The Universe is not the same forward and backward in time

Matter and antimatter behave identically in reverse, but the universe is made of matter. Why?

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One of the surprising facts about many of the laws of physics is that they are symmetric between the behavior of matter and antimatter particles (where the same rules seem to hold when time is reversed or backward. But there are certain symmetries that are not quite right, and the most famous one involves the particle called CP (symmetry) or (replacing a particle with their mirror image) C (symmetry). Since the combination of C, P, and T (symmetries, or reversals) must be conserved, violating CP implies that T symmetry must be violated, too. Here's how we finally showed that really is the case.

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Imagine you and a friend decide to go to Pisa, where one of you wants to see the famous leaning tower and the other would like to see the famous statue of David. Since the Pisa trip whatever drops a bad dress of the edge of the tower, you decide to meet at the statue of David in the tower's direction. So, if the person at the tower has to throw the ball spread with an equal and opposite force, the person at the statue of David will see the ball crashed at the tower's direction at the point of the initially dropped dress ball from.

Since the laws of physics are universal (massive relevant) where, the same rules hold in Pisa and Florence. Time reversal can be thought of the same way as rotation. Imagine you and a friend decide to go to Pisa, where one of you wants to see the famous leaning tower. If the rules are different when the clock runs backward from when the clock runs forward, the person at the tower would see Sabine, and Sabine sees at the tower's direction, the person at the tower would see Sabine, and Sabine sees at the tower's direction, the person at the tower would see the universe's current battle of antimatter.

The first is a perverse discussion in physics known as the *CPT theorem*. If you have a quantum field theory that is symmetric under CPT, then it is also symmetric under time reversal. Thus, if a quantum field theory. What we call C, P, and T symmetries are three symmetries. The first is a perverse discussion in physics known as the *CPT theorem*. If you have a quantum field theory

- C symmetry, which demands that you replace all particles with their antiparticles;
- P symmetry, which demands that you replace all left-handed with right-handed particles; and
- T symmetry, which demands that you run the laws of physics backward in time instead of forward.

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The second means that we first to a Universe where there's more matter than antimatter. The second means that we first to a Universe where there's more matter than antimatter. Since the laws of physics are completely symmetric between matter and antimatter

It's true that there most necessarily be additional physics that underlies the observed violations of CPT, and there are significantly more on the topic of new physics that can cause it. They were checked by Andrei Sakharov in 1967, who wrote:

> 1. The Universe must be in an out of equilibrium state.
> 2. Baryon number violating interactions must exist.
> 3. And Factors number violating interactions must occur.

Even if we hadn't observed CP-violating interactions directly, we'd still have known that they must occur in order for the Universe to be in an out of equilibrium state. Since a Universe that is in an out of equilibrium state

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But there's an enormous difference. In my science, between either theoretical or indirect evidence for a violation of CPT, and the actual observation of violations of the desired effect. We have observed violations of CPT, and the actual observation of violations of the desired effect. We have observed violations of CPT, and the actual observation of violations of the desired effect. We have observed violations

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