



Scientific Explanation of the Quantum Enigmas

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This is a review of a book by two physics professors titled, "Quantum Enigma: Physics Encounters Consciousness." I argue that to understand quantum mechanics you need to understand the difference between science, metaphysics, and philosophy.

Human beings have a drive to know and understand everything, and there are two methods of inquiry that stand side-by-side as equals: metaphysics and science. *Quantum Enigma: Physics Encounters Consciousness* shows that a lack of understanding of metaphysics is a stumbling block in understanding science. Metaphysical questions arise from our transcendence, that is, our ability to make ourselves the subject of our own knowledge: What is the conscious knowledge of humans as opposed to the sense knowledge of animals? What is a real being? What are mental beings (images, concepts, past, future, dreams)? What is truth? What is causality? What is free will? What does it mean to understand something? Is the universe intelligible?

Basically, the answer to all of the above questions is that there is no answer. They are mysteries. We can comprehend what a human being is because we know everything we do and everything that happens to us, but we can't define or explicate what a human being is. In other words, humans are embodied spirits. Using the categories of metaphysics, the human soul is spiritual. Assuming or hoping that the universe is intelligible leads to the existence of a transcendent reality that is called God in Western religions. God is not a free image, like Santa Clause, but a real being, like a beloved friend who gets on your nerves from time to time.

In science, there are no mysteries because science has a tremendous track record of success. There are only unanswered questions. It can be said of metaphysics that there is no record of success. An example of metaphysical wisdom is that knowledge is the openness of being to the self-manifestation of being. In metaphysics, whether or not the universe is intelligible is an open question. But in science, it is not. If Johannes Kepler thought for one minute the universe was not intelligible, he would not have spent 10 years trying to understand why the planets move as they do. What caused the Big Bang is not a mystery. What is consciousness is a mystery. Calling both questions mysteries indicates you don't understand the difference between metaphysics and science.

A quantum enigma arises from the question of why the isotope cobalt-60 decays into nickel-60 with a half-life of 5.27 years. Using the probability waves of quantum mechanics, physicists can calculate the half-lives of isotopes. A particular cobalt-60 atom may decay in 10 minutes or 10 years. There is a 50% probability that it will decay in 5.27 years. This raises the question: What causes a particular cobalt-60 atom to decay at the particular time it does? With our present state of knowledge, there is no

hope of answering this question. This is an enigma or puzzle because we understand so much about isotopes from quantum mechanics, but not this.

The authors agree with the nonsense that there is a connection between human rationality (consciousness and free will) and quantum mechanics. I think this idea arises from a lack of understanding of the difference between science, metaphysics, and philosophy. Philosophy is a method of inquiry that arises above another method of inquiry. How should scientists do science is a philosophical question. The scientific method is an answer to this question. The various interpretations of quantum mechanics are part of the philosophy of quantum mechanics because they are attempts to answer questions about quantum mechanics.

One way we obtain knowledge and understanding is through analogies. If you poke a lion in a cage with a stick, it will roar and try to claw you. We know by analogy that the lion is angry because this is how we would feel if it was happening to us. There is an analogy that is used in quantum mechanics to answer the question: What are quantum mechanical waves?

To answer this philosophical question, consider the decay of cobalt-60. If you observe a cobalt-60 atom for 5.27 years it may decay (D) or may remain stable (S). Repeated observations will give you a series of S's and D's. You get, in other words, a set: (S,S,D,D,D,S,..). The fraction of times you get S or D approaches 1/2 in the limit as the number of elements in the set increases. I am using set theory because you need set theory to understand an observation analogous to the decay of cobalt-60: Flipping a coin high in the air with your thumb and fore finger and getting heads (H) or tails (T). With coin tosses you get the same kind of set as you get observing cobalt-60 atoms. The probability of getting heads or tails is 1/2 because that is the fraction you get from the set and all possible subsets. In the case of the coin, there are two events (flipping and landing head or tails), the subtle proviso that the calculation is done for all subsets to eliminate the possibility that there is a demon or hidden variable affecting the outcome, and the fact that we understand why we get heads (or tails) half of the time. In the case of cobalt-60, there is only one event: the decay of the atom. These are two different phenomena. Saying, "1/2 is the probability of a cobalt-60 atom decaying in 5.27 years" is an analogy or a philosophical comment. In my opinion, calling the quantum mechanical waves probability waves is an example of philosophizing.

The basis for thinking there is a connection between consciousness and quantum mechanics is the double-slit experiment with particles (photons, electrons, or atoms). A version of this experiment is on YouTube.com ("Double-Slit Experiment-Water Wave Interference Pattern"). The double-slit creates two water waves and a very visible interference pattern. The same interference pattern occurs with particles. The probability waves of quantum mechanics explain this and it is another triumph for quantum mechanics.

The big difference between the two interference patterns is that you don't need a screen to see the water interference pattern. You don't observe any particle interference pattern if there is no screen. But, the screen is there because a human being put it there. Hence, it is the action of humans that created the interference pattern. This is an enigma or puzzle because it raises the question: What is happening to the particles after they hit the double-slit if there is no screen? In any case, this is the reasoning, so far as I can figure out, behind the idea that quantum mechanics involves human consciousness but classical physics does not.

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