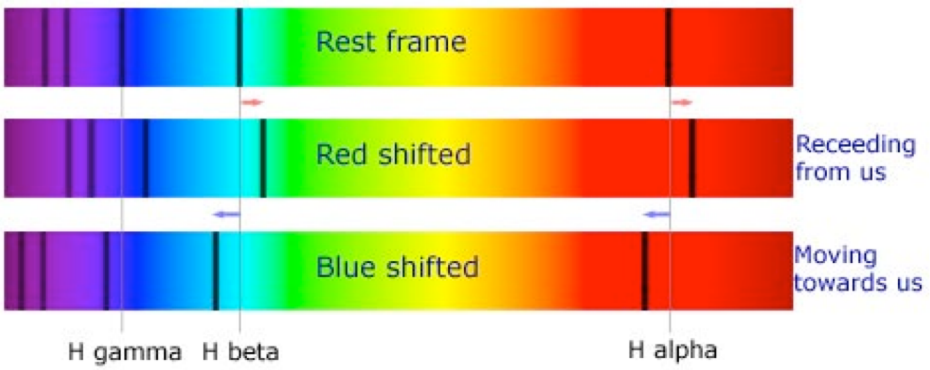
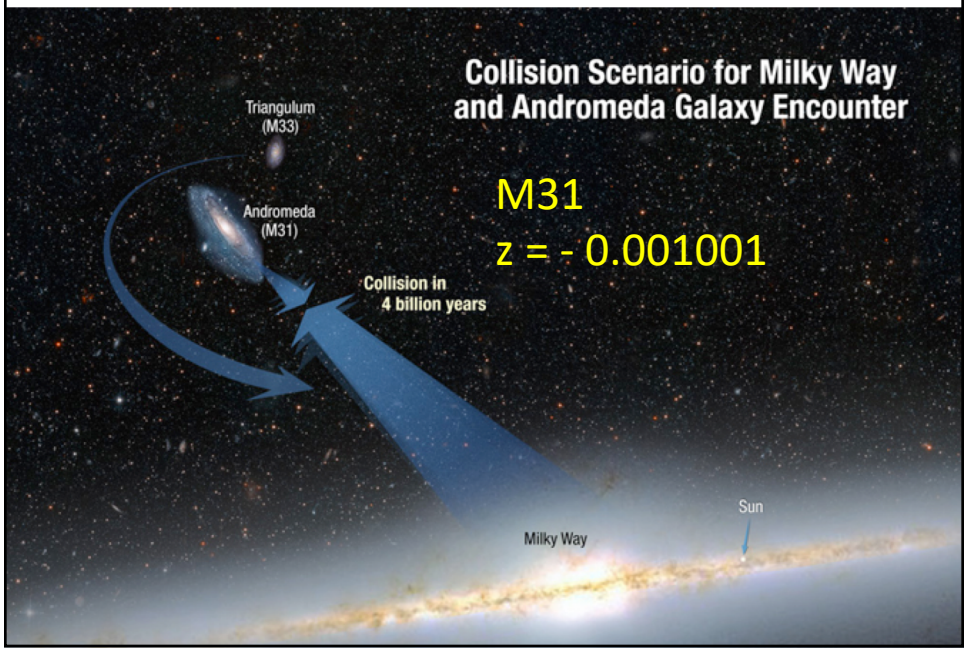
Redshift vs Blueshift



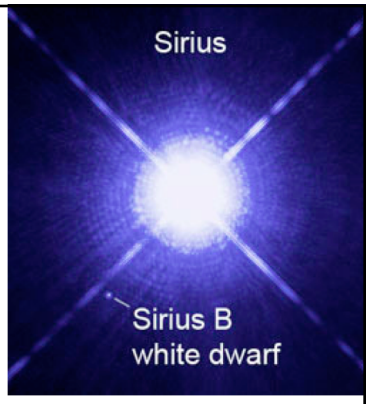
Doppler Shift ("Peculiar" Velocity)



M31

z = - 0.001001

Gravitational Redshift



$$f_\infty = f_{emission}\sqrt{1-\frac{2GM}{rc^2}}$$

$$\Delta f = \frac{f_{emission}-f_\infty}{f_{emission}} = 1-\sqrt{1-\frac{2GM}{rc^2}}$$

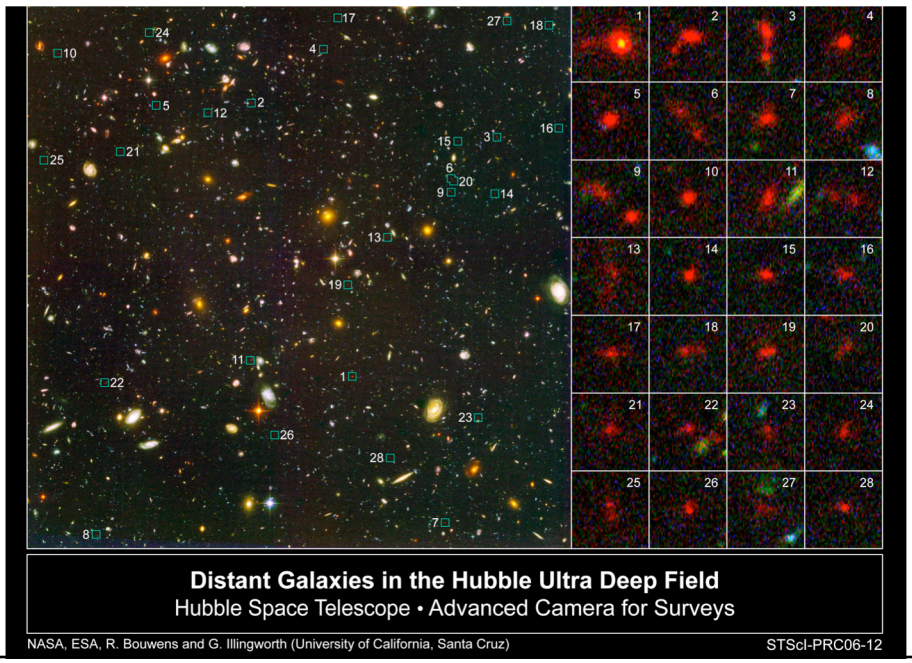
$$\Delta f \simeq 1-(1-\frac{GM}{rc^2}) \simeq \frac{GM}{rc^2}$$

with $G = 6.67\times10^{-11}m^3.kg^{-1}.s^{-2}$

$c \approx 3\times10^8 m.s^{-1}$ $M_{SiriusB} = 2.1\times10^{30}kg$ $R_{SiriusB} = 5.5\times10^6 m$

$$\Delta f \approx \frac{6.67\times2.1}{5.5\times9}\times10^{-3} \approx 2.83\times10^{-4} \approx 0.03\%$$

Cosmological Redshift (Expansion of Spacetime)



Distant Galaxies in the Hubble Ultra Deep Field
Hubble Space Telescope • Advanced Camera for Surveys
NASA, ESA, R. Bouwens and G. Illingworth (University of California, Santa Cruz) STScI-PRC06-12