The Quantum Paradox[1]

Our tradition of objective reality began with Aristotle's view that:

"*… the world consists of a multitude of single things (substances), each of them characterized by intrinsic properties …*" (Audretsch, 2004) p274

Two thousand years later, this vision of a world of things with intrinsic properties and local effects still dominates our thought. It is the official doctrine of physics, but the quantum states that predict physical events ignore physical restrictions so they can't be real. But why not?

"*… why not simply accept the reality of the wave function?* (Zeh, 2004) p8

The problem is that if the wave function is real, so is what it does, which is physically impossible:

"*… if we are to take ψ [the quantum field] as providing a picture of reality, then we must take these jumps as physically real occurrences too…*" (Penrose, 1994) p331

Schrödinger tried to explain quantum activity in physical terms but failed, and so has everyone else who has tried since. What quantum theory describes isn't the physicality we know: quantum states that disappear at will ignore the permanence of physical matter; entangled effects that occur instantly over any distance ignore speed of light limits; and superposed states can co-exist in physically opposite ways that should cancel, like opposite spin. In sum, the *quantum world described by quantum theory cannot possibly be physical*. For example, an electron's quantum wave can spread across a galaxy, then instantly collapse to any point when observed, but:

"*How can something real disappear instantaneously?*" (Barbour, 1999) p200

If quantum waves are real then the physical world isn't, which is unacceptable, but when Pauli and Born defined the quantum wave amplitude as the probability of physical existence, physics ceased to be about anything physical at all:

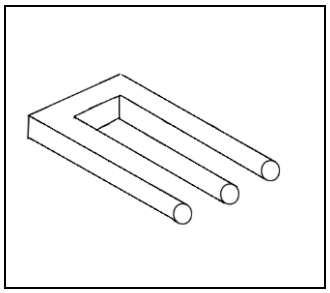

Figure. A paradox

"*For the first time in physics, we have an equation that allows us to describe the behavior of objects in the universe with astounding accuracy, but for which one of the mathematical objects of the theory, the quantum field* ***ψ****, apparently does not correspond to any known physical quantity.*" (Oerter, 2006) p89

The quantum paradox is that quantum "unreality" *causes* our "reality", so:

"*Can something that affects real events … itself be unreal?*" (Zeh, 2004) p4.

As Penrose says:

"*How, indeed, can real objects be constituted from unreal components?*" (Penrose, 1994) p313

By "real" mean physical but in quantum realism that is just a *view*. The problem Zeh and Penrose identify is that so-called quantum unreality creates so-called physical reality. For a culture of physical realism to host a theory that non-physical things (quantum states) cause physical things, isn't logically sustainable. The emperor of quantum theory has no physical clothes, so must either retreat to a nineteenth century physical realism that doesn't work, or put on new quantum clothes.

For a century, physics has faced the quantum paradox like a deer in headlights, attracted by the brilliance of quantum theory but afraid to abandon its current position of physicalism. Yet paradoxes only go away if the false assumptions they are based on are exposed, e.g. the Figure shows an object with two square and three round prongs, depending on where you look, which is impossible. The answer

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[1] This is section 3.7.3 from Chapter 3 The Light of Existence, of the book Quantum Realism by Brian Whitworth, currently under development. The link gives a free early access to the whole chapter.

is not to institutionalize this illogicality by inventing some mystical "square-circle duality", but to identify the error, which is that one line can't bound both square and round prongs at once.

Likewise the quantum paradox arises from the false assumption that the physical world is complete[2]. Explaining this paradox by a mystical "wave-particle duality" is to institutionalize the illogic. If we accept what quantum theory is saying, that physical events are quantum generated, the error that the physical world is inherent real is abandoned and the quantum paradox disappears.

Audretsch, J. (2004). *Entangled World: The fascination of quantum information and computation*. Verlag: Wiley.

Barbour, J. (1999). *The End of Time: The next revolution in physics*. Oxford: Oxford University Press.

Oerter, R. (2006). *The Theory of Almost Everything*. London: Plume, Penguin.

Penrose, R. (1994). *Shadows of the Mind*. Oxford: Oxford University Press.

Zeh, H. D. (2004). The Wave Function: It or Bit? In J. D. Barrow, P. C. W. Davies, & J. Charles L. Harper (Eds.), *Science and Ultimate Reality: Quantum Theory, Cosmology and Complexity* (p. http://arxiv.org/abs/quant–ph/0204088). Cambridge: Cambridge University Press.

[2] How can a physical universe that is *complete in itself* also *begin in a big bang*? A physics that take both these statements as true has built a paradox into its foundation.