

## SCIENTIFIC CASE: Study of Hertzsprung-Russell Diagram

### Context

An open star cluster is a group of stars which were originally formed from the same initial gas cloud (mostly hydrogen). These clusters can be made up of dozens or hundreds of stars.

Open star clusters are excellent astronomical laboratories. The stars that form one are all equally as far from us, they move in the same direction, they are approximately the same age, and they have about the same chemical composition. Thus, **when we see differences between the brightness of different stars in the same cluster, we know that it can only be because they have different masses**. Studying several clusters, we can compare them and know more about stellar evolution, clusters' ages, and much more.

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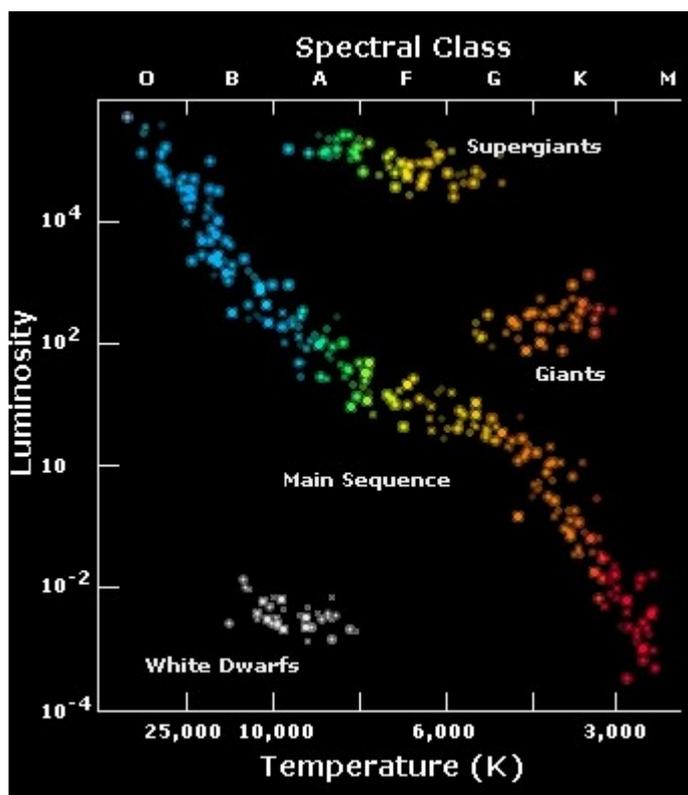


**Pleyades.** NASA, ESA, AURA/Caltech, Palomar Observatory.

Source: <http://hubblesite.org/newscenter/archive/releases/2004/20/image/a/Author>

This and other research have allowed us to find out the different types of stars that exist and how most of them evolve.

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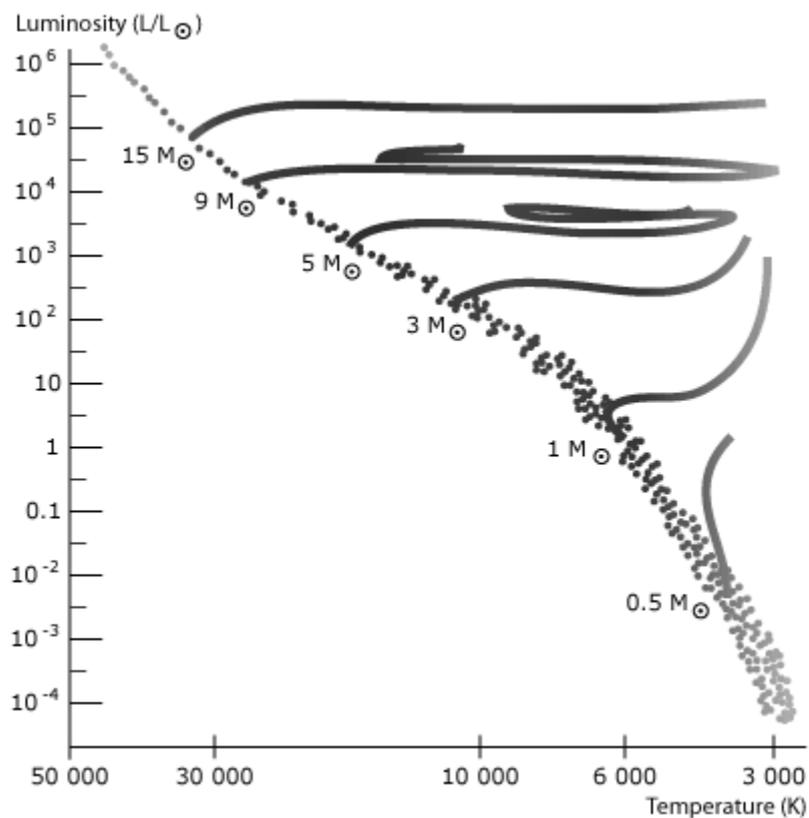
Hertzsprung-Russell Diagram.

Credit: ESA.

<http://sci.esa.int/education/35774-stellar-radiation-stellar-types/?fbclid=1703>

Nearly all stars are in one of the places shown on the graph. For instance, there are no blue stars with luminosity 10. But there are, in fact, stars with luminosity  $10^4$ . Also, as you can see, most of them are in the **Main Sequence**.

Each star has an age, and because they can live thousands of millions of years, we can only know how they evolve by observing relationships between different stars. In the following plot, you can see how some of them change over time. That is, we took some stars (dots) and we traced a line that describes how their temperature changes over time.



HR Diagram showing paths of different mass stars.

Credit: ESA. <http://sci.esa.int/jump.cfm?oid=36828>

More educational resources:

Hertzsprung-Russell Diagram: <http://sci.esa.int/jump.cfm?oid=35774>

CESAR: <http://www.cosmos.esa.int/web/cesar>

ESA education: <http://sci.esa.int/education/>