

A JOURNEY THROUGH TIME

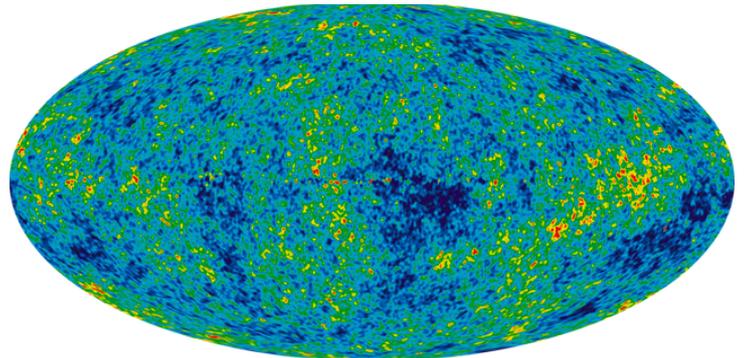


Kautilya Katariya

The Universe

The universe we know today is fascinating, enormous, and incredibly mysterious. However, it wasn't always that way. The early universe was very different from the one we know today. We started our journey approximately 14 billion years ago (some scientists still debate this number) when, according to the most widely accepted scientific theory, the universe was born. It started with just one atom, then exponentially grew in a period called cosmic inflation. It grew even faster than light for a fraction of a second! However, the rate of expansion slowed down quickly but was still relatively fast. Now, we enter the Cosmic Dark Ages, when—you guessed it—the universe was quite dark! This period lasts between proton decoupling (which we can still detect today as CMB-cosmic microwave background radiation) and the first stars.

More on the CMB: it tells us the temperature of the early universe 370,000 years after it was born. The red and blue spots are exaggerated, though, in reality, the red is only 0.002 degrees hotter than the blue.



However, these slight differences in density create stars, galaxies, and planets. Now, let's see how. Because of the temperature differences, multiple dust clouds emerge, which, with the help of gravity, start to contract (incredibly slowly, though). After tens of millions of years, the dust cloud finally fully contracts, and a star is born. However, most of the time, some dust and gas remain. For another few thousand years, these particles crash into each other and create rocks that smash into each other and repeat. Finally, after all the extra dust and gas are cleared up from the orbit of one of those rocks, it becomes a planet. In our solar system, we have eight planets and one star (the sun). Other systems could have two stars or three stars, and we have even identified one with six stars. At this time, the Earth is just a ball of flaming rocks.



Four billion years ago, a period called the Late Heavy Bombardment started. Multiple asteroids crashed into Earth, including one dwarf planet, Theia. The dwarf planet's collision caused a chunk to break off of Earth and eventually form the moon. The asteroids, comets, and dwarf planets added lots of water to the Earth's surface, but as the temperature was too high, it quickly transformed into water vapor. Around 3.8 billion years ago, the Earth cooled down to support liquid water. The water vapor in the air immediately began to cool and fall to the ground as rain. Around that time, 3.8 billion years ago, the first life forms began to emerge. They were called microbes and are too small to see with the naked eye. Microbes and other single-celled organisms started to dominate the oceans. Soon, land emerged in what is now the Singhbhum region of India 3.2 billion years ago. Bacteria quickly began to spread over this new territory. There were already many microbes, but 600 million years ago, multi-cellular life emerged. It was called *Grypania spiralis*, and it was clear they had a massive advantage. They were one of the factors causing the Cambrian Explosion when sea life began to flourish.



Not too much later, 500 million years ago, the first land plants on Earth started to emerge. The first were simple, non-vascular plants such as mosses and liverworts. Then, arthropods, such as millipedes and arachnids, began the transferral to land. And finally, amphibians and other tetrapods first appeared on land 360 million years ago. Also, dinosaurs and mammals appeared 250 mya (a million years ago).



Then, an enormous extinction event was triggered by an asteroid crashing into the Earth's surface 66 million years ago, and the dinosaurs were wiped out. Only 1/4 of life on Earth survived this major impact. Turtles, mammals, snakes, lizards, frogs, and birds were the survivors. The mammals began to evolve into many different species, such as humans. One of the earliest known humans is *Homo habilis*, or "handyman," who lived about 2.4 million to 1.4 million years ago in Eastern and Southern Africa. The reason for their extinction is debated, but it is most likely that *Homo Habilis*'s technology did not adapt to the changing climate (we have the same issue today!). *Homo Habilis* and *Homo Rudolfensis* created a new member of the homo family, *Homo sapiens* (that's us!).



The expansion of modern humans was rapid and exhilarating. First, we expanded towards the Middle East, Asia, and Europe 56,800 years ago. Then Australia was 50,000 years ago. Then Russia was 42,000 years old. However, it would take a while for us to get there because of the oceans separating America and Asia. However, between 35,700 and 11,700 years ago, the Ice Age occurred as a result of it getting colder, which allowed more ice to form and caused the weather to become cooler. Ice combined all the continents so the North and South American continents could be observed (16,000–14,000 years ago). Most of the Earth was finally uncovered to humans. It would be a while, though, before reaching Antarctica and the Arctic. Then, 8,000 years ago, humans created the very first boat. This was a breakthrough, as people could finally navigate the ocean. Then, the first civilizations emerged: Egypt, Mesopotamia, and the Indus River Valley. The first cultures truly interested in navigating oceans were the Greeks and Chinese 7,000 years ago. They used boats primarily for fishing but also sometimes for trading.



However, the Phoenicians were roaming the world with their ships 3000 years ago. They used stars for navigation and songs to remember how to do so. They arrived in Cyprus, then in Crete, and multiple cities, including Carthage, Cyrene, Leptis Magna, Gadir, and Tingi. The Polynesians also achieved a similar feat slightly earlier (4,000 years ago). They originated within the Southern Hemisphere, so they had to use considerably more complicated navigation, using the southern cross. To make the feat even more astonishing, they sailed thousands of miles from Taiwan to South America! These two were clear believers in the power of sea dominance.



It has paid off with their investment in sea infrastructure as the cultures exploring the sea started to flourish. Humans reached 50 million in population, a significant milestone. At this time, Assyrians were leading in weapon technology, inventing the battering ram in 850 BC. They also discovered how to make steel and used it a lot in battles. Meanwhile, in Athens, in particular, the Greeks started becoming the center of knowledge and philosophy in 500 BC. After that, the Mauryan Empire was formed in 321 BC and would be the first to encompass most of India. Jumping ahead to 43 AD, the Romans had finally subdued the last of the Celtic tribes in England, and they now ruled the country. After their swift exit in 383 AD, the Anglo-Saxons took control of Britain. In 1300 AD, Europe finally overtook most of the world to be some of the most technologically advanced. Armed with superior technology, they managed to start taking over the world in 1500 AD.



The universe is so big that it may seem like it will never end. However, nothing lasts forever! In a long time (scientists aren't sure when), the universe will come to an end in one of three ways.

The first way is heat death. This will happen if dark energy stays constant so that galaxies hurtle away from each other.

The second way is the big rip. This will happen if dark energy gets stronger so that even molecules hurtle away from each other.

Finally, the last way is if dark energy gets weaker so that even faraway stars fly towards each other.

However, this will not be how long the solar system or Earth lasts. This is just the universe. In 5 billion years, the sun will completely engulf the Earth, and the solar system will last for about 6 billion years after the sun turns into a white dwarf.



Kautilya Katariya got a top-grade A*/9 in GCSE (same as the 10th Board India exam) mathematics result while still studying in class 3rd in his school at Northampton when he was only eight years old.

He is currently pursuing an A-level exam (equivalent to India's 12th Board exam) at the age of 10, along with studying in his regular 5th grade class.

Along with mathematics, Kautilya also self-taught computer programming by using free online resources (MIT, Stanford University, and IBM artificial intelligence) available at home in all the free time he got during the COVID lockdown. He held the Guinness Book of World Records for 'Youngest Computer Programmer' at the age of 6 before the title was discontinued. He is currently self-learning, competing with university and professional programmers in coding. He is an IBM-certified artificial intelligence professional as well.

Kautilya is taking the initiative to build a portal or platform ('TheDeciphers') to build a community to help, discuss, and connect with passionate people like himself to come together online and solve problems, share their thoughts, and develop mathematical and computational thinking in the process.

Some of his achievements

- 1. At the age of 8, he got a gold medal in the Intermediate and Junior Mathematical Challenges organized by UKMT (United Kingdom Mathematical Trust).**
- 2. Kautilya was invited by the Prime Minister's Office, UAE, to participate and address the world leaders gathering at the 'World Government Summit, 2022' about 'How he became a programmer so young and how the government can support young talent like himself'.**
- 3. Kautilya is an associate member of 'The Masason Foundation in Japan.'**
- 4. Kautilya was invited and spoke at many programming conferences and summits around the world.**

katariya.i@gmail.com