History of the Entire Universe[1]

The Big Bang is believed to have taken place between 15 and 20 billion years ago.

10^{-45} seconds – Some say gravitation was quantized, but no one really knows.

10^{-35} seconds – The four forces of nature are no longer unified as the strong nuclear force is separated from the electroweak force. This causes the inflationary period, in which the universe expanded very rapidly, and during which time, many of the anti-particles were annihilated, which is why we have more matter than anti-matter today.

10^{-32} seconds – Inflation ends. Universe is entirely made up of photons, quarks, antiquarks, and gluons. At this time there are no protons, and therefore no elements.

10^{-12} seconds – Weak nuclear and electromagnetic forces separate.

10^{2}-10^{3} seconds (within first 15 minutes) – Nucleo genesis – hydrogen and some other light element begin to form.

10^{11} seconds (about 1000 years) – Matter begins to dominate the universe.

10^{16} seconds (about 100 million years) – First generation stars, galaxies and planets form.

10^{18} seconds (about 10 – 20 billion years) – The present. Radiation left over from the big bang is about 3^{o}K. It appears that universe is expanding and based on current measurement of the density of the universe, it will continue to do so forever.

10^{40} seconds (about 100 thousand trillion trillion trillion years) – Protons decay, leaving nothing but scattered radiation throughout the universe.

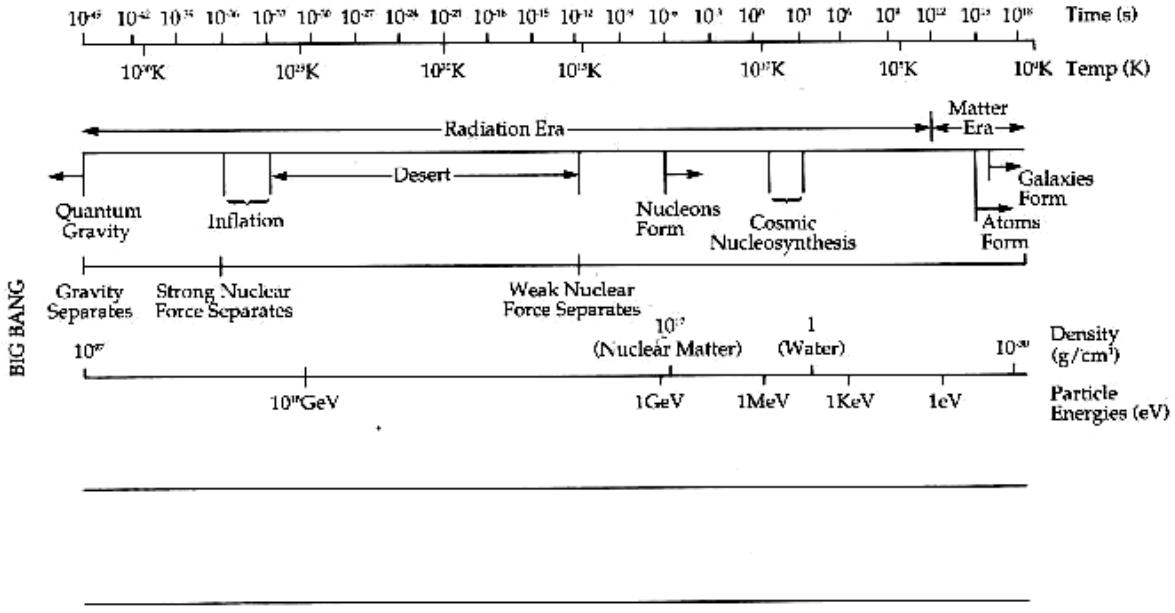

FIGURE 26–2 History of the Universe. All the horizontal axes are actually coincident. The history proceeds from the Big Bang on the left to today on the right.

[1] Taken from Zeilik, Michael; Gregory, Stephen A.; and Smith, Elske v.P. *Introductory Astronomy and Astrophysics.* Forth Worth: Saunders College Publishing, 1992. P. 503.