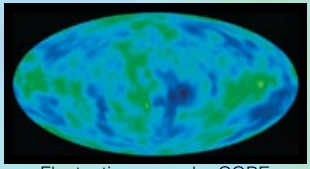
Looking Back In Time



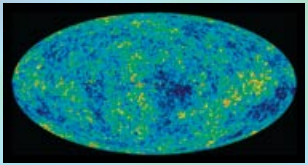
Fluctuations seen by COBE

The Big Bang theory predicts that our universe emerged from a tremendously dense and hot state about 13.7 billion years ago, and has been expanding ever since.

At first, photons of light were completely trapped by the cloud of hot, charged, primordial matter that made up the early universe in much the same way sunlight is obscured on an overcast day. As the Universe continued to expand, it began to cool, and there came a point in time when the interactions subsided enough to allow the light to escape into space.

When scientists measure cosmic microwave background radiation (CMB), they capture a glimpse of the faint "afterglow" of the radiation that initially escaped into space about 379,000 years after the Big Bang and has only now reached the Earth. The CMB is very "cold" (2.725 Kelvin) and can only be "seen" in the microwave region of the electromagnetic spectrum—between 20 and 100 gigahertz. When scientists first measured CMB, it appeared the same across the entire sky, but as observations improved, it soon became apparent that this was not the case. Tiny fluctuations in CMB provide scientists with great insight into the origin, evolution, and content of the "infant" universe.

Maps of the cosmic microwave background have been produced in the 1990s by NASA's Cosmic Background Explorer (COBE)—top left—and more recently by the Wilkinson Microwave Anisotropy Probe (WMAP)—bottom right. Both maps depict an all-sky picture of the infant universe, when it was about 379,000 years old. The signal from our galaxy has been removed. Note that WMAP detects much finer features than are visible in the COBE maps of the sky. Hot regions, shown in red, are 0.0004 Kelvin hotter than the cold regions, shown in blue and purple.



Fluctuations seen by WMAP

wmap.gsfc.nasa.gov

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