Párhuzamos univerzumok

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Do parallel universes really exist?

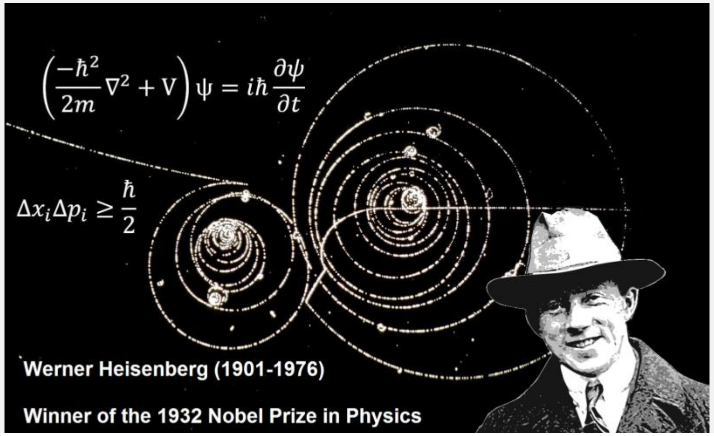
by Josh Clark

In 1954, a young Princeton University doctoral candidate named Hugh Everett III came up with a radical idea: That there exist parallel universes, exactly like our universe. These universes are all related to ours; indeed, they branch off from ours, and our universe is branched off of others. Within these parallel universes, our wars have had different outcomes than the ones we know. Species that are extinct in our universe have evolved and adapted in others. In other universes, we humans may have become extinct.

This thought boggles *(megzavarja)* the mind and yet, it is still comprehensible. Notions of parallel universes or dimensions that resemble our own have appeared in works of science fiction and have been used as explanations for metaphysics. But why would a young up-and-coming physicist possibly risk his future career by posing a theory about parallel universes?

With his **Many-Worlds theory**, Everett was attempting to answer a rather sticky question related to **quantum physics**: Why does quantum matter behave erratically? The quantum level is the smallest one science has detected so far. The study of quantum physics began in 1900, when the physicist Max Planck first introduced the concept to the scientific world. Planck's study of radiation yielded some unusual findings that contradicted classical physical laws. These findings suggested that there are other laws at work in the universe, operating on a deeper level than the one we know.

Heisenberg Uncertainty Principle



In fairly short order, physicists studying the quantum level noticed some peculiar things about this tiny world. For one, the particles that exist on this level have a way of taking different forms arbitrarily. For example, scientists have observed **photons** -- tiny packets of light -- acting as particles and waves. Even a single photon exhibits this shape-shifting [source: Brown University]. Imagine if you looked and acted like a solid human being when a friend glanced at you, but when he looked back again, you'd taken a gaseous form.

This has come to be known as the **Heisenberg Uncertainty Principle**. The physicist Werner Heisenberg suggested that just by observing quantum matter, we affect the behavior of that matter. Thus, we can never be fully certain of the nature of a quantum object or its attributes, like velocity and location.

This idea is supported by the **Copenhagen interpretation** of quantum mechanics. Posed by the Danish physicist Niels Bohr, this interpretation says that all quantum particles don't exist in one state or the other, but in all of its possible states at once. The sum total of possible states of a quantum object is called its **wave function.** The state of an object existing in all of its possible states at once is called its **superposition**.

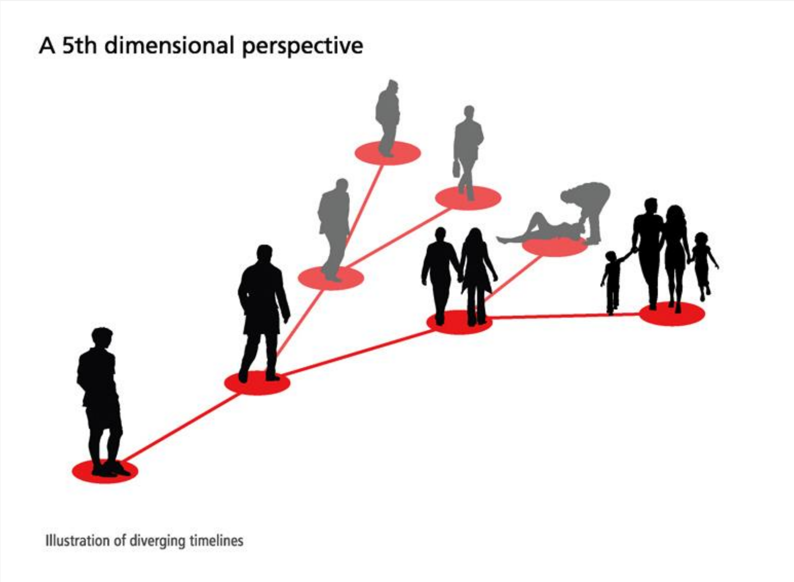
According to Bohr, when we observe a quantum object, we affect its behavior. Observation breaks an object's superposition and essentially forces the object to choose one state from its wave function. This theory accounts for why physicists have taken opposite measurements from the same quantum object: The object "chose" different states during different measurements.

Bohr's interpretation was widely accepted, and still is by much of the quantum community. But lately, Everett's Many-Worlds theory has been getting some serious attention. Read the next page to find out how the Many-Worlds interpretation works.

Many Worlds Theory

Young Hugh Everett agreed with much of what the highly respected physicist Niels Bohr had suggested about the quantum world. He agreed with the idea of superposition, as well as with the notion of wave functions. But Everett disagreed with Bohr in one vital respect.

To Everett, measuring a quantum object does not force it into one comprehensible state or another. Instead, a measurement taken of a quantum object causes an actual split in the universe. The universe is literally duplicated, splitting into one universe for each possible outcome from the measurement. For example, say an object's wave function is both a particle and a wave. When a physicist measures the particle, there are two possible outcomes: It will either be measured as a particle or a wave. This distinction makes Everett's Many-Worlds theory a competitor of the Copenhagen interpretation as an explanation for quantum mechanics.



When a physicist measures the object, the universe splits into two distinct universes to accommodate each of the possible outcomes. So a scientist in one universe finds that the object has been measured in wave form. The same scientist in the other universe measures the object as a particle. This also explains how one particle can be measured in more than one state.

As unsettling as it may sound, Everett's Many-Worlds interpretation has implications beyond the quantum level. If an action has more than one possible outcome, then -- if Everett's theory is correct -- the universe splits when that action is taken. This holds true even when a person chooses not to take an action.

This means that if you have ever found yourself in a situation where death was a possible outcome, then in a universe parallel to ours, you are dead. This is just one reason that some find the Many-Worlds interpretation disturbing.

Another disturbing aspect of the Many-Worlds interpretation is that it undermines our concept of time as linear. Imagine a time line showing the history of the Vietnam War. Rather than a straight line showing noteworthy events progressing onward, a time line based on the Many-Worlds interpretation would show each possible outcome of each action taken. From there, each possible outcome of the actions taken (as a result of the original outcome) would be further chronicled.

But a person cannot be aware of his other selves -- or even his death -- that exist in parallel universes. So how could we ever know if the Many-Worlds theory is correct? Assurance that the interpretation is theoretically possible came in the late 1990s from a **thought experiment** -- an imagined experiment used to theoretically prove or disprove an idea -- called quantum suicide. (You can learn more about it in How Quantum Suicide Works.)

This thought experiment renewed interest in Everett's theory, which was for many years considered rubbish. Since Many-Worlds was proven possible, physicists and mathematicians have aimed to investigate the implications of the theory in depth. But the Many-Worlds interpretation is not the only theory that seeks to explain the universe. Nor is it the only one that suggests there are universes parallel to our own. Read the next page to lean about string theory.

Parallel Universes: Split or String?

Dr. Michio Kaku, the originator of string theory.

Ted Thai/Time Life Pictures/Getty Images

The Many-Worlds theory and the Copenhagen interpretation aren't the only competitors trying to explain the basic level of the universe. In fact, quantum mechanics isn't even the only field within physics searching for such an explanation. The theories that have emerged from the study of subatomic physics still remain theories. This has caused the field of study to be divided in much the same way as the world of psychology. Theories have adherents and critics, as do the psychological frameworks proposed by Carl Jung, Albert Ellis and Sigmund Freud.

Since their science was developed, physicists have been engaged in **reverse engineering** the universe -- they have studied what they could observe and worked backward toward smaller and smaller levels of the physical world. By doing this, physicists are attempting to reach the final and most basic level. It is this level, they hope, that will serve as the foundation for understanding everything else.

Following his famous Theory of Relativity, Albert Einstein spent the rest of his life looking for the one final level that would answer all physical questions. Physicists refer to this phantom theory as the **Theory of Everything**. Quantum physicists believe that they are on the trail of finding that final theory. But another field of physics believes that the quantum level is not the smallest level, so it therefore could not provide the Theory of Everything.

These physicists turn instead to a theoretical subquantum level called string theory for the answers to all of life. What's amazing is that through their theoretical investigation, these physicists, like Everett, have also concluded that there are parallel universes.

String theory was originated by the Japanese-American physicist Michio Kaku. His theory says that the essential building blocks of all matter as well as all of the physical forces in the universe -- like gravity -- exist on a subquantum level. These building blocks resemble tiny rubber bands -- or strings -- that make up **quarks** (quantum particles), and in turn electrons, and atoms, and cells and so on. Exactly what kind of matter is created by the strings and how that matter behaves depends on the vibration of these strings. It is in this manner that our entire universe is composed. And according to string theory, this composition takes place across 11 separate dimensions.

Like the Many-Worlds theory, string theory demonstrates that parallel universes exist. According to the theory, our own universe is like a bubble that exists alongside similar parallel universes. Unlike the Many-Worlds theory, string theory supposes that these universes can come into contact with one another. String theory says that gravity can flow between these parallel universes. When these universes interact, a Big Bang like the one that created our universe occurs.

While physicists have managed to create machines that can detect quantum matter, the subquantum strings are yet to be observed, which makes them -- and the theory on which they're built -- entirely theoretical. It has been discredited by some, although others believe it is correct.

So do parallel universes really exist? According to the Many-Worlds theory, we can't truly be certain, since we cannot be aware of them. The string theory has already been tested at least once -- with negative results. Dr. Kaku still believes parallel dimensions do exist, however [source: The Guardian].

Einstein didn't live long enough to see his quest for the Theory of Everything taken up by others. Then again, if Many-Worlds is correct, Einstein's still alive in a parallel universe. Perhaps in that universe, physicists have already found the Theory of Everything.

For more information on parallel universes, visit the next page.

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