Quantum Quackery

Quantum physics is claimed to support the mystical notion that the mind creates reality. However, an objective reality, with no special role for consciousness, human or cosmic, is consistent with all observations.

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Certain interpretations of quantum mechanics, the revolutionary theory developed early in the century to account for the anomalous behavior of light and atoms, are being misconstrued so as to imply that only thoughts are real and that the physical universe is the product of a cosmic mind to which the human mind is linked throughout space and time. This interpretation has provided an ostensibly scientific basis for various mind-over-matter claims, from ESP to alternative medicine. "Quantum mysticism" also forms part of the intellectual backdrop for the post-modern assertion that science has no claim on *objective reality.*

The word "quantum" appears frequently in New Age and modern mystical literature. For example, physician Deepak Chopra (1989) has successfully promoted a notion he calls *quantum healing,* which suggests we can cure all our ills by the application of sufficient mental power.

According to Chopra, this profound conclusion can be drawn from quantum physics, which he says has demon-

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traditional teaching of Eastern mystics: that human consciousness and the universe form an interconnected, irreducible whole. An example:

> To the enlightened man . . . whose consciousness embraces the universe, to him the universe becomes his "body," while the physical body becomes a manifestation of the Universal Mind, his inner vision an expression of the highest reality, and his speech an expression of eternal truth and mantric power
>
> Lama Anagarika Govinda
> *Foundations of Tibetan Mysticism*[3]
> (Capra 1975, 305)

Capra's book was an inspiration for the New Age, and "quantum" became a buzzword used to buttress the trendy, pseudoscientific spirituality that characterizes this movement.[4]

Wave-Particle Duality

Quantum mechanics is thought, even by many physicists, to be suffused with mysteries and paradoxes. Mystics seize upon these to support their views. The source of most of these claims can be traced to the so-called *wave-particle duality* of quantum physics: Physical objects, at the quantum level, seem to possess both local, reductionist particle and nonlocal, holistic wave properties that become manifest depending on whether the position or wavelength of the object is measured.

The two types of properties, wave and particle, are said to be incompatible. Measurement of one quantity will in general affect the value the other quantity will have in a future measurement. Furthermore, the value to be obtained in the future measurement is undetermined; that is, it is unpredictable—although the statistical distribution of an ensemble of similar measurements remains predictable. In this way, quantum mechanics obtains its indeterministic quality, usually expressed in terms of the *Heisenberg uncertainty principle*. In general, the mathematical formalism of quantum mechanics can only predict statistical distributions.[5]

Despite wave-particle duality, the particle picture is maintained in most quantum mechanical applications. Atoms, nuclei, electrons, and quarks are all regarded as particles at some level. At the same time, classical "waves" such as those of light and sound are replaced by localized *photons* and *phonons*, respectively, when quantum effects must be considered.

In conventional quantum mechanics, the wave properties of particles are formally represented by a mathematical quantity called the *wave function*, used to compute the probability that the particle will be found at a particular position. When a measurement is made, and its position is then known with greater accuracy, the wave function is said to "collapse," as illustrated in Figure 1.

Einstein never liked the notion of wave function collapse, calling it a "spooky action at a distance." In Figure 1, a signal would appear to propagate with infinite speed from A to B to

strated that "the physical world, including our bodies, is a response of the observer. We create our bodies as we create the experience of our world" (Chopra 1993, 5). Chopra also asserts that "beliefs, thoughts, and emotions create the chemical reactions that uphold life in every cell," and "the world you live in, including the experience of your body, is completely dictated by how you learn to perceive it" (Chopra 1993, 6). Thus illness and aging are an illusion and we can achieve what Chopra calls "ageless body, timeless mind" by the sheer force of consciousness.[1]

Amit Goswami, in *The Self-Aware Universe: How Consciousness Creates the Material World,* argues that the existence of paranormal phenomena is supported by quantum mechanics:

> . . . psychic phenomena, such as distant viewing and out-of-body experiences, are examples of the nonlocal operation of consciousness . . . . Quantum mechanics undergirds such a theory by providing crucial support for the case of nonlocality of consciousness. (Goswami 1993, 136)

Since no convincing, reproducible evidence for psychic phenomena has been found, despite 150 years of effort, this is a flimsy basis indeed for quantum consciousness.[2]

Although mysticism is said to exist in the writings of many of the early century's prominent physicists (Wilber 1984), the current fad of mystical physics began in earnest with the publication in 1975 of Fritjof Capra's *The Tao of Physics* (Capra 1975). There Capra asserted that quantum theory has confirmed the tell the wave function to collapse to zero at B once the particle has been detected at A. Indeed, this signal must propagate at infinite speed throughout the universe since, prior to detection, the electron could in principle have been detected anywhere. This surely violates Einstein's assertion that no signals can move faster than the speed of light.

Although they are usually not so explicit, quantum mystics seem to interpret the wave function as some kind of vibration of a holistic ether that pervades the universe, as "real" as the vibration in air we call a sound wave. Wave function collapse, in their view, happens instantaneously throughout the universe by a willful act of cosmic consciousness.

In their book *The Conscious Universe,* Menas Kafatos and Robert Nadeau identify the wave function with "Being-In-Itself":

> One could then conclude that Being, in its physical analogue at least, had been "revealed" in the wave function. . . . [A]ny sense we have of profound unity with the cosmos . . . could be presumed to correlate with the action of the deterministic wave function . . . . (Kafatos and Nadeau 1990, 124)

Thus they follow Capra in imagining that quantum mechanics unites mind with the universe. But our inner sense of "profound unity with the cosmos" is hardly scientific evidence.

The conventional interpretation of quantum mechanics, promulgated by Bohr and still held by most physicists, says nothing about consciousness. It concerns only what can be measured and what predictions can be made about the statistical distributions of ensembles of future measurements. As noted, the wave function is simply a mathematical object used to calculate probabilities. Mathematical constructs can be as magical as any other figment of the human imagination—like the Starship Enterprise or a Roadrunner cartoon. Nowhere does quantum mechanics imply that real matter or signals travel faster than light. In fact, superluminal signal propagation has been proven to be impossible in any theory consistent with conventional relativity and quantum mechanics (Eberhard and Ross 1989).

Romantic Interpretations

Not everyone has been happy with the conventional interpretation of quantum mechanics, which offers no real explanation for wave function collapse. The desire for consensus on an ontological interpretation of quantum mechanics has led to hundreds of proposals over the years, none gaining even a simple majority of support among physicists or philosophers.

Spurred on by Einstein's insistence that quantum mechanics is an incomplete theory, that "God does not play dice," subquantum theories involving "hidden variables" have been sought that provide for forces that lie below current levels of observation (Bohm and Hiley 1993). While such theories are possible, no evidence has yet been found for subquantum forces. Furthermore, experiments have made it almost certain that any such theory, if deterministic, must involve superluminal connections.[6]

Nevertheless, quantum mystics have greeted the possibility of nonlocal, holistic, hidden variables with the same enthusiasm they show for the conscious wave function. Likewise, they have embraced a third view: the *many worlds* interpretation of Hugh Everett (Everett 1957).

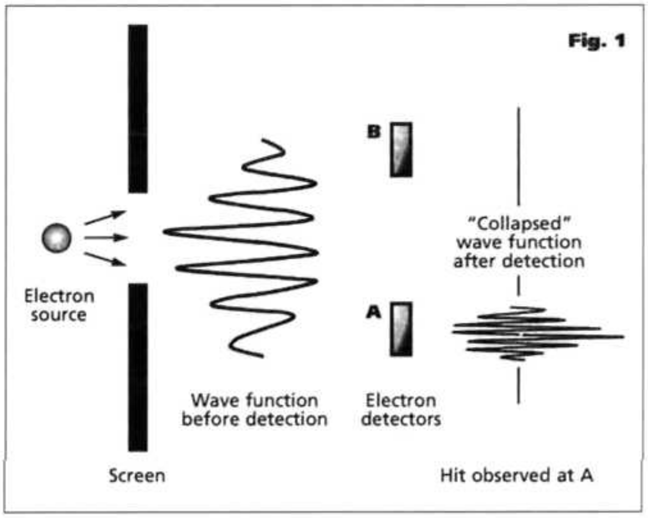

Figure 1. Wave function collapse in conventional quantum mechanics. An electron is localized by passing through an aperture. The probability that it will then be found at a particular position is determined by the wave function illustrated to the right of the aperture. When the electron is then detected at A, the wave function instantaneously collapses so that it is zero at B.

Everett usefully showed how it was formally possible to eliminate wave function collapse in a quantum theory of measurement. Everett proposed that all possible paths continue to exist in parallel universes which split off every time a measurement is made. This has left the door open for the quantum mystics to claim that the human mind acts as sort of a "channel selector" for the path that is followed in an individual universe while existing itself in all universes (Squires 1990). Needless to say, the idea of parallel universes has attracted its own circle of enthusiastic proponents, in all universes presumably.

Effective Nonlocality

Admittedly, the quantum world is different from the world of everyday experience that obeys the rules of classical Newtonian mechanics. Something beyond normal common sense and classical physics is necessary to describe the fundamental processes inside atoms and nuclei. In particular, an explanation must be given for the apparent nonlocality, the instantaneous "quantum leap," that typifies the non-commonsensical nature of quantum phenomena.

Despite the oft-heard statement that quantum particles do not follow well-defined paths in space-time, elementary-particle physicists have been utilizing just such a picture for fifty years.

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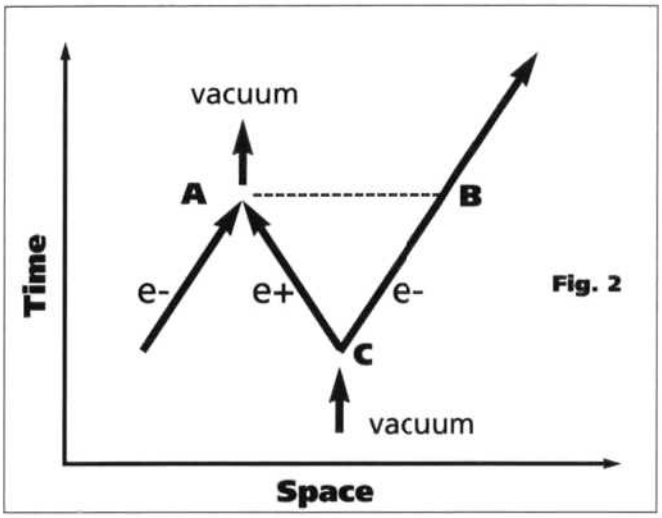

Figure 2. Effective nonlocality. How an apparent instantaneous "quantum leap" can be made between two points in space. An electron-positron pair is created at C by a quantum fluctuation of the vacuum. The positron annihilates an electron at A, undoing the original vacuum fluctuation so that there is zero net-energy change. The electron thus appears to make an instantaneous quantum leap from A to B. The distance AB is comparable to the wavelength associated with the particle, so "holistic" wave behavior results.

How is this reconciled with the quantum leap that seems to characterize atomic transitions and similar phenomena? We can see how, in the space-time diagram shown in Figure 2.

On the left, an electron (e^-) is moving along a well-defined path. An electron-positron pair ($e^- e^+$) is produced at point C by a quantum fluctuation of the vacuum, allowed by the uncertainty principle. The positron annihilates the original electron at point A while the electron from the pair continues past point B. Since all electrons are indistinguishable, it appears as if the original electron has jumped instantaneously from A to B.

In Figure 2, all the particles involved follow definite paths. None moves faster than the speed of light. Yet what is observed is operationally equivalent to an electron undergoing superluminal motion, disappearing at A and appearing simultaneously at a distant point B. No experiment can be performed in which the electron on the left can be distinguished from the one on the right. A simple calculation shows that the distance AB is of the order of the (de Broglie) wavelength of the particle. In this manner, the "holistic" wave nature of particles can be understood in a manner that requires no superluminal motion and certainly no intervention of human consciousness.

Furthermore, since the quantum jump is random, no signal or other causal effect is superluminally transmitted. On the other hand, a deterministic theory based on subquantum forces or hidden variables is necessarily superluminal.

Thus quantum mechanics, as conventionally practiced, describes quantum leaps without too drastic a quantum leap beyond common sense. Certainly no mystical assertions are justified by any observations concerning quantum processes.

Conclusion

Quantum mechanics, the centerpiece of modern physics, is misinterpreted as implying that the human mind controls reality and that the universe is one connected whole that cannot be understood by the usual reduction to parts. However, no compelling argument or evidence requires that quantum mechanics plays a central role in human consciousness or provides instantaneous, holistic connections across the universe. Modern physics, including quantum mechanics, remains completely materialistic and reductionistic while being consistent with all scientific observations.

The apparent holistic, nonlocal behavior of quantum phenomena, as exemplified by a particle's appearing to be in two places at once, can be understood without discarding the commonsense notion of particles following definite paths in space and time or requiring that signals travel faster than the speed of light.

No superluminal motion or signalling has ever been observed, in agreement with the limit set by the theory of relativity. Furthermore, interpretations of quantum effects need not so uproot classical physics, or common sense, as to render them inoperable on all scales—especially the macroscopic scale on which humans function. Newtonian physics, which successfully describes virtually all macroscopic phenomena, follows smoothly as the many-particle limit of quantum mechanics. And common sense continues to apply on the human scale.

Notes

1. For a review of alternate medicine, including "quantum medicine," see Douglas Stalker and Clark Glymour, eds., *Examining Holistic Medicine* (Amherst, N.Y.: Prometheus Books, 1985).

2. For a fuller discussion and references, see Victor J. Stenger, *Physics and Psychics: The Search for a World Beyond the Senses* (Amherst, N.Y.: Prometheus Books, 1990).

3. L. A. Govinda, *Foundations of Tibetan Mysticism* (New York: Samuel Weiser, 1974), p. 225, as quoted in Capra 1975, p. 305.

4. See, for example, Marilyn Ferguson, *The Aquarian Conspiracy: Personal and Social Transformation in the 1980s* (Los Angeles: Tarcher, 1980).

5. Of course, in some cases those distributions may be highly peaked and thus an outcome can be predicted with high probability, that is, certainty for all practical purposes. In fact, this is precisely what happens in the case of systems of many particles, such as macroscopic objects. These systems then become describable by deterministic classical mechanics as the many-particle limit of quantum mechanics.

6. For a fuller discussion and references, see Victor J. Stenger, *The Unconscious Quantum: Metaphysics in Modern Physics and Cosmology* (Amherst, N.Y. : Prometheus Books, 1995).

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