Hubble's Law – in class exercise
Name =

Edwin Hubble found in 1929 that the more distant a galaxy was from us, the faster it was moving away from us. This is now called Hubble's Law and can be stated as:

{1} $$\boxed{v = H_0 d}$$

In this equation v is the recessional velocity of the galaxy, d is the distance to the galaxy and H_0 is referred to as the Hubble constant . Current measurements show

{2} $$H_0 = 71 \pm 2.5 \quad km/s/Mpc$$

Where we use Mpc for our distance unit with 1 parsec = 1 pc = 3.3 light-years. The Hubble constant affects many different elements of cosmology and is related to the approximate age of the Universe by

{3} $$\boxed{age = \frac{1}{H_0}}$$

EXERCISE

A. Label your graph paper with Distance on the horizontal axis with scale from 0 to 70 Mpc (4 blocks = 10 Mpc) and recessional velocity on the vertical axis with scale from 0 to 6000 km/sec (5 blocks = 1000 kn/sec).

B. Put a mark on your plot for each of these galaxies from http://ned.ipac.caltech.edu/forms/byname.html

Galaxy	distance	recessional velocity
NGC 0055	1.9 Mpc	129 kn/sec
M64	5.3	408
M74	9.1	657
M104	10.4	1024
NGC1566	12.2	1504
M87	16.8	1307
M58	19.6	1517
NGC4261	31.3	2238
NGC664	68.3	5425

1. Draw a straight line from the origin (0,0) that best goes through all of your points. Determine the slope of this line. This is the value of the Hubble constant which you should write here.

2. Use equation {3} to estimate the age of the Universe from your value of the Hubble constant in problem 1. You need to use the conversion factor:

$$\boxed{1\frac{\sec * Mpc}{km} \cong 1000\, billion\ \ years}$$

3. If the Hubble constant was determined to be twice as big as your value in problem 1, how would this change the estimated age of the Universe?