



Temperature–Luminosity Diagram

Evolution of Stars. Activity 6

Classroom Activity

Material List:

- Worksheet

Outline

By using a computer animation you will explore the connection between the temperature and luminosity of stars to understand that stars form specific groups on the diagram corresponding to the stage of their evolution.

Procedure:

Step 1. To Do:

Open the *ClassAction* animation *Stellar Properties/ HR Explorer (NAAP)*. Switch off “show main sequence” and “show isoradius lines”. Move the red cross around the diagram and watch the changes of star size and colour. Answer the questions:

At which part of the diagram large stars are placed? _____

At which part of the diagram small stars are placed? _____

At which part of the diagram blue stars are placed? _____

At which part of the diagram orange (so called red stars) are placed? _____

Switch on “both the nearest and brightest stars”. What pattern can be seen? Answer the question:

What is the main sequence? _____

Switch on “show luminosity classes”. Some stellar luminosity classes (familiar from the *Evolution of Stars. Activity 5*) appear on the screen. Listen to the explanation given by teacher and answer the question:

Why the stars cannot be at random places on the temperature-luminosity diagram?

Step 2. To Do:

Continue to work with the *ClassAction* animation *Stellar Properties/ HR Explorer (NAAP)*. Input (write in) the temperature and the luminosity of the stars mentioned in the table, observe their size, colour and the position on the temperature-luminosity diagram, write down the calculated radius at the worksheet. Then fill the last column of the worksheet. Roman numerals of luminosity classes are already shown.

Table. Stars belonging to different groups

Star	Temperature, K	Luminosity, solar units	Radius, solar units	Group (colour, luminosity class)
Rho Cassiopeiae	6500	500 000		0
Betelgeuse	3600	120 000		I
Gamma Cygni	5800	33 000		I
Theta Scorpis	7300	1800		II
Arcturus	4300	170		III
Vega	9600	40		V
Sun	5800	1		V
Barnard star	3000	0,0004		V
Sirius B	25 000	0,03		VII

Assessment:

Answer the questions:

1. At which part of the diagram stars of high luminosity and big size are placed?

2. At which parts of the diagram red (low temperature stars) and blue (high temperature stars) are placed? _____

3. At which part of the diagram red supergiants, blue supergiants, red main sequence dwarfs and white dwarfs are? _____

4. Why the stars cannot be at random places on the temperature-luminosity diagram?

5. What is the radius of Betelgeuse in kilometres if the radius of the Sun is 700 000 km? Compare the radius of Betelgeuse with the radius of the Jupiter orbit 780 millions of kilometres! _____

6. What is the radius of Sirius B in kilometres if the radius of the Sun is 700 000 km? Compare the radius of Sirius B with the radius of the Earth 6400 km!

7. Name the four main groups of the stars on the temperature-luminosity diagram!
