

FYI

Spectral Classification — A Look Back

The first effort to classify stars was begun in the late 19th century at the Harvard College Observatory. The work was funded by a grant from the estate of Henry Draper, a well-known astronomer of the time. A group of women, headed by Annie Jump Cannon, were chosen to do the menial work of classifying as many stars as they could. They began by classifying stars by the strength of their hydrogen lines, labeling stars with the strongest lines A, next strongest B, and so on.

Canon became so proficient at classifying stars that soon she was examining several hundred stars per hour! In 1918, after 25 years of hard work, Canon's team published the Henry Draper catalog, which described the spectra of a quarter of a million stars. A co-worker of Cannon's—Antonia Maury—reordered the spectra so that all the elements visible in the spectra smoothly transitioned from class to class. The sequence became OBAFGKM—at one end were the O stars, the hottest, having just a few spectral lines; at the other end of the classification were the M stars, the coolest, with the most spectral lines. Each class is further divided into ten subclasses—0 to 9. For instance, B stars are divided into B0, B1, B2, to B9. A B9 star is very close in spectral composition to the next subclass, an A0 star.

Maury also noticed that spectral lines for the same class of star differed depending on the size of the star, with the larger stars having broader lines than the smaller stars.



Figure 2-2: Photograph of Annie Jump Cannon busy classifying stellar spectra from glass plates

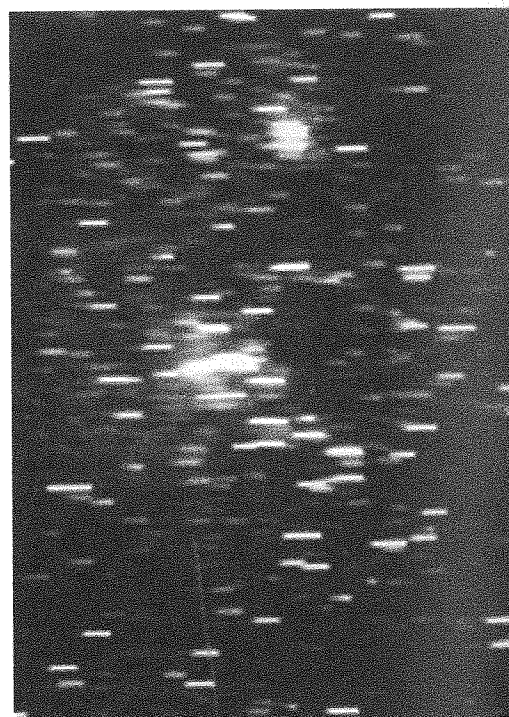


Figure 2-3: An example plate of some of the 250,000 stars that Annie Jump Cannon classified between 1911 and 1914. The spectra of many stars were captured on each image and exposed on glass plates. Annie could classify three stars per minute from these plates!

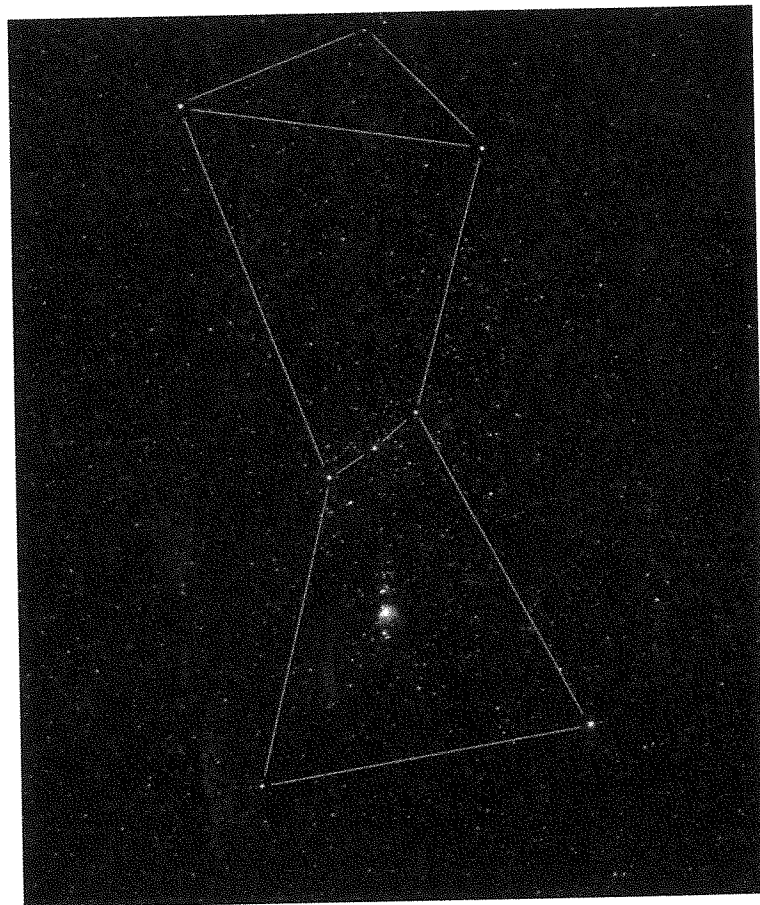
She proposed a second level of classification, termed **luminosity classes**. Luminosity class is designated by a Roman numeral for five classes:

- Ia = bright supergiants
- Ib = supergiants
- II = bright giants
- III = normal giants
- IV = sub-giants
- V = main sequence stars

Further elaboration of the two-parameter system took place in the 1940s and '50s by W. W. Morgan and P.C. Keenan. They introduced several additional spectral types such as C stars (stars with carbon lines), WR stars (after Wolf-Rayet stars that show emission lines), and D stars (white dwarfs). Under the new system of classification, a letter, a number, and a roman numeral designate a star's spectral class. Our sun is a G2 star on the main sequence (see Activity 3 in this Exploration), so it is classified as a G2V star.

Checking In

1. How were stars first classified?
2. Describe the color, temperature, and size of the following stars:
 - a. KV
 - b. B1b
 - c. FIII



The constellation of Orion