

Stellar Evolution

Adapted from <http://www.astro.lsa.umich.edu/Academics/Undergrad/labs.php>

Introduction

Stars spend 90% of their lifetime on the Main Sequence, but in the last 10% of their lives, their life tracks take them to other parts of the Hertzsprung-Russell Diagram. The stars change dramatically in temperature, luminosity, and size. They also produce some fascinating end-products in these late evolutionary stages.

Theories of stellar evolution were originally founded on a few optical observations and some physics and chemistry. These initial models were difficult to confirm when they were first developed. However, modern observations, like the discovery of a supernova in the Large Magellanic cloud in 1987, have advanced our understanding of stellar evolution into a true scientific theory. Our understanding comes from a mixture of images at many different wavelengths as well as data, such as light curves. The Hertzsprung-Russell (H-R) diagram is a useful tool for organizing our information. We can trace the changes in luminosity and surface temperature over time on an H-R diagram. In this lab you will look at a number of pictures, including multi-wavelength images and illustrations. Your goal will be to identify the images and put them in place on an H-R diagram.

You can get a pdf with the images here:

<http://www.astro.lsa.umich.edu/Academics/Undergrad/Labs/StelEv/images.pdf>

Images and the H-R Diagram

You have two H-R diagrams, one labeled “High Mass” (50 Msun) and one labeled “Medium Mass” (2 Msun). An evolutionary track is drawn on each, with several points labeled.

Begin by identifying each of the pictures.

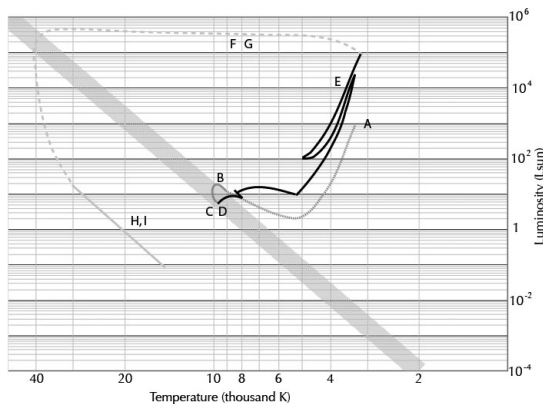
Construct a table as follows:

#	Letter(s)	Description
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Write a concise description in your table in the row with the picture number.

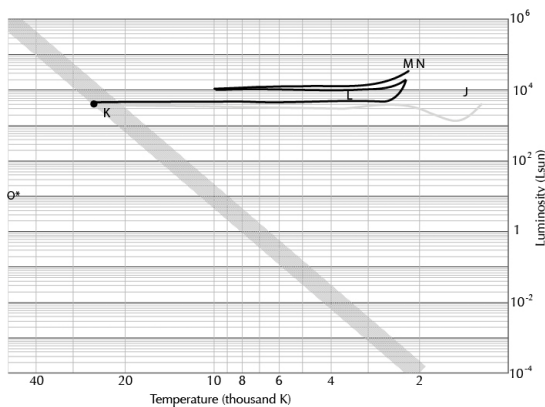
Identify which image belongs with each label on the H-R diagram. Record the letter in table 1. Make sure your description in table 1 makes it clear why the image belongs in that position. All the letters must be used, and places with two letters indicate two images. Some of the images may be used for both high and medium mass stars.

H-R Diagram for Medium Mass Star



Darker dotted line is the proto-star (pre H fusion)
 Light dashed line indicates the star is not actually visible
 Letters mark general areas on the line.

H-R Diagram for High Mass Star



Events at specific points are marked with a dot. Otherwise, they correspond to that general area on the line.
 * This object's position varies greatly (enough so it isn't usually plotted on an HR diagram)