Cosmic microwave background radiation

Cosmic Microwave Background Radiation The Big Bang theory predicts that the early universe was a very hot place and that as it expands, the gas within it cools. Thus the universe should be filled with radiation that is literally the remnant heat left over from the Big Bang, called the " cosmic microwave background radiation", or CMB. The CMB is an almost-uniform background of radio waves that fill the universe. The CMB is, in effect, the leftover heat of the Big Bang itself - it was released when the universe became cool enough to become transparent to light and other electromagnetic radiation, 100, 000 years after its birth. At this time, the universe was filled with a hot, ionized gas. This gas was almost completely uniform, but did have slight deviations - spots that were slightly (1 part in 100, 000) more or less dense. " The slight changes in the intensity of the CMB across the sky (deviations of only than 1 part in 100, 000) give us a map of the early universe" (Griswold). The study of the CMB is an extremely rich subject which has revolutionized the study of cosmology. According to several studies, in its early days, the universe was extremely smooth and homogenous. At the time the CMB was released, for example, its density was constant to about 1 part in 100, 000. It is believed this smoothness comes about because of inflation, a time of extremely rapid expansion in the first 10-34 seconds or so of the universe's existence. " This rapid expansion smoothed out any lumpiness the universe may have initially had, but quantum mechanical fluctuations introduced new ones - tiny fluctuations of density at all length scales" (Griswold). " These tiny fluctuations have grown with time due to gravity (slightly denser regions attract more stuff to become denser yet), eventually providing the seeds for the galaxies and galaxy clusters we see today" (Griswold). This lumpiness affects the CMB largely because of gravitational red shifting. It is said that radiation emitted from a dense spot in the sky has to fight against a bit of extra gravity as it heads toward our detectors. When it leaves that gravity well, the radiation will be a little less energetic than radiation emitted from a less-dense region, so that spot of the sky will appear to be a little colder. In the next decade or so, many new CMB experiments are planned. “ The Planck satellite is expected to study the CMB in even greater detail than WMAP was capable of" (Griswold). The main focus will be on measuring the polarization of the CMB, an early measurement of which is described in the lower part of the plot at right. Studying the polarization will give us new windows onto the physics of the early universe, perhaps even letting us learn about some of the details of inflation itself. I think this is amazing stuff! Learning about Cosmic Microwave Background Radiation was interesting. It is important to understand why there are scientists out in the world studying the cosmic microwave background. I am now more aware of the importance of CMB and how it relates to the Big Bang theory. Bibliography Griswold, Britt. " WMAP Big Bang CMB Test." Wilkinson Microwave Anisotropy Probe (WMAP). Dr. Edward J. Wollack. Web. 11 Apr. 2011. .