This is because it takes time for light from distant objects to reach us. We see the sun as it looked about 8 minutes ago... other stars as they looked years ago... and distant galaxies as they looked millions or even billions of years ago. When we look at these extremely distant galaxies, they appear more primitive than galaxies closer to us, because we are seeing what they looked like billions of years ago.

Distant Galaxies Are Less Evolved

Redshift

Most galaxies show redshift, that is, the observed light appears longer, towards the red end of the spectrum. Only a few galaxies show blueshift, indicating that they are moving towards us. This is due to the Doppler Effect, wherein the source of the waves moves towards you and the frequency of the sound or light increases. When the source moves away from you the wavelength increases and the frequency of the sound or light decrease. The entire Universe is spreading apart, with distant galaxies speeding away from us in all directions. Therefore, if we reverse the clock to 13.8 billion years ago, everything in the Cosmos started out as a single point in space.

Why Evidence Matters

These pieces of evidence, along with additional observations, make the Big Bang one of the most well supported theories in cosmology. Cosmologists have a good idea of what is going on, and as time progresses will be able to come up with new experiments that will further refine our understanding of the universe's history.

What is the Big Bang?

The Big Bang is the theory that the universe started as a single point (the singularity) that became unstable and exploded outwards about 14 billion years ago, marking the beginning of time, space, energy, and matter.

Composition of the Universe

98% or more of normal matter in the universe is composed of hydrogen and helium, the simplest two elements. Hydrogen is the most common at 74-75% and helium makes up 24-25%. This gives the universe composition we would expect if it once acted as a giant star, fusing hydrogen into helium. The rest of the elements are formed from fusion in stars or in the case of elements heavier than iron, supernovae.

Dark Matter and Dark Energy

The expansion of the universe appears to be accelerating, not decelerating as would be expected from the force of gravity alone. In order for the universe to accelerate, a force must be pushing all of the galaxies away from each other, and this force must be strong enough to counteract the deceleration by gravity. Today, we do not know what is the exact cause of this force, just that it exists. Since we call the matter that we cannot observe directly "dark matter," we call this new mysterious force (or equivalently, the energy provided by this force) "dark energy".

Cosmic Background Radiation

In the mid-1960s, Arno Penzias and Robert Wilson detected leftover heat from the Big Bang in the form of microwave radiation coming from all directions in the sky. Theories predicted that the huge release of from the Big Bang would be moving away from us fast enough to shift its wavelength from visible light to microwave radiation. Enough heat remains that the entire sky measures a few degrees above absolute zero.