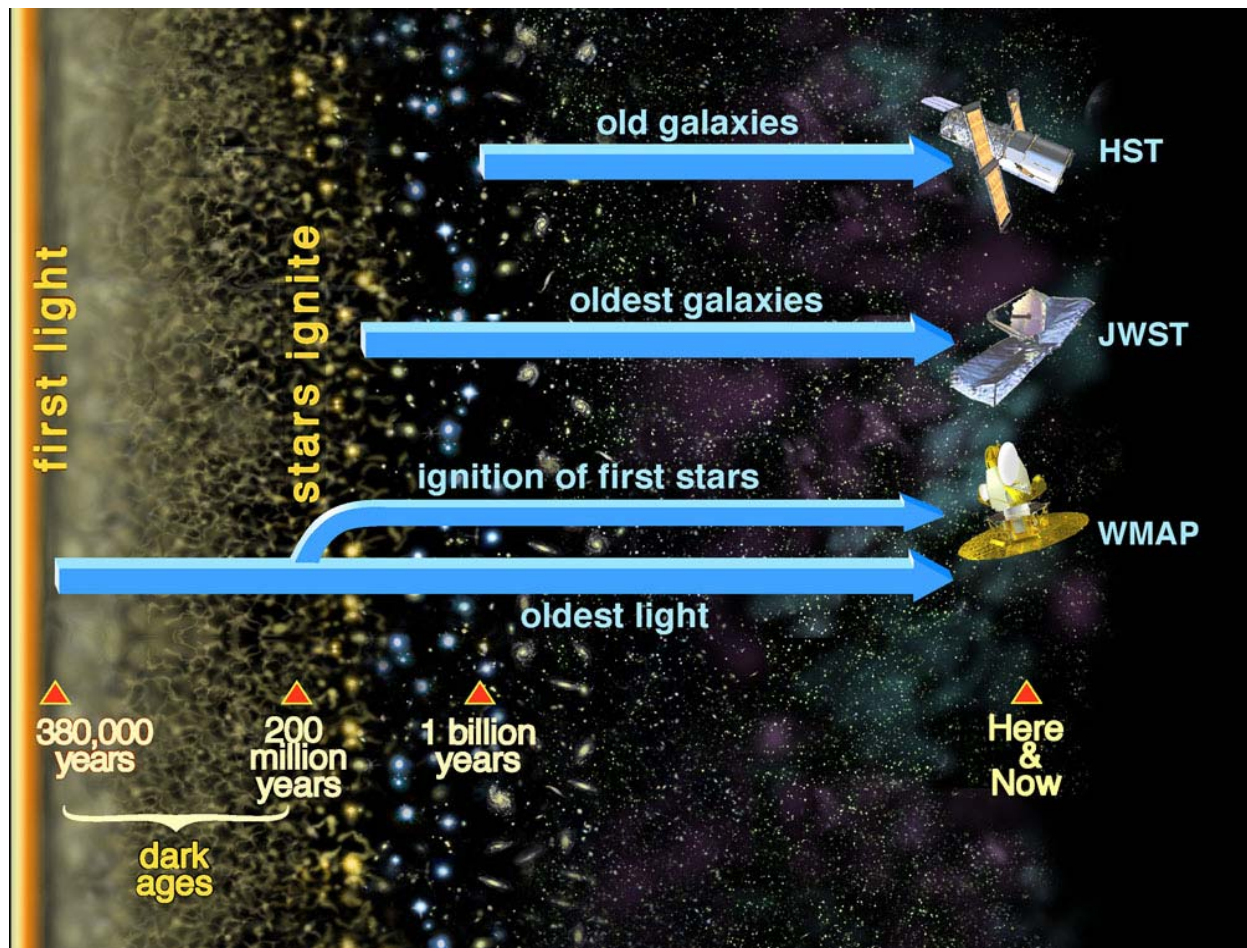


# History of the Universe



Credits: NASA, WMAP Science Team.

## Early history of the universe in a nutshell:

The beginning of our physical universe was the beginning of its time, space, matter and energy. It was unimaginably hot and dense everywhere. It was filled with light, but the light was scattered, as if in a fog. Space expanded tremendously. Finally, after about 380,000 years, atoms (mostly hydrogen) began to form and the universe became transparent to light. At this time, the temperature of the gas was 5000 degrees C – the temperature of the surface of our sun today. There were slight random variations in its density and temperature. The gas continued to expand and cool, causing the glow to shift from yellow to orange to red to infrared. The whole universe became darker and darker until 200 million years had past. By this time, the denser regions of gas had gathered by gravity into dense clumps, which heated up, and once again the universe was bathed in brilliant light – this time from points of starlight everywhere. After a billion years, these stars and gas drew together by gravity to form galaxies – spirals or oval-shaped blobs of billions of stars. The galaxies continued to evolve, drift into clusters and collide with each other. Stars in the galaxies gradually burned up their hydrogen fuel and exploded, spewing atoms of heavier elements like carbon and silicon and oxygen into clouds of gas and dust. These in turn gathered by gravity into new stars, this time containing the heavier elements. Many of the stars formed spinning disks that condensed into planets. On at least one of the planets, which formed 4.5 billion years ago, conditions were stable enough to sustain liquid water over billions of years, and complex carbon-based molecules were present in abundance. Thus the stage was set for life to flourish on earth.

Today on earth we can look back in time by looking back into distant space with instruments like the Hubble Space Telescope (HST) to see the early galaxies, and the Wilkinson Microwave Anisotropy Probe (WMAP) to see the cosmic background radiation. In a few more years NASA plans to launch a more powerful telescope, the James Webb Space Telescope (JWST) to see the earliest, most distant galaxies and also – maybe – planets revolving around nearby stars.

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