

## Transcript - Long

### Robert Lawrence Kuhn:

Paul, we're at the FQXI seminar, the Physics of the Observer, and one of the topics is consciousness, the application of physics to try to explain consciousness. This has been my obsession for my whole sentient life. I did my doctorate in neuroscience. At that time, you know, 50 years ago, I thought we could, you know, neuronal circuits and neurophysiology, neuroanatomy. You know, they made a lot of progress, but did not explain consciousness and now we have a new generation of people who think that physics, whether it's the quantum physics level or mathematical mechanisms, are needed to explain this first person phenomenal experience of consciousness. How do you evaluate these new efforts through fundamental physics and mathematics to explain consciousness?

### Paul Davies:

First, I should say it's still a deep mystery. We would like to be able to say there's something particular about what's going on in this complex system in here that is not going on in that complex system over there, that this is conscious, that isn't, but what exactly is it about that? The use of the word system is critical here, that I don't believe and I don't think many of my colleagues would believe that, say, an atom is individually conscious and that it's a matter of adding up all lots of little bits of consciousness to get a lot of it. It's got something to do with the system and the complexity of the system or the way it hangs together as a whole, that, if this system is the brain. And so, that's a very difficult concept to get into physics because all of physics is really formulated at the fundamental level in terms of local things; that is, say, the particle has a force acting on it at that particular point. That's something and we understand behavior at that level. When we're into something which involves a system, which is many degrees of freedom and distributed throughout space and time, we're wanting to describe that at a fundamental level, well, then that's a difficult thing to, to write down equations for, but at the moment, there is a particular point of view, which has been put forward by Giulio Tononi, that somehow we can characterize the wholeness of the system, like a brain, say, in terms of a particular mathematical quantity, which equals integrated information. And here we have a really key point. I think everybody would agree that one of the things that brains do is process information. We get, sense data comes in, and this information swirls around in the brain, and then sometimes leads to agency or action. So, that information processing is important, but there have been great advances in trying to understand the behavior of information in networks and that you can ask, well, where is the information processing taking place? Is it just in a lot of little places, like individual neurons, and that somehow the brain is the sum total of it, or are there collective degrees of freedom or collective modes in the brain which is doing the heavy lifting of the information processing? Now, this is, this adage, the whole is greater than the sum of the parts, can that be quantified? That we would say the brain is a good example. No neuron in my brain is conscious, yet the brain, as a whole, has consciousness. How do we capture that notion of the whole being greater than the sum of the parts? Well, Tononi has a candidate measurement. It may not be the right one, but it's a stab, trying to capture that idea mathematically and I'm very much drawn to that because, for the first time, we've got a mathematical quantity which is defined on the whole system, which captures the two aspects. One is its complexity, but the other is its inability to be decomposed into the parts without losing the essential thing that you're looking for. I'd like to import that particular quantity into quantum physics to tackle the measurement of observer problem of quantum physics. I think that this is a great application of that idea.

### Robert Lawrence Kuhn:

So I can understand, possibly, how a test like that could decide whether something is consciousness...is conscious or not conscious. That, that I can follow. What I'd have difficulty was [sic] is going to the next step and saying that that is consciousness because it, it gets back to the old, so-called identity theory.

### Paul Davies:

Right.

### Robert Lawrence Kuhn:

So, if I have stubbed my toe, I have impulses along the C fibers to my brain, and people have to say that the feeling of pain is those C fiber firings, and they seem like such radically different categories, it's hard to see that one is the same. I have the same problem here because whatever that structure is, how does that create the phenomenal experience?

### Paul Davies:

Right. And that's entirely justified because what this is, is a quantitative measure of the degree of consciousness, but it doesn't, in my view, address what you're describing, which David Chalmers calls the hard problem of consciousness, the fact that it is like something to experience the redness of red, and it's quite different from the sound of a bell, or the greenness of green or, you know, the smell of a meal. These are all very different internally. These so-called qualia which attach to these conscious experiences is something which is outside of the scope of what I've just been saying and that, that remains a mystery.

### Robert Lawrence Kuhn:

And that's why David Chalmers and others have increasingly moving [sic] towards a panpsychist approach to reality, where there is some protoconsciousness in every, in every particle, every wave function, that somehow when, a combination problem they have, but when you bring it together in some form, you create it. But because they're, they, they cannot make sense of any identity theory, that the phenomenal experience being identical with anything that you say that happens in the brain, or physics, or measures; therefore, you have to postulate something completely outside of that.

### Paul Davies:

Right. They want a dualist view of the world and I have some sympathy with that. I don't like panpsychism. I don't like atoms are a little bit conscious, but I do think that we will almost certainly have to add something to systems that are above a certain threshold of complexity, have a particular amount of integrated information that we, that the qualia, the internal experiences, I don't think can be derived from the physics. You can't...physics deals with particles, and forces, and things like that. The mental world deals with sensations, and thoughts, and impressions, and if you open up my head, you just see a lot of atoms and things. You don't see thoughts, and sensations, and impressions. And so, these two may be correlated, but at the end of the day, I

don't see that you can ever explain my internal personal experience or the redness of red in terms of electrons and signals and physical forces.

**Robert Lawrence Kuhn:**

What's the implication of that? Does that mean that your so-called substance dualist is some other thing that exists in reality, that has to somehow work with the physical world?

**Paul Davies:**

I think there is something else that exists, yes. Where I would part company with some people is to suppose that this other thing could have an independent existence, floating around, sort of free of the system in which it's instantiated. I think it's part and parcel of the phenomenon, the complexity that we would associate with brains and, who knows, maybe computer systems that might be conscious. I don't think there's anything particularly magical about the, you know, the flesh and blood stuff. But I think to, to fully explain the world as we experience it, which includes the qualia – for me, I mean, I can't say for you, but certainly for me – then there has to be something in it, in addition to the particles and the forces, yes.