

Columns and letters of The Daily Beacon are the views of the individual and do not necessarily reflect the views of the Beacon or the Beacon's editorial staff.

http://www.utdailybeacon.com/opinion/ask-a-scientist-what-is-schr-dinger-s-cat/article_a1acf7a0-4fc7-11e7-91f3-7bc82a5003b9.html

Ask a Scientist: What is Schrödinger's cat?

Abby Barnes, PhD student in biological psychology with edits by Scott Satinover, PhD student in bioenergy and biofuels and Brooke Dulka, PhD student in biological psychology.

Jun 13, 2017



Courtesy of The University of Tennessee, Knoxville.

Courtesy of The University of Tennessee, Knoxville.

Question: What is Schrödinger's cat?

Just what the heck is Schrödinger's cat? Before answering this question, we wanted to get a good idea of what people already understood about this paradox, so that we could address the relevant misconceptions. So we asked around, and here's what a few of you said:

“It shows how you can’t measure something’s energy and place at the same time, because once you find where it is, you affect its energy.”

“Something about a cat being both alive and dead in a box, right? But how is it both? Like, was he being serious?”

“It’s talking about something about the property of light and reality; or how you can never really see something for what it really is.”

We want to start off by saying these answers aren’t entirely wrong (although some are more wrong than others!), but the idea behind Schrödinger’s cat has been taken out of context. Physicist Erwin Schrödinger wasn’t trying to explain concepts like reality or perception. His cat was a way of discussing the “states” of particles. “What is a state,” you say?

Well, think of a book: it could be open or closed, facing up or down, on a table, a shelf, or a floor. A state specifies which of these arrangements the book is currently in. Particles work the same way! At any given time, there are a range of possible states that a particle can be in. But particles are weird, and it turns out that all these possible states can combine into one “super” state. This means that a particle can exist in two or more states at once, in what’s called a “quantum superposition”.

Now, what’s really cool is that this idea has actually been supported by experimentation – the tiny particles that make up our entire universe really do seem to have multiple coexisting states! But physicists took a step back. What about bigger stuff that people actually deal with, like a book? After all, if everything is made up of these tiny “superpositioned” particles, then everything should exist in multiple states at the same time. But that’s insane, right? How could that be true? When we look around us, everything is clearly in just one state. A book would never be both open and closed! Physicists struggled to understand how we could solve this riddle. How can there be multiple states if we only ever see one?

One particular answer to this puzzle is the “Copenhagen interpretation” which says that things exist in multiple states until they are observed, at which point the act of observation decides what single state they will exist in. But this interpretation was problematic to Schrödinger, even though his work had contributed to it. So, he created a thought experiment to explain some of his misgivings, and “Schrödinger’s cat” was born.

In this thought experiment, Schrödinger asks people to imagine a cat placed in a closed box, along with a very tiny amount of radioactive material. The box contains a sensor that detects radiation, and the sensor is hooked up to a vial containing a deadly acid that is released and kills the cat if the sensor is activated. However, because radiation is produced by a random process, there's no way to know if the sensor has detected it without looking into the box. This means that the closed box has two possible states. In one state, the radioactive material has decayed, the sensor has gone off, and the cat is dead. In another state, the material hasn't decayed, the sensor hasn't gone off, and the cat is alive! Now we are asked: is the cat alive or dead?

According to the Copenhagen interpretation, until the box is opened, both states exist simultaneously because they remain unobserved. So, as long as no one ever opens the box, the cat is technically alive and dead. However, if you open the box and the cat is dead, your observation killed the cat! Schrödinger meant for this to sound ridiculous. Obviously the cat can't be both alive and dead! Schrödinger thought the Copenhagen interpretation gave too much power to observation and that there had to be a better explanation.

Many physicists ended up agreeing with Schrödinger. Other explanations of quantum superposition were proposed, and Schrödinger's cat has been used to think about the possibility of each of them! Notice, however, that by itself Schrödinger's cat doesn't really explain anything. It's just a useful tool for thinking about what we know to be true about particles and what we know to be true about much larger things, like books and cats. Ultimately, this means that Schrödinger's cat doesn't indicate that reality can't be known, it just illustrates that we don't have complete knowledge yet – but we should always keep investigating!

Have a question for Ask a Scientist or want to join our organization? Contact us by email at askasci@utk.edu or tweet us at [@AskAScientistUT](https://twitter.com/AskAScientistUT). Check us out on [VOLink](#) for sources used in this article and upcoming events we'll be hosting.