

15.0: The Cosmic Microwave Background Introduction



This video contains no audio

The opening movie begins with a perspective on our place in the Milky Way Galaxy, in the spiral arms of the disk. Looking out at the night sky, we see the disk of our Galaxy as a band of stars. The movie then shows a grid of coordinates, the Galactic equivalents of latitude and longitude. These coordinates can be spread out into an ellipse, called a Mollweide projection, so that all positions on the sky can be seen at once. Next, the movie shows us views of the sky in different wavelengths, from visible light, to infrared, to microwave. At microwave wavelengths, there is a nearly uniform glow coming from all directions in the sky. In the final segment of the movie, the contrast on the map is dialed up, so that we can see the tiny variations from place to place in the microwave sky.

Since its discovery in 1965, the cosmic microwave background (CMB) has provided some of the most important observational constraints for our theories of the nature and evolution of the Universe. The CMB is a glow of microwave light coming from every direction in the sky. Together with the abundances of the lightest elements and the Hubble expansion, it is one of the key observational pillars supporting the Big Bang theory. We can make several types of measurements of the CMB, each of which we will discuss in detail in this chapter. To date, there have been over 50 experiments either completed or ongoing to observe the CMB. The instruments used to measure the CMB feature components similar to devices we use in everyday life. They have features in common with radio receivers, satellite dishes, televisions, cell phones, and microwave ovens. In fact, if you want to observe the CMB yourself, find a TV with an antenna and switch to a channel on which no station is broadcasting; a small fraction of the "snow" pattern is the CMB. You might need an older-model TV for this, as newer models generally display a blue screen on any channel without a signal. If you have an FM radio, a small fraction of the static between stations is also the CMB.

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