to consult other fields as well, such as sociology and psychology, which are related to the study of human character. Buildings must be designed to reduce energy loss and work toward energy sufficiency, or sustainability, which has recently become a buzzword. We are fortunate to have aspects created by science and technology, such as solar panels, as well as the option of recycling organic waste, in addition to materials with novel thermal and acoustic properties.

Objective:

Public Interest in Physics is Growing

The special and general theories of relativity (Albert Einstein, 1905, 1915) and quantum physics, which, unlike relativity, cannot be attributed to a single figure as it emerged from the combined efforts of a large group of scientists, are two revolutions that marked the twentieth century and significantly modified its foundations and brought about profound socioeconomic changes. As a result, physics is considered the queen of twentieth-century science, and rightly so, as that century was marked by two revolutions that significantly modified. Have long-term ramifications that may not be as drastic as those that caused the initial breach, but which can nonetheless result in later advancements, discoveries, or methods of comprehending reality that were previously unthinkable. Once the new fundamental theories were finished, physics experienced the same thing. We are speaking to quantum mechanics in the context of quantum physics.(Erwin Schrödinger, 1926; Paul Dirac, 1925; Werner Heisenberg, 1925). The experimental discovery of the universe's expansion was welcomed as one possible model of the universe in Einstein's world by relativistic cosmology, which quickly emerged (Edwin Hubble, 1929). The most widespread "consequences-applications" nevertheless came from the field of quantum physics.

The development of quantum electrodynamics (c. 1949), the transistor (1947), which has been dubbed "the atom of globalisation and digital society," and the fields of particle physics (later referred to as "highenergy physics," astrophysics, nuclear physics, and solid-state or "condensed matter" physics are just a few examples among many that are too numerous to list here. The discovery of the Higgs boson, which was predicted theoretically about 50 years ago, was one of the most acclaimed physics developments of the past ten years.

Let's look at the environment in which this forecast was made. The introduction of particles, whose names were suggested by one of the scientists responsible for their introduction, Murray GellMann, resulted in an enormous advancement in high-energy physics. Gell-Mann and George Zweig proposed this quark theory in 1964. Protons and neutrons were thought to be the most fundamental and unbreakable atomic structures, with an indivisible unit of electric charge, before they were discovered. This criterion was broken by quarks since they were given fractional charges.

Nuclear world

In fact, there can be two different types of hadrons: baryons, which are protons, neutrons, and hyperions, and mesons. According to Gell-Mann and Zweig, hadrons—the particles subject to strong interaction—are made up of two or three types of quarks and antiquarks called u (up), d (down), and s (strange), whose electric charges are, respectively, 2/3, 1/3, and 1/3 of an electron's.As a result, a proton has two u quarks and one d quark, whereas a neutron has two d quarks and one u quark. Consequently, they are composite structures. Since that time, three more quarks—charm (c; 1974), bottom (b; 1977), and top—have been suggested by other scientists (t; 1995). Quarks are described as having six distinct flavours to describe this kind. Each of these six additionally comes in three different varieties or hues: red, yellow (or green), and blue. In addition, there is an antiquark for every quark. (Of course, labels like these—color, flavour, up, down, and so on—do not represent the reality we typically connect with such concepts, even though they occasionally have a certain logic, as in the case of colour.) These prior theories came together to provide a theoretical framework for comprehending the building blocks of nature, and it turned out to have extraordinarily accurate prediction abilities.

As a result, two theories were accepted: the first postulated that elementary particles fall into one of two groups—bosons or fermions—depending on whether their spin is whole or fractional (photons are bosons, whereas electrons are fermions)—and that these groups follow two distinct statistics (means of "counting" groupings of the same sort of particle).These are the Fermi-Dirac statistic and the Bose-Einstein statistic, respectively. Second, all matter in the universe is composed of aggregates of electrons and their relatives, muons and taus, neutrinos (electronic, muonic, and tauonic neutrinos), quarks, and the quanta associated with the fields of the four forces that we can observe in nature (remember that in quantum physics the wave-particle duality denotes that a particle can behave like a field and vice versa): the photon for electromagnetic interaction, Z and W particles (gauge bosons) for weak interaction, gluons for strong interaction, and hypothetical gravitons for gravitational interaction, but gravity has not yet been incorporated into this framework.

The quantum chromodynamics

Given the balance between predictions and experimental evidence, the subgroup created by quantum chromodynamics and electroweak theory (i.e., the theoretical system that contains relativist theories and quantum theories of strong, electromagnetic, and weak interactions) is particularly potent. This became known as the Standard Model, but it had a flaw: it required the creation of a new particle, a boson, whose associated field would permeate all of space and act as a sort of "brake," so to speak, on particles with mass, causing them to interact with the Higgs field and reveal their mass (it particularly explains the great mass possessed by W and Z gauge bosons, as well as the idea that photons have no mass because they do not interact with the Higgs boson).Peter Higgs (1964a, b) signed the first page, François Englert and Robert Brout (1964) the second, and Gerald Guralnik, Carl Hagen, and Thomas Kibble (1964) the third (1964a). They designated the hypothesised particle as the "Higgs boson." The discovery of the Higgs boson, which was predicted theoretically about 50 years ago, was one of the most notable physics developments of the past ten years. It took a long time for a particle accelerator with the capability of producing the required high temperatures to be developed in order to detect this purported particle.

The Large Hadron Collider (LHC), the largest particle accelerator in the world with a 27-kilometer ring ringed by 9,600 different types of magnets, was finally approved for construction by CERN in 1994. 1,200 of these were two-pole superconductors, which can operate at minus 217.3 oC, a temperature that is even lower than outer space and is obtained with the use of liquid helium. Two beams of protons would be accelerated inside that ring and directed by the magnetic field produced by "an escort" of electromagnets until they were travelling in opposite directions almost at the speed of light.Until each of these beams attained the necessary level of energy, they would each rotate in their own tube, which would be kept in an absolute vacuum. Then, the two beams would be made to clash. Theoretically, one of these collisions would result in the production of Higgs bosons. However, the most significant issue was that this boson breaks down into other particles extremely instantly, necessitating the use of particularly sensitive sensors to identify it. The ATLAS, CMS, ALICE, and LHCb detectors were created specifically for the LHC and stand as imposing symbols of cutting-edge engineering. On September 10, 2008, the LHC had its initial test following construction by rotating a proton beam. On March 30, 2010, the first proton collisions occurred, producing a total energy of 71012 eV (or 7 tera-electron volts; TeV), a level of energy never before attained by any particle accelerator. Last but not least, CERN made a public announcement on July 4, 2012, stating that it had discovered a particle with a mass of around 125109 eV (or 125-gigaelectron volts; GeV), whose characteristics strongly indicated that it was a Higgs boson (the Standard Model does not predict its mass).

Almost every newspaper and news broadcast in the world featured this story on the main page. The Higgs boson's existence had been established nearly 50 years after its theoretical prediction. Therefore, it comes as no surprise that Peter Higgs and François Englert received the 2013 Nobel Prize for Physics "for the theoretical discovery of a mechanism that contributes to our understanding of the origin of mass of subatomic particles, and which recently was confirmed through the discovery of the predicted fundamental particle, by the ATLAS and CMS experiments at CERN's Large Hadron Collider," according to the Nobel Foundation's official statement.

While it is obvious that this confirmation is reason for celebration, some would have liked a different result—namely, that the Higgs boson had not been discovered where the theory predicted it would—that is, with the predicted mass. US theoretical physicist and supporter Jeremy Bernstein (2012 a, b: 33) made their argument before the discovery was made public, and it was a strong one.

God particle victory Higgs Boson

Nevertheless, the discovery of the Higgs boson represents a fact and a victory. But as science is never still, the LHC's activities were suspended in February 2013 so that modifications could be made to enable it to attain 13 TeV. It started its next stage on April 12, 2014, with the corresponding proton-collision tests. This required looking for unexpected evidence that could indicate the existence of novel physics principles. For the time being, however, we can state that the Standard Model is one of the greatest achievements in the history of physics and that it functions extremely well. This achievement was made possible by a great deal more people working together than with quantum mechanics and electrodynamics, let alone with special and general relativity.

The Standard Model is not, and cannot be, "the final theory," notwithstanding its success. It excludes gravitational interaction first, and then it has an excessive number of scientifically definable properties. These are the basic but never comforting reasons. Why even exist the fundamental particles that we have detected? Why do we need four fundamental interactions instead than three, five, or one? And why do these interactions have the characteristics they have (such the degree of intensity and scope of action)? The American Physical Society's review, Physics Today, published in August 2011.

Some of these ideas were discussed by Steven Weinberg (2011: 33), among others:Naturally, long before the discovery of neutrino masses, we were already aware of another phenomenon outside of the scope of the standard model that predicts novel physics at masses a bit above 1016 GeV: gravitation. Additionally, one powerful and two powerful At energies of the order of 1015–1016 GeV, the electroweak coupling parameters of the standard model, which depend solely logarithmically on energy, appear to converge to acquire a single value.

Supersymmetry and the so-called string theory are two excellent ideas for ways to go beyond the standard model, but there is currently no experimental evidence to support any of them. We may never be able to construct accelerators that can reach energy like 1015 to 1016 GeV, even if governments are extraordinarily generous to particle physics. One day, we might be able to find high-frequency gravitational waves that were produced during the early universe's inflationary period and can inform us about extremely high-energy physical processes.

While we wait, we can only hope that the LHC and its successors will offer the answers we so sorely need to advance past the achievements of the previous 100 years. At the end of the day, hadrons are white; quarks are coloured. Only the "white" particles, according to the theory, may be seen in the natural world. As they are "restricted," or linked together to form hadrons, quarks are not. A free quark will never be visible to us. Quarks must now be bound by forces that differ significantly from electromagnetic or other forces in order for them to stay contained.

According to Gell-Mann (1995: 200), "Just as the electromagnetic force between electrons is measured by the virtual exchange of photons, quarks are linked to each other by a force arising from the exchange of other types: gluons (from the word, glue) bear that name because they stick quarks together to form observable white objects such as protons and neutrons." Rightfully so, since the twentieth century was characterised by two revolutions that fundamentally altered the foundations of physics and brought about significant societal changes: the quantum physics and relativity specific and general theories A new theory called quantum chromodynamics arose about ten years after quarks were discovered to explain why quarks are so tightly bound that they can never escape the hadronic structures they make. The name chromodynamics, derived from the Greek word chromos, refers to the colour of quarks, while the adjective quantum denotes that it complies with quantum rules. A theory of primary particles with colour that is connected to quarks is known as quantum chromodynamics. We may also say that quantum chromodynamics accurately captures this interaction because these are associated with hadrons, which are the particles sensitive to strong interaction.

Look up quantum theories

As a result, quantum theories of electromagnetic and strong interactions, respectively, include quantum electrodynamics and quantum chromodynamics. There was also a weak interaction hypothesis, but it had significant flaws. Weak interactions are those that cause radioactive processes like beta radiation and the emission of electrons during nuclear processes. In 1967 and 1968, American scientist Steven Weinberg and Pakistani scientist Abdus Salam separately proposed a theory that integrates electromagnetic and weak interactions, bringing about a more suitable quantum theory of weak interaction. They used Sheldon Glashow's 1960 concepts, which were included in their model. This work was recognised by Weinberg, Salam, and Glashow's joint receipt of the Nobel Prize in Physics in 1979, particularly when one of their theories' predictions—the presence of "weak neutral currents"—was experimentally verified in 1973 at CERN, a significant European high-energy laboratory. It conceivable to go even further in the direction of unification and find a formulation that would also incorporate the strong interaction described by quantum chromodynamics? Electroweak theory united the description of electromagnetic and weak interactions. In 1974, the answer came, and it was affirmative. The first concepts for what are now known as Grand Unification Theories were developed that year by Howard Georgi and Sheldon Glashow (GUT). One aspect of what is known as Big Science is revealed by the gravitational wave detection: The announcement of their discovery was made in the publication Abbott et al. (2014), which appeared on February 11 and was written by 1,036 authors from 133 institutions (of its sixteen pages, six are occupied by the list of those authors and institutions). The significance of LIGO's finding was acknowledged in 2014 with the division of the Nobel Prize in Physics. Rainer Weiss, who invented and developed the laser interferometry technique used in the finding, received one-half of the award. The other half was contributed by Kip Thorne, a general relativity expert in theoretical physics who collaborated with Weiss in 1975 to create the project's future rules and is still connected to him today. (This prize was given to David Thouless, Duncan Haldane, and Michael Kosterlitz in 2014 for their work in proving the existence of previously undiscovered states, or "phases," of matter. Examples include superconductors and superfluids, which can exist in thin sheets—something that was previously thought to be impossible. Phase transitions, the mechanism that causes superconductivity to vanish at high temperatures, were also clarified.)

Conclusion

Nanomaterials and nanodevices are already being employed in a number of situations thanks to developments in the fields of physics and the closely linked nanotechnoscience. For instance, using a solution of 35 nm gold nanoparticles, it is feasible to identify and pinpoint cancerous tumours in the body because abnormal cells have a protein that reacts with the antibodies that cling to these nanoparticles, making it possible to discover malignant cells. In fact, nanotechnoscience is particularly well suited to the realm of medicine, which has led to the development of nanomedicine. The development of image and analysis techniques to identify diseases in their early stages, the search for molecular-level treatments that directly affect affected cells or pathogenic areas, and regenerative medicine are three broad areas that this field is frequently divided into due to humans' propensity for compartmentalization (the controlled growth of artificial tissue and organs). The "Brain Activity Map Project" is one very significant instance where physics is obviously engaged. And in determining that future, physics, like all the other sciences, will play a significant and intriguing part.

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