The quantum mysteries

We do not see things as they are, we see them as we are.
Anais Nin

Abstract

The allure of quantum mechanics lies in its mysteries and the exotic possibilities they introduce such as worm holes, parallel universes, and teleportation. It is shown here that these are illusions perpetuated by the self-serving ends of establishment physicists. The mystique disappears when experiments are described in strict detail with classical fields and straightforward causal arguments. Quantum physics is shown to be accessible to everyone, not just mathematicians.

1.0 Introduction

The control of science is desirable for the financial rewards and prestige that accompany it. However, it also carries with it responsibility since science is often used to comment on questions that have moral implications, and our role in the natural order is often defined by the sciences. Examples of this are common: A model for the creation and evolution of the universe has been calculated, the ultimate particle has been called the "God particle"; and most significant of all, it is often claimed that God is a mathematician. Because physicists are mathematicians it should not be surprising that they behave in many respects like priests, as God's anointed ones. In the case of quantum physics they seem especially to be promoting this idea having proposed the existence of "mysteries" which are thought to be of fundamental importance in nature. They "explained" the mysteries by using obscure mathematical language in the form of functionals and non-linear vector spaces, essentially declaring themselves as qualified interpreters of nature. The mathematics was introduced as a form of "canon law" and so had to be accepted as an article of faith. The stature of quantum physics is protected in ways similar to a religion: Access to the priesthood is limited, changes are made by consensus, axioms and laws are often incomprehensible to the laity, and insurmountable impediments are placed in the way of new theories1.

The mysteries are an important part of involving the general public as participants in quantum physics. They allow physicists to conjure up magical powers such as wormholes, parallel universes, and teleportation to awe the uninitiated in ways that can be visualized. By introducing fantastic visions and prophecies into popular culture they engage popular opinion, thereby earning respect for their faith-based beliefs and at the same time they help to ensure funding. Thus mysteries provide a link between obscure mathematical terminology and concepts from ordinary life. The strength of this connection depends upon the truthfulness of the science it is based upon. However, Truth is not limited to a chosen few or the wealthy, nor is it dependent upon human will. It depends upon facts derived from experiment that provide the simplest, most straightforward answers, not the most complex. Most importantly it must be equally accessible to all men rather than a specific class of men, the mathematicians. Let us examine the facts behind the mysteries.

2.0 The first quantum mystery

An interference pattern forms on a fluorescent screen or photographic plate even when the intensity of the light is reduced to the extent that photons arrive as single events.

Although light is emitted and absorbed in tiny bundles of energy called photons, the photons do not retain their identity throughout transmission. In the case of interference fringes sinusoidal wave forms consisting of electromagnetic fields determine the points of arrival of photons on the screen, which are then indicated as flashes of light. The flashes are photons that are released when an electron in a high energy orbital decays to a lower energy orbital. However, in order for a photon to be released the electron must first be raised to the higher orbital. Conventional wisdom has concluded that a photon causes excitation. However, because the photons are guided by waves it also makes sense to see if fields can cause excitation. Looking at the available experimental evidence we find that excitation occurs over time periods many times longer than the period of a single photon2. Photodetectors are a thousand times slower than the period of a photon while film is a hundred thousand times slower. If the energy that is absorbed by the electron takes place over a relatively long period of time how can it be due to a single photon? To say that the energy that is absorbed by a fluorescent material must be due to a photon because it is nearly the same energy as the photon that is emitted is the easy answer. On the other hand, we are talking about photon locations that are determined by waves and waves are composed of fields. If energy transfer is relatively slow we should consider the possibility that fields are transmitters. Polarization is also a factor in fluorescence indicating that electron excitation may be due specifically to transverse fields.

A likely candidate for the cause of excitation is a wave packet, a model often used in the literature to represent the photon. A localized wave packet of the type shown below can exert a transverse force upon the electron by means of its fields thereby causing excitation. Because energy transfer to the electron occurs slowly its length and total energy must be much larger than a single photon. The wave form of the packet is obtained by means of Fourier analysis, an interference pattern obtained by superposing many sinusoidal wave train components. It is a mathematical model representing in part a photon's internal physical composition and in part its external appearances. The simplest interpretation of the Fourier transform is to assume that each of its components originates as a wave train from a source atom. The source atoms vibrate and move in different directions so the Doppler effect will cause a wide range of frequencies to appear. If a single wave train strikes the screen it will cause bound electrons to oscillate rather than be excited. However, a wave packet that is formed by the superposition of wave train components contains sufficient field energy in its superposed components to cause a detection event. So long as the components are on similar trajectories wave packet identity will be maintained over long distances. Because the components are not bound together the canceled and reinforced fields may separate and change as they propagate, thereby altering the characteristics of the wave packet.

It should now be clear why low intensity light is capable of causing an interference pattern. Localized interference effects that give rise to wave packets also cause light beams to have an uneven structure at the microscopic level. The filters used to reduce light intensity act uniformly on the beam having a time-averaging effect. Therefore the spikes in field intensity caused by wave packets are not eliminated. The uneven structure goes unnoticed because our eyes have a very slow response time and the beam appears to be of uniform intensity. The atoms on a fluorescent screen, however, have a much faster response time and detect the fluctuations due to intensity peaks of wave packets.

3.0 The second quantum mystery

If one slit is closed or if we attempt to determine which slit a photon passes through, the interference pattern disappears. Therefore photons must go through both slits.

Again the key to understanding this mystery is to precisely define what is meant by "photon". In the last section we noted that the appearance of a low intensity interference pattern on a fluorescent screen may be understood if the radiation field is resolved into wave trains even though it develops by means of single detection events. Because the wave packet is a mathematical construct representing many independent wave trains it is a random association of independent elements, not a physical entity. Therefore it is a normal occurrence for it to pass through both slits and recombine on the other side. If the intensity is reduced to single wave trains in some areas of the beam they may pass through one slit, but they cannot be detected at the screen because they are unable to raise electrons to a higher orbital. Instead they cause the electron to oscillate in a transverse direction. On the other hand, the wave packet passes through both slits and recombines in phase-shifted form on the other side. The superposition of its many individual wave train components in the form of a wave packet is then detected at the screen if the fields reinforce, or is not revealed if they cancel. Although the wave packet's presence is observed due to the emission of a photon, this is only the last step in a lengthy causal chain.

4.0 The third quantum mystery

Wave function collapse. When a quantum superposition state is detected it instantaneously collapses thereby violating the absolute speed of light.

4.1 Wave packets

The wave packet is an example of the simplest quantum superposition state. It is composed of sinusoidal components of infinite length. Its "collapse" occurs when it is detected as a photon at the screen and is reduced to a single point. The collapse occurs instantaneously so elements of the wave packet at infinity return to its center at speeds exceeding that of light.

Because quantum theorists have assigned undue importance to the mathematical constructs of physics they regard it as an insignificant detail that the mathematics collapse, but not the actual physical elements of the interaction. The Fourier series that approximates the wave packet represents in part its structure, and in part its appearances; however, like all models it is imperfect. Reinforced fields in the packet excite the electron thereby losing energy to the electron. The fields of the wave packet that remain continue to interact with electrons, but are too weak to be detected. Thus the packet itself does not collapse and disappear, it only loses its particle-like properties. It is wrong to think that the entire wave packet is involved in a detection event. Superposed fields can be detected, but isolated fields are unobservable. Fields interact locally therefore only a small part of the packet actually contributes to the excitation.

The key to understanding wave function behavior is to dissect the mathematics into its independent physical components. The same method must be applied to particle diffraction. We use our understanding of the simplest example of interference to understand more complex cases, not the reverse. Even though the wave function of particles is more complex because it is three-dimensional, interference must occur by means of field superposition similarly to the case of light. Wave function "collapse" is then due to a collapse of the mathematical representation of the fields. Thus the wave behavior of particles must be due to the superposition of an electron's field and the fields of the barrier. Quantum mechanics is not about mechanics, it is about structure.

5.0 Conclusion

Throughout the history of man science has been carried out with considerable passion and little personal compensation. However, a great power struggle occurred at the beginning of the last century to change that trend. It was discovered that classical physics was deficient in its description of natural phenomena and an intense competition was instituted to discover what shape the new physics should take. This struggle assumed its greatest intensity during a period of approximately 10 years from 1917 to 1926 when quantum physics was developed. At stake was power and influence in the scientific establishment in the form of Nobel prizes, government support, and notoriety with the general public. Although Einstein became known as the greatest theoretical physicist of the period, the greatest political success was achieved by Niels Bohr. By obtaining funds to found the Institute for Theoretical Physics in his native Denmark he was able to invite those of his choice to work with him. This placed him at the center of efforts to influence development of the physical interpretation of quantum mechanics. Despite the efforts of a few individuals, most notably Einstein and Schroedinger, the consensus prevailed. Nevertheless the ambiguity of their work left much to be desired and these questions are still being debated today.

1 The electron's magnetic moment has been predicted to an accuracy of a hair's breadth in the distance from NY to LA. It
is claimed that this accuracy must be exceeded by a replacement theory.

2 P. Kowaliski, Applied Photographic Theory, (Wiley,NY), 1972; C.E.K. Mees & T.H. James, The theory of the photographic process, (McMillan, NY), 1966; RCA Phototubes and Photocells - Technical Manual PT-60, 1963.