

The Big Bang - How Did It All Start?

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Until around 100 years ago, most astronomers believed the "spiral" nebulae that they saw in their telescopes were located inside our Milky Way galaxy and, indeed, that the Earth was near the center of the universe and that the universe had basically always been the same. Over the last century, scientists have made several monumental discoveries that have altered nearly all of these assumptions.

The first of these discoveries was one that was made by Edwin Hubble (building on work by Henrietta Leavitt). By studying the variation in the light emitted by a special type of star called a Cepheid variable, Hubble was able to show that the Andromeda "nebula" was really a galaxy and was located outside the Milky Way (he thought it was about 600,000 light years away, and current measurements now put the figure at 2.2 million light years away). He also determined that the farther away galaxies were the faster they were receding from us. About this same time, George Lemaitre used the, then new, general theory of relativity to make essentially the same prediction. Hubble's measurements showed that the universe was expanding. This, in turn, implied that everything must have been much closer together in the past. In fact, if one went far enough back in time, the equations indicated that the universe must have been infinitely dense and infinitely hot at some point in time and have expanded in what was to become known as the "Big Bang".

While the evidence for expansion was accepted by most of the scientists of the time, the assertion that this meant that the universe had, at one time, been infinitely small at some point in the past was not accepted until the mid 1960's. At that time, two researchers at Bell Labs in New Jersey, Robert Wilson and Arno Penzias were trying to explain why their radio antenna was picking up a background "hiss" when they pointed it at the sky. Try as they might, these two could not find a source for this noise and concluded that it was real. When physicists did some calculations, they concluded that the remnant heat from the big bang would be exactly at the temperature that Penzias and Wilson measured.

Between the measurements of the Cosmic Microwave Background (remnant heat from the big bang) and those made by Hubble, the Big Bang theory of the universe has become the accepted theory of the creation of the universe. The Big Bang Theory states that approximately 13.7 billion years ago, both space and time were created from an incredibly dense, incredibly hot collection of energy (also called a singularity). Since that time, the universe has been expanding and cooling.

The Big Bang Theory also predicts that the universe will keep expanding indefinitely (with modern science suggesting that the expansion rate is increasing) and that in the far future, all of the galaxies will recede beyond our current event horizon.

While we can't show you the Cosmic Microwave Background, if you will join us at the Community Observatory, a gift of the Cameron Park Rotary Club, we can and will show you the distant galaxies that Hubble used in his pioneering work and explain how far away they are. For more information about the observatory and driving directions go to www.communityobservatory.com.