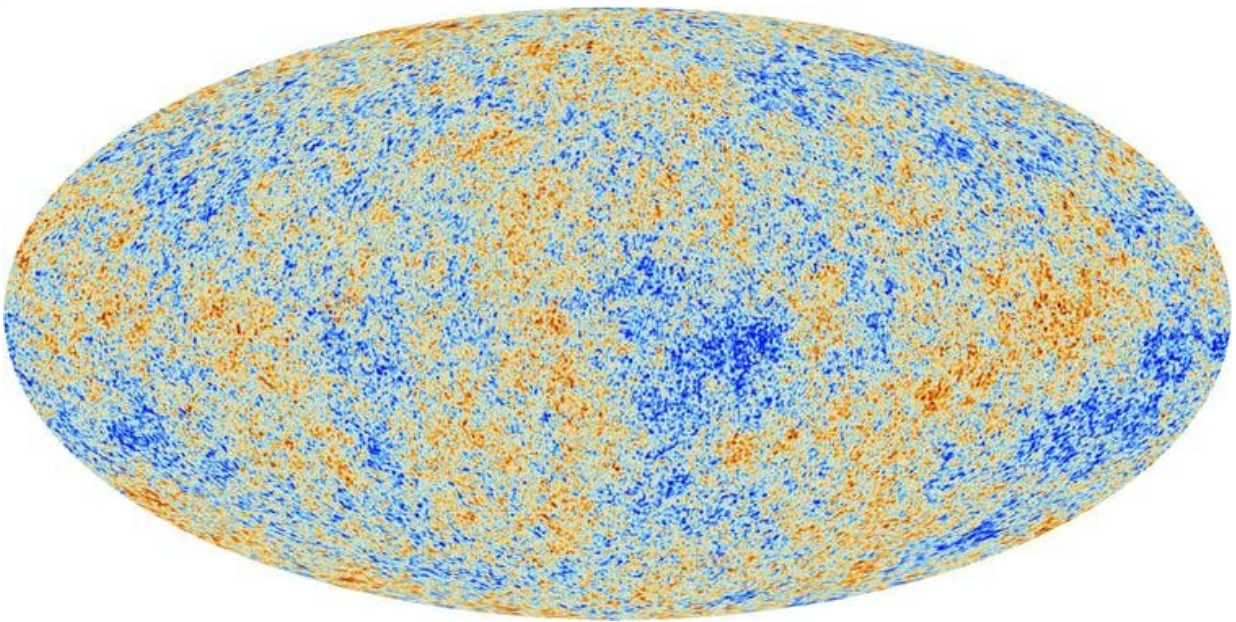


How could an explosive Big Bang be the birth of our universe?

May 1 2020, by Michael Lam



A visualization of tiny energy fluctuations in the early universe. Credit: ESA, Planck Collaboration, CC BY

How can a Big Bang have been the start of the universe, since intense explosions destroy everything? – Tristan S., age 8, Newark, Delaware

Pretend you're a perfectly flat chess piece in a game of chess on a perfectly flat and humongous chessboard. One day you look around and

ask: How did I get here? How did the chessboard get here? How did it all start? You pull out your telescope and begin to explore your [universe](#), the chessboard....

What do you find? Your universe, the chessboard, is getting bigger. And over more time, even bigger! The board is expanding in all directions that you can see. There's nothing that seems to be causing this expansion as far as you can tell—it just seems to be the nature of the chessboard.

But wait a minute. If it's getting bigger, and has been getting bigger and bigger, then that means in the past, it must have been smaller and smaller and smaller. At some time, long, long ago, at the very beginning, it must have been so small that it was infinitely small.

Let's work forward from what happened then. At the beginning of your universe, the chessboard was infinitely tiny and then expanded, growing bigger and bigger until the day that you decided to make some observations about the nature of your chess universe. All the stuff in the universe—the little particles that make up you and everything else—started very close together and then spread farther apart as time went on.

Our universe works exactly the same way. When astronomers like [me](#) make observations of distant galaxies, we see that they are [all moving apart](#). It seems our universe started very small and has been expanding ever since. In fact, scientists now know that not only is the universe expanding, but the speed at which it's expanding is increasing. This mysterious effect is caused by something physicists call [dark energy](#), though we know very little else about it.

Astronomers also observe something called the [Cosmic Microwave Background Radiation](#). It's a very low level of energy that exists all throughout [space](#). We know from [those measurements](#) that our universe

is [13.8 billion years old](#) – way, way older than people, and about three times older [than the Earth](#).

If astronomers look back all the way to the event that started our universe, we call that [the Big Bang](#).

Many people hear the name "Big Bang" and think about a giant explosion of stuff, like a bomb going off. But the Big Bang wasn't an explosion that destroyed things. It was the beginning of our universe, the start of both space and time. Rather than an explosion, it was a very rapid expansion, the event that started the universe growing bigger and bigger.

This expansion is different than an [explosion](#), which can be caused by things like chemical reactions or large impacts. Explosions result in energy going from one place to another, and usually a lot of it. Instead, during the Big Bang, energy moved along with space as it expanded, moving around wildly but becoming more spread out over time since space was growing over time.

Back in the chessboard universe, the "Big Bang" would be like the beginning of everything. It's the start of the board getting bigger.

It's important to realize that "before" the Big Bang, there was no space and there was no time. Coming back to the chessboard analogy, you can count the amount of time on the game clock after the start but there is no game time before the start—the clock wasn't running. And, before the game had started, the chessboard universe hadn't existed and there was no chessboard space either. You have to be careful when you say "before" in this context because time didn't even exist until the Big Bang.

You also have wrap your mind around the idea that the universe isn't expanding "into" anything, since as far as we know the Big Bang was the

start of both space and [time](#). Confusing, I know!

Astronomers aren't sure what caused the Big Bang. We just look at observations and see that's how the universe did start. We know it was extremely small and got bigger, and we know that kicked off 13.8 billion years ago.

What started our own game of chess? That's one of the deepest questions anyone can ask.

More information: *Hello, curious kids! Do you have a question you'd like an expert to answer? Ask an adult to send your question to CuriousKidsUS@theconversation.com. Please tell us your name, age and the city where you live.*

And since curiosity has no age limit—adults, let us know what you're wondering, too. We won't be able to answer every question, but we will do our best.

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