



The Big Bang

13.8 BILLION
years ago

Threshold 1: Big Bang

The Big Bang provided the raw materials for everything around us including space, time, matter, and energy.



<p>0:11</p> <p><i>Animated series of a timeline depicting the Big Bang explosion.</i></p>	<p>The beginning of everything was nothing. Well, not nothing exactly. Over 13.8 billion years ago, there may have been something. But scientists don't really know for sure what happened before the Big Bang that started our Universe. They do however, have a pretty good idea of what happened next. And it happened fast, like, really incredibly fast. In a fraction of a second, so small we wouldn't even notice that nothing or something expanded. And the Universe became a hot, dense, soup of all the energy and materials that would make up everything, ever.</p>
<p>0:54</p> <p><i>Animation of colorful stars, joining together to form atoms and elements such as Hydrogen and Carbon.</i></p>	<p>After that, things slowed down a little. The hot, dense, soup kept expanding and cooled down enough to start sticking together and making stuff. Fast forward about 380,000 years and all that stuff came together into atoms, the smallest building blocks of the chemical elements that make up matter. Those early atoms were mostly hydrogen and helium, which are still by far the most abundant elements in the Universe. And a few hundred million years after that those elements got pulled together by gravity and formed the very first stars.</p> <p>The hot centers of those stars started to make all the other kinds of elements we have in the Universe today. Everything from carbon and oxygen, to silver, and gold. And in the next billions of years, those new materials got trapped in stars gravity to form planets, moons, and other space objects.</p>
<p>1:53</p> <p><i>Animation of the formation of the sun and other planets in the solar system. Animation of vegetation and animals on Earth.</i></p>	<p>Like, about 4.5 billion years ago our Sun formed and the leftover matter swirling around it became our Solar System including the Earth we know and love. Then, all of that matter came together on Earth to form everything that's here. The air we breathe, the water we drink, the land we live on, and all the plants animals and people we share it with.</p>
<p>2:21</p> <p><i>Animation of the solar system followed by the birth of the universe.</i></p>	<p>That's why the Big Bang is our first Threshold of Increasing Complexity, a major turning point in the history of the Universe. It's when that unimaginable something, or nothing, suddenly expanded to become everything we've ever imagined. It's when the Universe as we know it was born. That birth happened a long time ago, though. And if nobody was around to take a picture and put a little hat on the newborn Universe's head, how do we actually know what happened in the Big Bang? Or, if it happened at all?</p>
<p>2:54</p> <p><i>Animation of a book called "how it all began" with silhouettes of scientists in the background. Animation of the scientists Edward Hubble and Georges Lemaître and their contributions to astronomy.</i></p>	<p>Well, it's because of one of our other Thresholds of Increasing Complexity, collective learning. Humans are really good at learning about stuff. Even stuff we can never witness firsthand. And over the past century or so, scientists have been finding evidence about the origins of our Universe and a lot of it points back to the Big Bang. Like, in the 1920s, astronomer Edwin Hubble figured out that the Universe is expanding. So, along with physicist Georges Lemaître, he theorized that if the Universe was growing it must at one point have been really really small.</p>



<p>3:34</p> <p><i>Animation of the work of Arno Penzias and Robert Wilson, depicting signals from a radio antenna. Animation of Albert Einstein adjacent to the phrase "Energy Matter."</i></p>	<p>In the 1960s, astronomers Arno Penzias and Robert Wilson picked up some weird signals on a radio antenna that turned out to be cosmic microwave background radiation. Leftover heat from the time when the Universe began. And other scientists, including Albert Einstein tried to figure out how elements formed in the early Universe. They discovered that when stuff gets really, really, hot energy and matter can change into one another. Like how energy matter soup of the early Universe eventually cooled off and separated out into different elements.</p>
<p>4:10</p> <p><i>Animation of the silhouettes of scientists overlaying a graphic of stars.</i></p>	<p>Those scientists could only figure that out because of the work of tons of people before them, who made observations and discoveries about math, physics, matter, and space. And today people are still building on those discoveries. But there's still a lot we don't know about how the Universe began. Like, whether something or nothing was there before, and why it suddenly expanded.</p>
<p>4:37</p> <p><i>Animation of a timeline of the Big Bang overlaying a graphic of stars, followed by the outline of a brain adjacent to the words "Big Bounce." Graphic of the solar system in addition to drawn telescopes.</i></p>	<p>There are other theories about how the Universe began too. Some people think it wasn't a Big Bang but a Big Bounce, where a previous Universe collapsed and then expanded again. Those questions, ideas, and more are still up in the air. And new generations of scientists are out there right now looking through telescopes and microscopes trying to figure out what exactly started it all.</p>