ADVENTURES OF THE PRIMORDIAL ATOM

In the beginning, there was nothing: no space, no time.

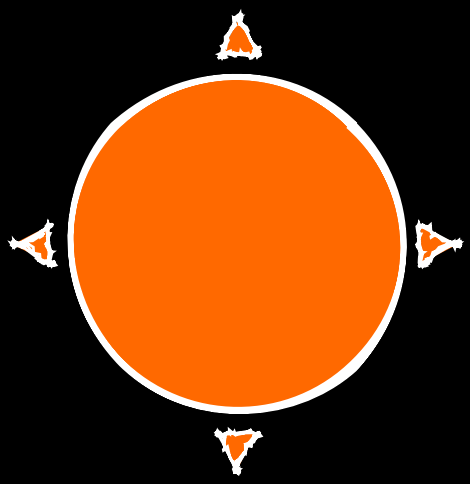
Now, of course, we can't really say "beginning", because there was no time.

0 SECONDS ABB

All of a sudden, there was everything: "[all matter in] a spot so infinitesimally compact that it has no dimensions at all" (Bryson).

This is the primordial atom — also known as a singularity.

10^{-43} SECONDS ABB

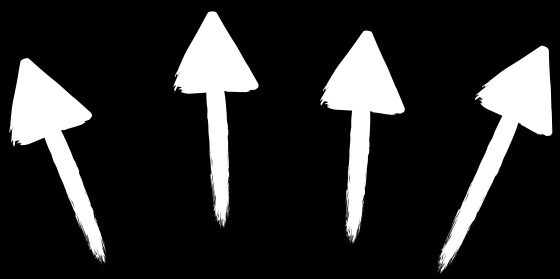


The universe undergoes a sudden "inflation", expanding from the size of an atom to the size of a grapefruit.

10^{-36} SECONDS ABB

The universe is unimaginably hot, unimaginably dense, and expanding at an unimaginably fast rate.
As it expands, it cools, however.

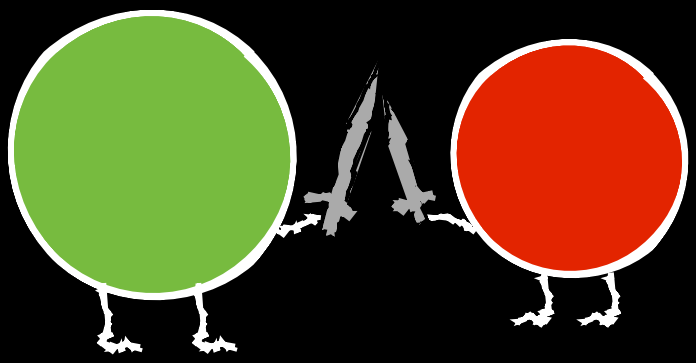
10^{-36} SECONDS ABB



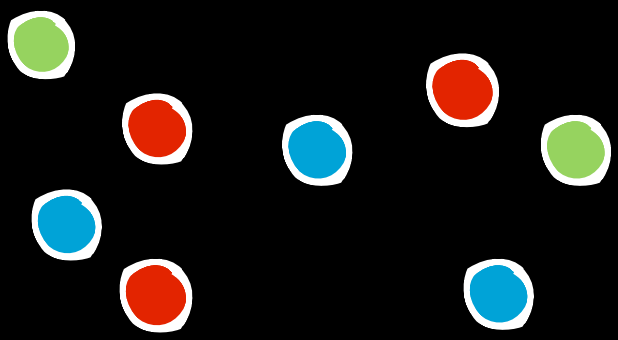
Four types of energy appear: gravity, electromagnetic force, and the strong and weak nuclear forces

10^{-32} SECONDS ABB

The particles were of two opposing kinds: matter and antimatter. "[They annihilated] each other on contact… [but] a slight — and by that we mean about one-billionth of 1 percent — excess of matter over antimatter was enough for matter to take hold in the universe" (Shubin).



10^{-12} SECONDS ABB



This energy congeals to form matter — and the first forms of matter in the universe are quarks.

10^{-6} SECONDS ABB

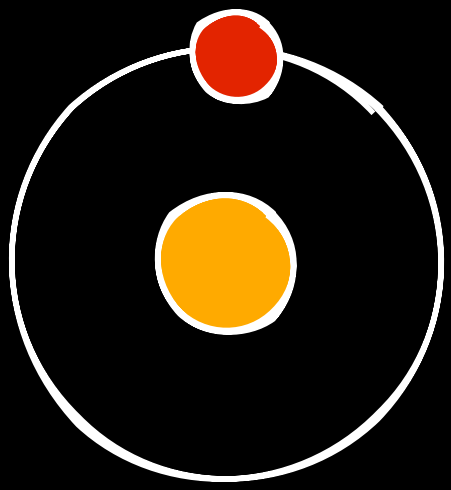
These quarks combined in triplets to form protons and neutrons, and, very quickly, at 10^-3 seconds after the Big Bang, electrons also appeared.

3 MINUTES ABB

This is because there's too much energy. Instead, we enter what's called a plasma universe. Now, the universe is about 10 billion degrees hot and 100,000 times as dense as a piece of rock.
The universe is dominated by these charged particles — protons and electrons — that cling to photons of light, and, because of this, there is no light in the universe.

377,000 YEARS ABB

The universe has now cooled down to 3000°K. This temperature is just right for the charges of protons and electrons, making them powerful enough to bind them together. Thus, hydrogen and helium nuclei finally form, and "this new combination of electrons with atomic nuclei set the stage for reactions that underpin every moment of our lives" (Shubin)



380,000 YEARS ABB

The Dark Ages, as some scientists have dubbed this period of time, ends. This is the moment when all of the matter went electrically neutral, and photons of light came out in a great flash of energy. This flash can still be detected today and it is known as Cosmic Background Radiation.

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