# Expansion of the Universe Exercise

Student Name: _____

## Step 1.

1. Using the data in Figures 1-4, measure the peak (in nanometers) of the H from the spectra for each of the four galaxies presented.

## Step 2.

A. Record the wavelength of the highest peak of each galaxy in Table 1.
B. Use Equation 1 to calculate the redshift value (z) for each one and record these values in Table 1 as well.
C. For the wavelength of H from a non-moving source, use 656.28 nm.

## Step 3.

Calculate the Velocity (V) in km/s for each galaxy and record your answers, using Equation 2.

## Step 4.

D. On a separate piece of graph paper, plot the distance in Mpc (on the x-axis) versus the Velocity (on the y-axis).
E. Draw your best fit straight line through your data points and use the of 0,0 as a fixed point.

## Step 5.

Calculate your value for the Hubble constant $H_0$ using the slope intercept formula as given in Equation 3.

$$Z = (\lambda_{obs} - \lambda_0) / \lambda_0$$

Equation 1.

$$z = V/c \text{ (c = speed of light)}$$

Equation 2.

$$m = y / x$$

(Here y = the Velocity, x = the distance and m = $H_0$.)

Equation 3.

- **Question 1:** Did your plot yield a fairly straight line relationship? Does the relationship shown by your plot match Hubble's Law? Explain.

- **Question 2:** Which galaxy would you predict would be moving at the lowest velocity relative to us? Which is moving at the greatest?

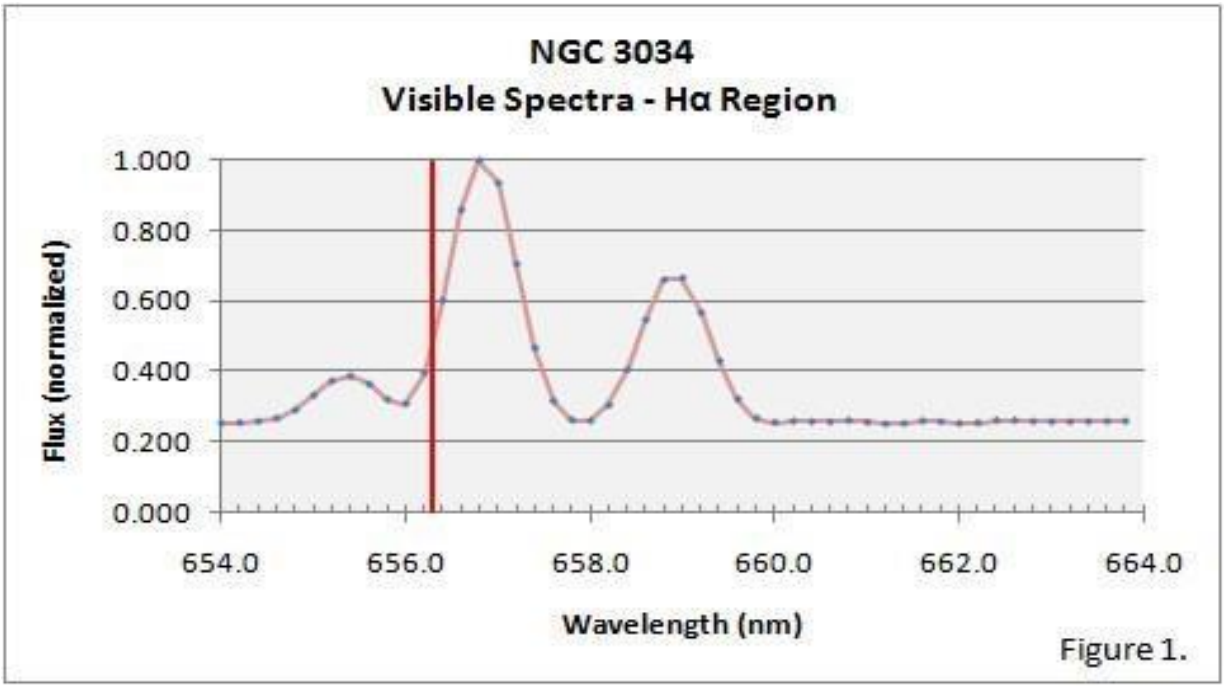


Figure 1.

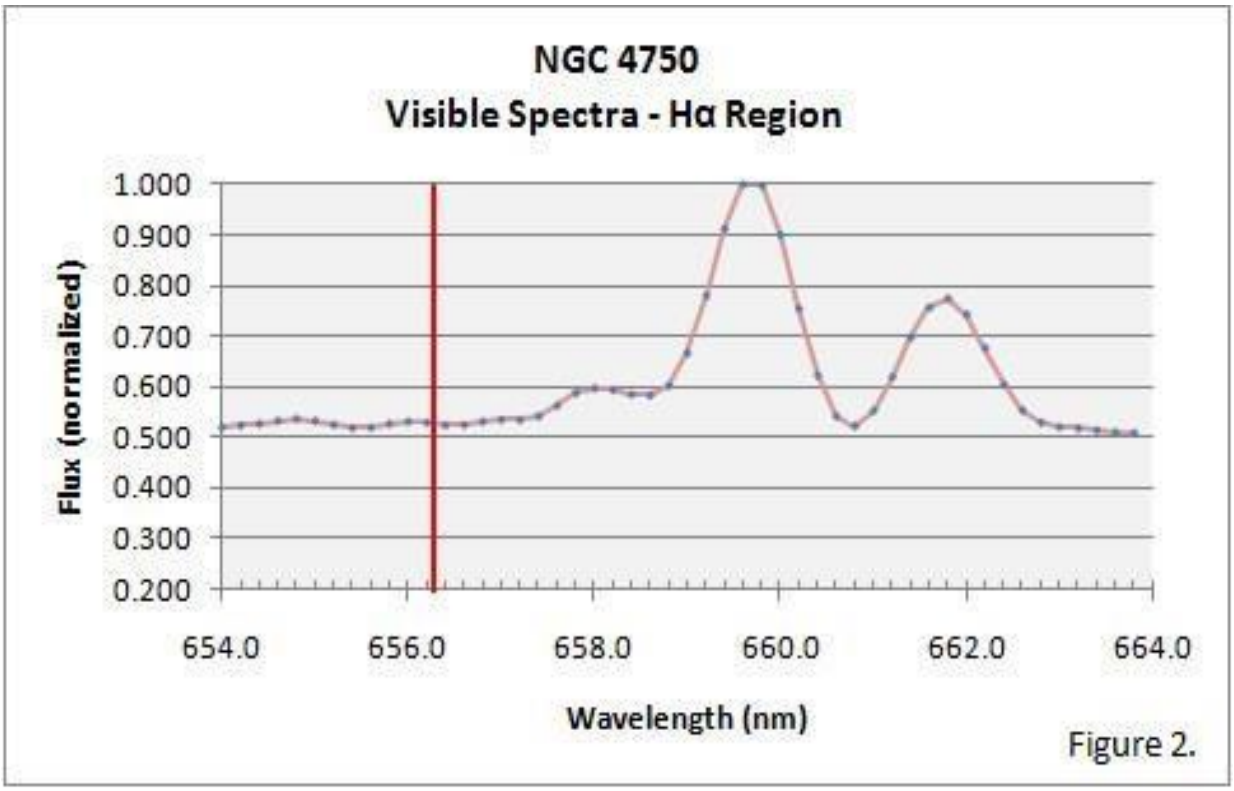


Figure 2.

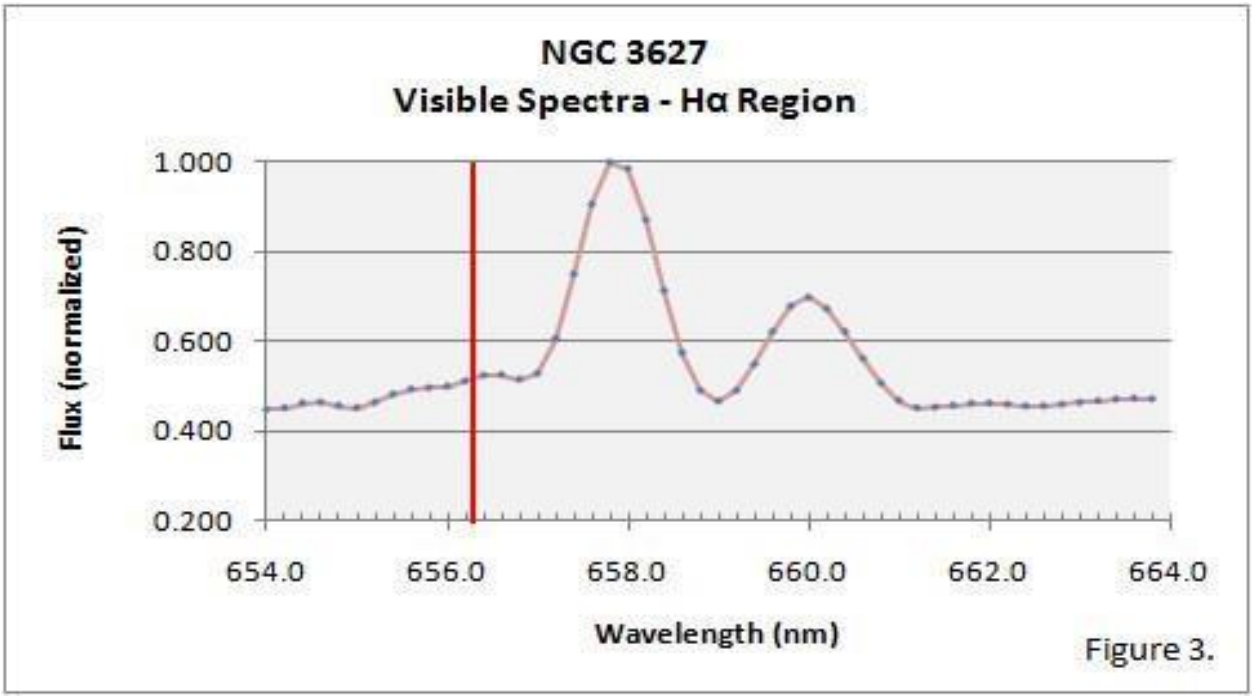


Figure 3.

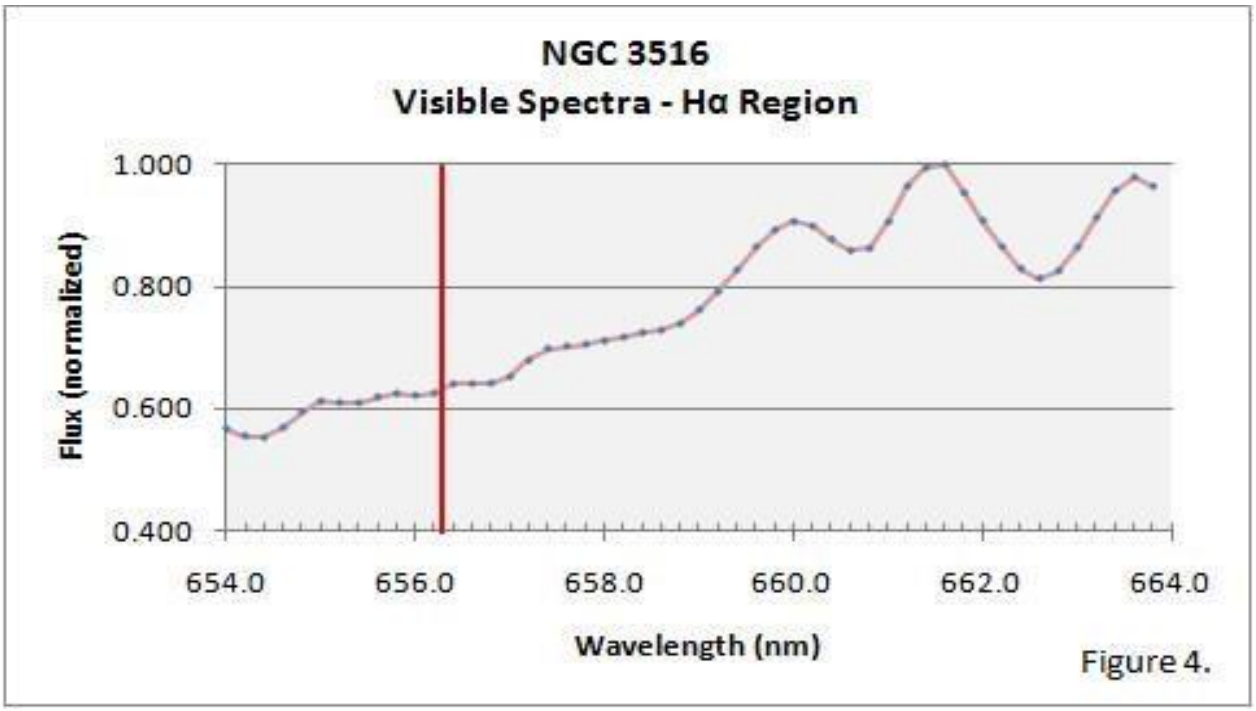


Figure 4.

All Spctra derived from the data of:
Kennicutt R.C.Jr. - Astrophys. J., Suppl. Ser., 79, 255-284 (1992) - 01.01.86 01.01.86
March 1992

| Galaxy | Peak (nm) | z | Distance (Mpc) | V (km/s) |
|---|---|---|---|---|
| NGC3034 | | | 3.53 | |
| NGC4750 | | | 22.70 | |
| NGC3627 | | | 11.35 | |
| NGC3516 | | | 36.81 | |

Table 1.