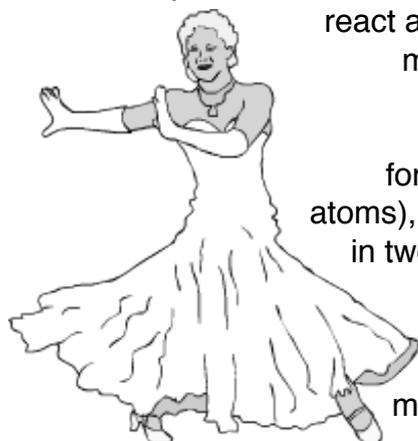


## Q IS FOR QUANTUM

Things in the world seem to follow simple laws that we can understand. You drop something, it goes down. You whack one snooker ball into another, it makes the other ball move. If I have an object in my hand, that same object cannot be over there on the table. If I do something over here, like wiggle my ears or whatever, and you stand way over there, it takes a little while for you to know what I've done and be able to react appropriately, like for example wiggling your ears back at me.



But as you start to examine very very small things, for example electrons (which are far smaller than atoms), bizarre things start to happen. An electron can be in two places at once, and it can jump instantly from one place to another. It can appear out of literally nowhere, and disappear again a moment later. This is the strange world of quantum mechanics.



This song is about one specific quantum phenomenon, namely quantum entanglement. I'll do my best to sum it up for you here. Particles have a strange property called 'spin', which doesn't really mean that they're spinning in the way we'd normally understand it, but that's what it's called anyway. And they can spin in two ways, which scientists call 'up' and 'down', although again it's not literally up and down. Now, one of the many weird things about quantum mechanics is that the spin will be both 'up' and 'down' *at the same time* until the moment when a scientist examines the particle and measures whether it's one or the other. To complicate things further, when two particles originate in the same place but travel in opposite directions (for example, two photons that leave an atom at the same moment), their spins will be 'entangled', meaning that one of them will have 'up' spin and the other will have 'down' spin. But here's the *really* weird thing: if it's true that the spin isn't determined until you do an experiment to check, then you could have two entangled photons at opposite ends of the Universe, and you could do an experiment to check the spin of one of them (and let's say you discovered it was 'up'), and at exactly that moment, the other photon would have to become 'down'. But information can't travel faster than the speed of light (says Einstein), so how does the second photon 'know' that you've done the experiment and that the answer was 'up'?

The answer is that we don't really understand it yet. But the experiment has been done, and we know quantum entanglement is a real (if utterly bizarre) thing. Most excitingly, as I mention in the final verse, we may eventually be able to use quantum entanglement to make computers far more powerful than they currently are.

There aren't very many musical genres beginning with the letter Q. In fact, there are two – quickstep and quadrille – and they're both dances, so you'd basically have been getting up to dance whatever I chose. Out of the two, quickstep is far cooler, so that's the one I chose.