

A portrait of Max Tegmark, a cosmologist, smiling and wearing a light blue button-down shirt and a grey blazer. The background is a dark space with stars.

MAX TEGMARK COSMOLOGIST

Max Tegmark is a cosmologist at the Massachusetts Institute of Technology (MIT) and author of the book *Our Mathematical Universe*. He argues that our universe is just one bubble in a sea of parallel universes, known as the “multiverse.” He is also a big fan of Einstein’s work.

Q When did you first understand Einstein’s theories about space and time?

A My dad told me fun stuff about relativity when I was a kid. Then I had a course in college on special relativity [a theory Einstein published in 1905]. But I only really understood it when I took a graduate course at Berkeley.

Q What was that moment like?

A I was like, oh my goodness! I'm actually able to understand this! I wasn't expecting that. I'd always kind of assumed that this was something I would never understand.

Q What is so cool about general relativity?

A General relativity makes reality more fun. It transforms space from this boring, static place that Euclid envisioned to this dynamic entity that can stretch, curve into black holes, or ripple with gravitational waves. General relativity makes space come alive.

Q When space comes alive, parallel universes sprout up, right?

A Yes. If space can be stretched and curved in interesting ways, then in a single space-time, you can fit an infinite number of Level I multiverses. [See page 16.] That's the power of general relativity. It sounds pretty crazy that you could even put one infinite space into a finite volume. But you can. You know the end of the *Men in Black* sequel? They discover that their whole universe is inside of a locker in an alien version of Grand Central Station. Einstein's general relativity says that that's actually possible.

Q How do you define one universe?

A In astronomy, our universe is the spherical region of space from which light has had time to reach us during the 14 billion years since the Big Bang. Our universe is everything we could see with the best possible telescopes that could ever be built. Then the question remains: Is that all there is? Is there a sign saying "Warning! Space ends here. Mind the gap!"?

Q Probably not. So how many universes might be out there? Millions? Billions?

A Probably infinitely many. We all wondered as kids, "Does space go on forever?" And it sounds like a very innocent question, but it has all these wild implications, like parallel universes.



Cosmologists like Max Tegmark study the structure of the universe.

Q What's the most common argument against parallel universes?

A People think they are too weird, and reality shouldn't be weird. I say to them, "Our job as scientists isn't to tell the universe how to be! We have to find out how it is." We've seen again and again that reality is much weirder than we thought. I mean, Einstein discovered that if you go really fast, time slows down. That's pretty weird, don't you think? But it was totally correct.

Q What would you say to Einstein if you could sit and have a cup of tea with him?

A First of all, I would say thank you for ushering in this amazing scientific adventure we're on now. No one else has done as much for science. Also, I would want to tell him how his theories have succeeded beyond his wildest dreams. We've actually found the black holes predicted by his theory of general relativity. He might be a little frustrated, though. We still haven't succeeded in his last goal of the unified theory of everything. We're still stuck trying to unify gravity and quantum mechanics. But I would love to see what he thinks of our progress so far.

Kathryn Hulick lives in Massachusetts. She would ask Einstein what inspired him and what big questions he hopes kids today are thinking about.