THE BEGINNING AND END OF THE UNIVERSE

Petros Kronis
(Mechanical/Structural and Research Engineer)
petros.kronis@gmail.com
www.kronis.tech

Initially, scientists believed that the universe was static, since that was what the observations of the time showed. That is, they believed that there was a balance between gravity which tends to compress matter towards a central point and energy which tends to create centrifugal expansive forces. During the 1920s, astronomer Edwin Hubble and others observed that the Universe is expanding, showing that most galaxies are moving away from our Milky Way and the farther away they are, the faster they are moving.

Extrapolating this cosmic expansion back in time, using the known laws of physics, the models describe an increasingly concentrated universe starting from a single point, the so-called Big Bang Singularity. Since then, detailed measurements of the universe's expansion rate place the Big Bang Singularity at about 13.8 billion years ago, representing the age of the universe.

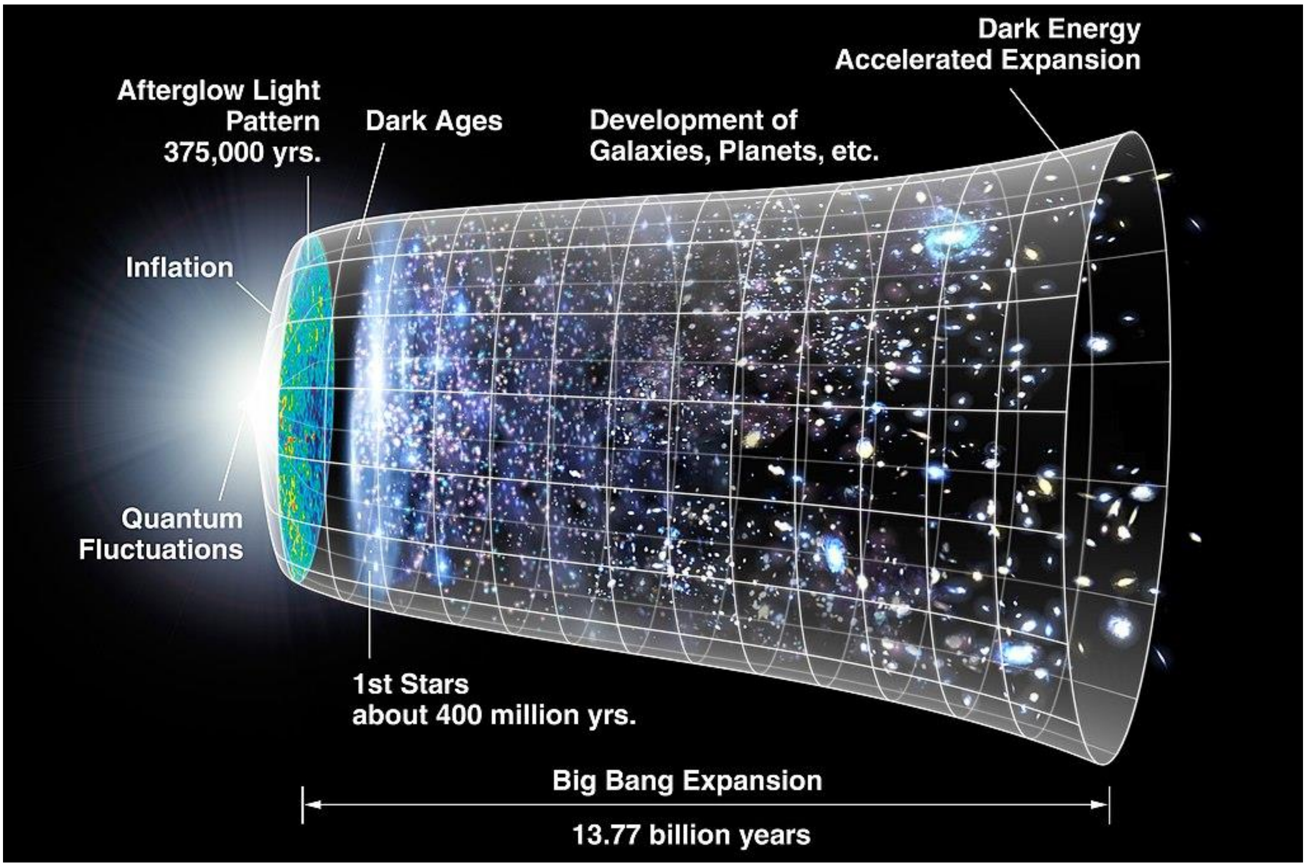
Einstein was initially skeptical about the expansion of the universe. In 1917 he introduced a term called the Cosmological Constant in the theory of General Relativity to compensate for the effect of gravity and achieve the effect of a static universe. On January 29, 1931, Hubble invited Einstein to Mount Wilson to see the observations being made with the famous 100-inch telescope. After this, Einstein was forced to admit that he was wrong. However recently scientists have revived Einstein's Cosmological Constant to explain the mysterious force called Dark Energy that appears to counteract gravity, causing the universe to expand at an accelerating rate. The best current measurements show that dark energy contributes 68% of the total energy in the present observable universe. In Einstein's Theory of Relativity there is also the famous equation of mass-energy equivalence, E = m c2 (E=Energy, m=mass and c=speed of light) which describes the creation of mass from energy during the Big Bang.

According to the Inflation Theory, the universe initially expanded at enormous rates in volume, to a radius of about 10.6 light years (about 100 trillion kilometers). A much slower and gradual expansion of space continued after that, until about 9.8 billion years after the Big Bang, when it gradually began to expand more rapidly, and continues to do so to this day. Various astrophysical observations, including gravitational effects that cannot be explained by currently accepted theories of gravity, show that there must be more matter than we can see in the universe. This matter was named "Dark Matter" since it is invisible and is estimated to make up 85% of the total mass of the universe.

The Hubble Space Telescope, named after the famous astronomer, has the ability to observe the universe as it existed 480 million years after the Big Bang, since light reaching its lenses began 13.32 billion years ago. The more advanced James Webb telescope recently launched into space will be able to observe the universe as it was young 200 million years after the Big Bang.

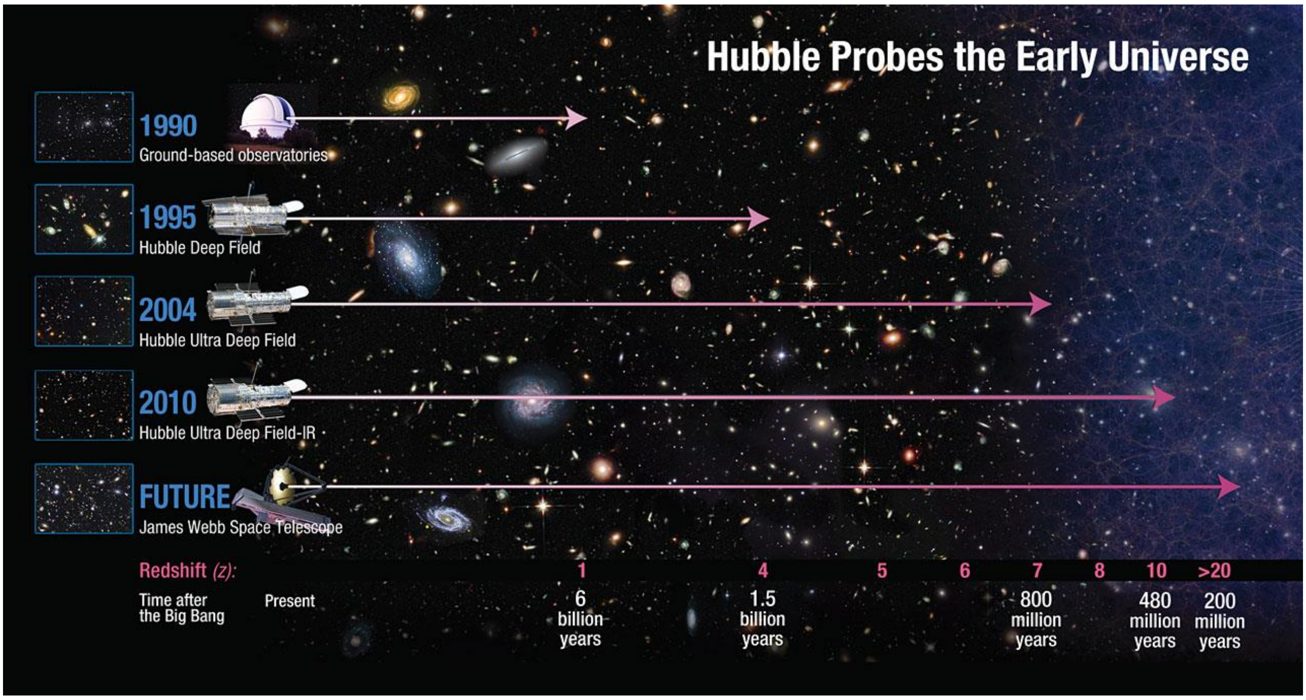
With this data, three theories stand out among many. One, called the Big Crunch, holds that gravity will eventually prevail and the universe will return to contraction and a subsequent Singularity. Another one is the Steady State theory with the creation and addition of new matter to the universe that balances the expansion. The third theory, which seems to be the most accepted today, holds that energy will prevail, expansion will increase, stars will die out due to lack of fuel, while matter will dissolve into an infinite void.

To end on an optimistic note, we must say that there is also the theory of Parallel Universes which holds that besides our own universe, there are many others (probably infinite) which are born and die ad infinitum.



The expansion of the universe

https://en.wikipedia.org/wiki/Big_Bang



How far back in time can telescopes see