

APPENDIX

SCIENTIFIC DATING METHODS

AGE OF THE UNIVERSE

Cosmologists believe the Universe is between 12 and 20 billion years old. When astronomers use their giant telescopes to take pictures of distant galaxies and stars, it is possible to take pictures of what the Universe looked like in the past. This was because the light generated from a remote galaxy would take millions and even billions of years to travel to a telescope here on Earth.

To determine how far away a light-emitting galaxy is in the first place, astronomers evaluate the brightness of the star or galaxies of stars. It is roughly the same method used by the driver of a car on a moonless night to judge the distance of an approaching car. The farther away the approaching car is, the dimmer will be its headlights. As the car comes closer, the headlights become brighter. The same is true for galaxies. The closer they are, the brighter is their light. Those that are far out in space are very dim indeed.

To measure the speed and distance of galaxies far out in space, astronomers use what is known as the "red shift" effect. As a galaxy moves away from Earth its color becomes redder in the same way that a receding automobile horn or train whistle becomes deeper in tone as it moves farther and farther away. Visible light is basically a train of waves in space. As a lighted object moves away from a viewer, its light waves appear stretched out or lengthened by the receding motion.

Our eye perceives the length of light waves in the form of color. We perceive short light waves as blue (an advancing object) and longer light waves as red (a receding object). In a process called spectrographic analysis, scientists are able to compare the colored spectrum of light from a distant galaxy with the color spectrum from a source that is not moving relative to the Earth. They are then able to determine the degree of red shift in a receding galaxy's color