**3 Ways the Universe is Trying to Kill Us | Sara Webb | TEDxSwinburne University**
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[0:00]
In the beginning, the universe was created. This made a lot of people very angry and has been widely regarded as a bad mood. What Douglas Adams portrays in these iconic words is just the complete absurdity of our own existence. The fact that in this world, in this life, it is so complicated and confusing and challenging. And yet, when you zoom out on the grand scale of the universe, it's nothing but completely insignificant.

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As an astrophysicist, this has always resonated pretty deeply with me, and I think it's because beyond the humour, obviously in these words, there’s actually a bit of truth. Adams picks out that I think resonates with anyone who studies the cosmos for just more than ten minutes. That is, that our universe is as awe-inspiring as it is completely indifferent.

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Our universe has zero obligation to, one, exist in the first place, and two, be habitable for life. And yet, here we are. These are the thoughts that keep me up at night, quite literally, as I ponder all of the cosmic catastrophes that could, if they wanted to, kill the Earth.

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So tonight, I want to share just three ways that the universe is trying to kill us and how we might survive. I want to start with a bang, quite literally, with Armageddon by asteroid. Now, obviously, this is the topic of epic Hollywood blockbuster movies. Some of the best and worst movies ever made. But it is also the topic of many of our nightmares. And that's because we've seen what happens when an asteroid hits the Earth.

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Only 65 million years ago, the dinosaurs were the rulers of this world. That was until one pesky asteroid slammed straight into the side of the Earth. Not only did it wipe out the dinosaurs, but we estimate that 75% of all animal species on the Earth's surface went extinct from this event.

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Now, I’m not going to lie to you. If this were to happen today, I have zero confidence that we would survive. So realistically, what are our chances? To understand this, we need to understand, well, are there asteroids similar to this one? And it turns out we're really good at finding asteroids. In fact, we have found 1 million of them around our sun and we track them pretty continuously.

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Now, if there is one asteroid that we could and probably should be afraid of, that is my friend Bennu here. Bennu was discovered in 1999, and it's about 500 metres in diameter—so a fraction of the asteroid that killed the dinosaurs. But this would certainly wreak havoc if it were to hit the Earth.

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Now, why Bennu is so terrifying is not just because it's big. It's because it's something called a near-Earth asteroid, meaning that every now and again it comes a little bit too close for comfort. So we've kept an eye on Bennu, and we've actually modelled the most dangerous time to be alive on this Earth as this asteroid approaches us. Turns out that the year 2182 will be that time.

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That is the most dangerous time to be alive, because Bennu has a small chance of hitting us. Now, I don't know about you, but I do not plan on being here for that event. But even if I was, I probably wouldn't be worried. And that's because this event only has a 0.05% chance of actually hitting the Earth. Peanuts, tiny.

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But I'm going to tell you, even if it had a 100% chance of hitting our Earth, I still would be cool, calm, and collected. Do you want to know why? Because we've tested technology to combat this. It's something called a kinetic impactor. Seriously. And it really is just throwing a spacecraft at an asteroid and watching it move. It's so simple and so basic. It's beautiful.

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We've already tested this back in 2022 with the NASA DART mission. They threw a spacecraft at a moon of an asteroid, proving that it imparted enough momentum for that moonlet to change its orbit indefinitely. So we have a way as humans to combat things like asteroids, and it's not what keeps me up at night.

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In fact, if I had to tell you the thing of my nightmares, it would be the possibility of an alien abduction. As of 2024, we’ve found no evidence for alien life. Nothing. Not a thing. And it's not through lack of trying. In fact, the first extraterrestrial searches began over 80 years ago. And in recent decades, we've doubled down on this effort. And yet, all of that searching, and we have nothing to show for it.

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You might be wondering why. A famous physicist, Enrico Fermi, actually pondered this back in 1950. He wondered aloud at a table of colleagues, "Where is everybody? Where is everybody?" As in, where are the aliens? And his logic was pretty sound. The idea is that we exist and we are pretty smart. We are technologically advanced. So why isn't anyone else? Why don't we see signals out there from other civilisations?

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It is a question that has quite literally plagued us for over 70 years because we don’t have an answer. One physicist tried to quantify it. His name was Frank Drake, and he came up with this idea of the Drake Equation. What this is, is a numerical way to put in some numbers that we already know about the universe, and the very fact that we exist, to understand how many intelligent species could there actually be in the universe?

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Now, if we solve this equation tonight for all of the things we know about our observable universe, and again, the fact that we exist, we get an incredible number. The number is 15.5 million intelligent species. That's how many we should expect in our universe. Now, before you get too excited or too worried, that is across the entire universe. Our galaxy alone has over 400 billion stars. Our galaxy is just one galaxy in at least 2 trillion.

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So you sprinkle 15.5 million species across the entire universe. The likelihood of a single galaxy having two intelligent species is next to none. It's almost depressing when we think about it, but it does mean that we are safe for now from an alien invasion. In fact, if I were a wagering person, I would say that our Earth and our world would actually end before we got any communication from life out there.

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And that brings me to our final cosmic catastrophe: the way that we really will die this time, unfortunately, and that is by the hand of our own sun. Our sun is our life giver. If we didn’t have its warmth and its radiation, this world would not be habitable. And yet it is. But just as it gave us life, it will one day yank that away very quickly.

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And that's because our sun has to die. Now, our sun’s death is not one that is a spectacular explosion, but rather it's a demure departure. You see, it will become something called a red giant. It will expand out, and then it will fade away into something called a white dwarf. It sounds magical until you realise that as it starts to expand, it gets closer to the Earth.

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We estimate that in 1 billion years, the sun will have expanded and increased its brightness so much that our oceans will start to evaporate. Shortly after, our atmosphere will be stripped into the lands of space. And if we’re very lucky, our sun will actually engulf the entire Earth as it expands 250 times the size it is right now. And that’s it. That’s the end of the Earth, and there's nothing we can do about it.

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And what is incredible about this is that even though our end is absolutely certain, I don’t think it will be the end for humanity. I have hope. A lot of hope that our curiosity and our drive for discovery will lead us to find something like an Earth 2.0, and humans will continue to exist somewhere else in the galaxy. We won’t know for sure, but that is my hope.

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And so what do you now do with all of this information? Does knowing any of this change your everyday life? No. Absolutely not. And it’s almost ironic because we know already we are finite beings. Every day we have, it’s cheesy, but it is a gift. Our existence was never guaranteed, is never guaranteed.

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And I think understanding our place within the cosmos can offer us this kind of cosmic perspective, this idea that we are part of something so much bigger than ourselves. So I want to leave you with just one more quote from Douglas Adams. Words of advice or words to live by, if you will. And that is, don’t panic. Thank you.