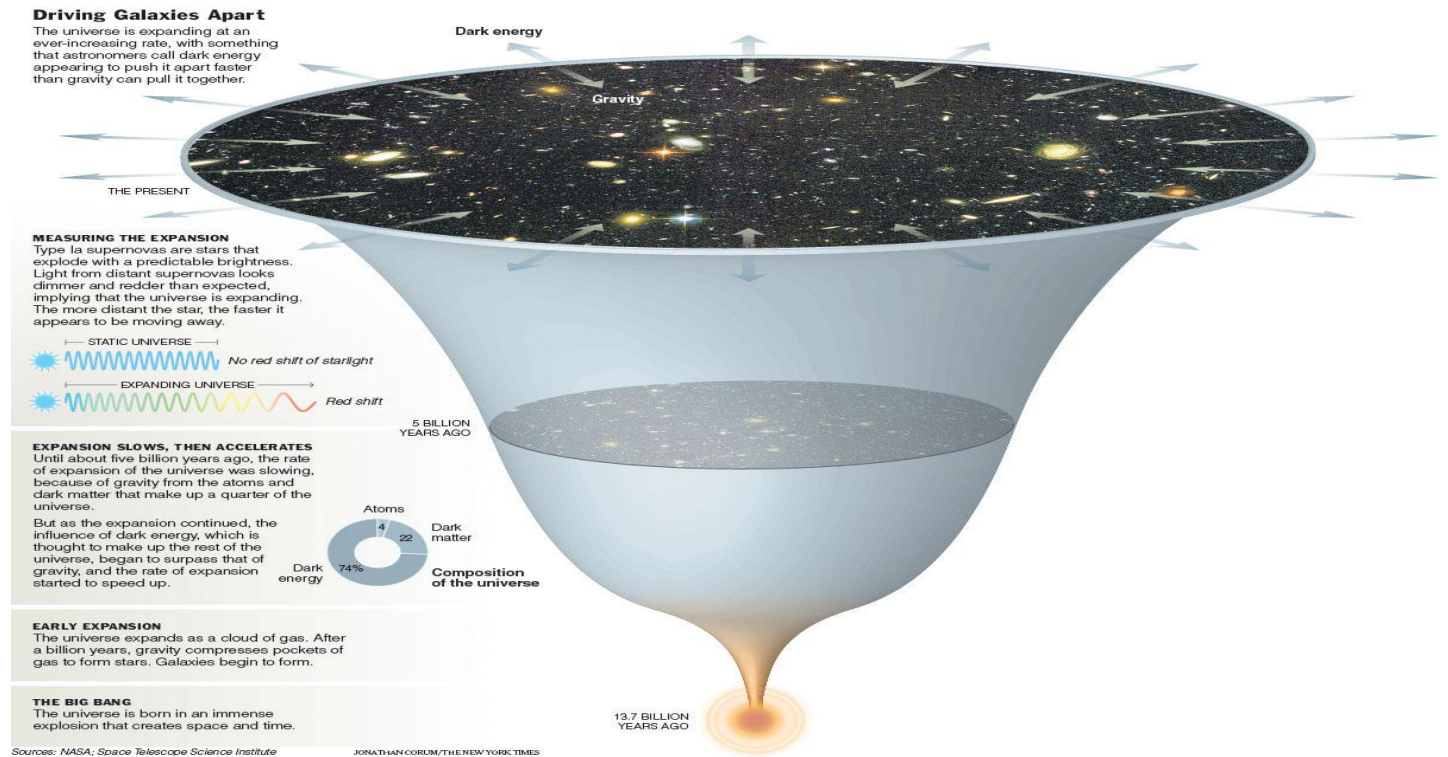


WAVES & SOUND

Unit 22 & 23 Dr. John P. Cise, Professor Of Physics, Austin Com. College, 1212 Rio Grande St.,

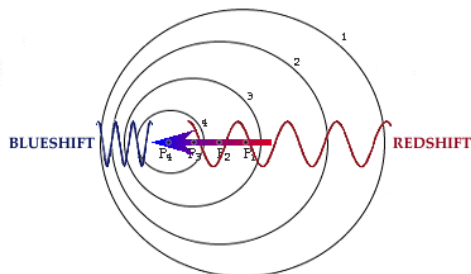
Austin Tx., 78701 jpcise@austincc.edu & New York Times June 3, 2008 by Dennis Overbye

Dark, Perhaps Forever



By [DENNIS OVERBYE](#)
Published: June 3, 2008

Preliminary: The following is from the U. of Illinois as listed below. Astronomers use Doppler shifts to calculate precisely how fast stars and other astronomical objects move toward or away from Earth. For example the [spectral lines](#) emitted by hydrogen gas in distant galaxies is often observed to be considerably redshifted. **The spectral line emission, normally found at a wavelength of 21 centimeters on Earth, might be observed at 21.1 centimeters instead. This 0.1 centimeter redshift would indicate that the gas is moving away from Earth at over 1,400 kilometers per second (over 880 miles per second).**



Above is thanks: U of Illinois, Elen i Adrian, NCSA ,Last modified by David Curtis, 6/24/95

Question: Show that with a .1 cm shift from 20 cm to 20.1 cm longer wavelength(the red shift) indicates the universe(or a gas) is expanding at ~880 miles/second ? Hint: New lambda = old lambda (1 + v/c) where v is speed of expanding universe(or gas) and c = speed of light = 186,000 miles/second

