An ever-evolving universe

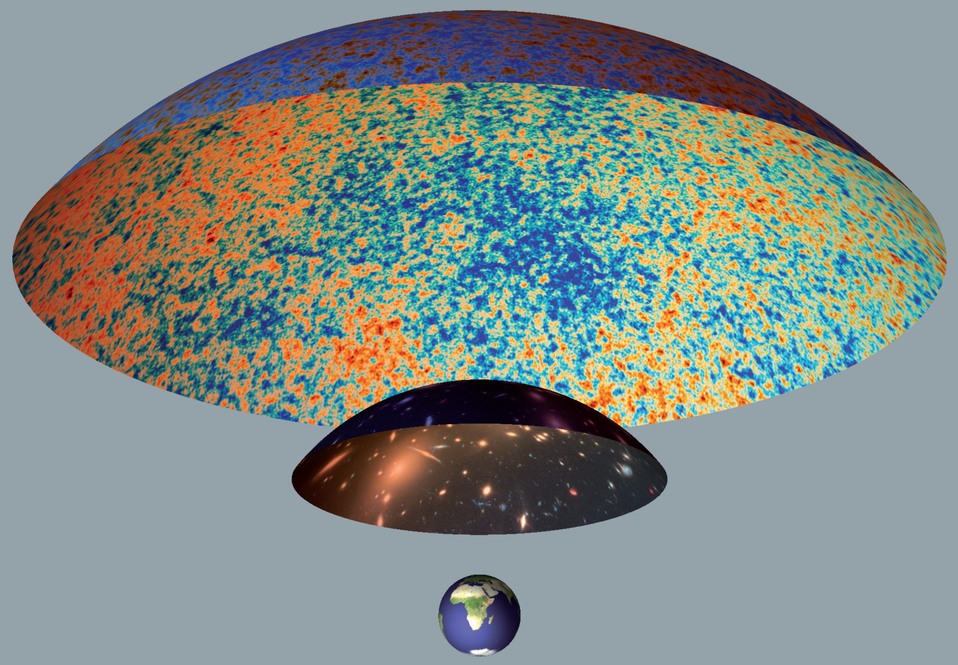
The age of the universe

The universe cools down as it expands. Therefore, we can estimate the age of the universe by measuring its temperature. According to theory and the latest observations, the universe is around 13,800 million years old.

The size of the universe

Although theory predicts that the universe may be infinite, only the so-called 'observable universe' is accessible to us. This is limited by the furthest light that has had enough time to reach Earth since the Big Bang.

The size of the observable universe (around 45,000 million light years) is much larger than the distance that the light has travelled during the lifetime of the universe. This is due to the expansion of spacetime.



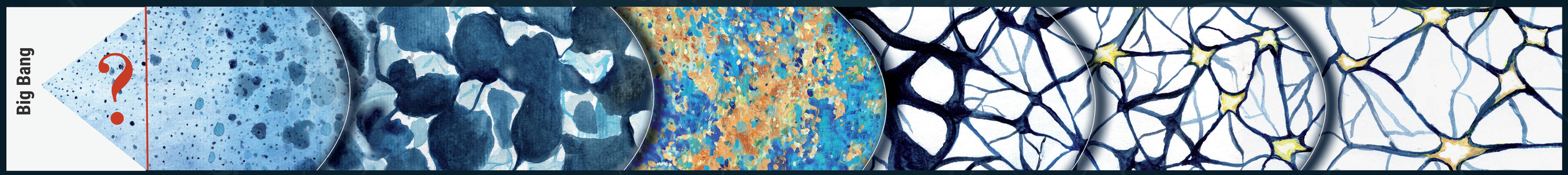
The further away we look, the younger the universe we see is.

This is because the light we observe has to travel further to reach us, so the light from very distant objects was emitted very long ago.

In the beginning, the universe was very dense and extremely hot. Since then, it has never ceased to expand. Some 380,000 years after the Big Bang, the universe cooled down enough to allow the first atoms to form. Only from this moment on, could light propagate freely. Therefore, this is the oldest light we will ever observe: the cosmic microwave background.

The cosmic microwave background is the footprint left by the early universe and can tell us what it looked like. It was formed by radiation, ordinary matter and dark matter. It was extremely homogeneous, with small 'overdensities'. These denser regions grew up because of gravitational attraction and ended up forming the galaxies we observe nowadays.

Illustrations of the history of the universe and how we observe it from Earth.
Top illustration (ICCUB; background images: cosmic microwave background map (ESA/ Planck Collab.), cluster of galaxies (NASA/ESA/P. U. C. Chile), Earth (P.D. [CC])). Bottom illustration (ICCUB, inspired in the illustration "Cosmic History" (ESA)).



10^{-32} seconds

Inflation

Still without definitive experimental confirmation, this theory predicts an extremely fast expansion of the universe.

10 seconds

Nucleosynthesis

Neutrons and protons bond together to form the first atomic nuclei.

380,000 years

Cosmic microwave background

First atoms form. Light and ordinary matter become separated.

300-500 m.y.

Dark epoch

Atoms feel the attraction of dark matter and become part of the cosmic web.

1,000 m. y.

First stars

The universe is luminous again. In the densest regions the first stars are born. These start to cluster and form the first galaxies.

13,800 m.y.

Current universe

Cold universe in which spacetime is expanding at an increasingly fast rate.