The Browse page of this website lists galactic coordinates for each planetary nebula as "lll.l (sign)bb.b," where lll.l is the galactic longitude in degrees, and bb.b is the galactic latitude in degrees. The plus or minus sign before the galactic latitude indicates whether the object is above or below the galactic plane, respectively.

The Exercise

Listed below are eight planetary nebulae. For each of them, you will estimate the relative intensities of the Hα and Hβ lines and compare them with the theoretical prediction of 2.86 and with each other. Finally, you will be able to come to some conclusions about the distribution of dust in the Milky Way.

H4-1
IC 2448
J900
NGC 2022
NGC 6578
NGC 7026
NGC 7662
Pe1-18

Data Collection

1. Print out a copy of the data table for this exercise. You may also find it helpful to print out this page as well.
2. The wavelength of Hα is 6563 Angstroms, and for Hβ it is 4861 Angstroms. Take a moment to look at the relevant templates for wavelength identifications to familiarize yourself with the appearance of the spectrum in the vicinity of these Balmer lines. You will find it helpful to print out a copy of the templates containing them.
3. Review the Help page to make sure you know how to view and expand a spectrum.
4. Click on one of the nebulae listed above. This will get you to the "View Spectrum" page where you will see the full spectrum of the nebula.
5. Locate the Hα line and expand the spectrum to zoom in on this wavelength region. Repeat if necessary to give a good view of the line. (It is usually bracketed on either side by two lines that come from nitrogen.) Now zoom in on the upper part of the line so that you can get a good estimate of the maximum intensity (height) at the center. Write this maximum height down in the data table, remembering to include the scale exponent, given at the top left of the graph window (e.g., $x10^{-12}$).
6. Zoom back out to the full spectrum by pressing on the "zoom out" button under the spectrum display. Now zoom in on the bottom of the Hα line. Read the level of the continuum, or base level of the spectrum near the Hα line, and record it on the data sheet.
7. Subtract the continuum level from the maximum height and record the Hα net height in the data table. Zoom back out to the full spectrum.
8. Repeat steps 5-7 for the Hβ line.
9. Now calculate the observed ratio of Hα/Hβ using the net heights and write the result in the last column of the data table.
10. Repeat steps 5-9 for all remaining nebulae.

Data Analysis

1. Fill in Table 2 of the data table, listing the nebulae in order from highest Hα/Hβ to lowest.
2. Fill in the last column with each nebula's galactic latitude, **without** the plus or minus sign (i.e., use the absolute value of the galactic latitude).
3. What trend do you notice between the galactic latitude and the value of the Hα/Hβ ratio?
4. Remember that the amount of reddening depends how much dust you are looking through along the line of sight to any nebula. This in turn depends on the thickness of the dust and the distance to the nebula. If all of these nebulae were at the same distance from us (**which they are not**, although most of the objects in this sample are at similar distances), what does your conclusion from step 3 imply about the distribution of dust in the Milky Way? Can you find images or other material from your textbooks or reliable websites to support your conclusion?