RAFT IDEAS

Topics: Star Properties, Luminosity, Scatter plot

Materials List

- ✓ Table of Star Data (page 2)
- ✓ Chart for H-R Diagram (page 3)
- ✓ Colored pencils, 3 colors
- ✓ Optional: foam or cardboard for backing and 2 colors of push pins

This activity can be used to teach:

- Life cycle of stars (Next Generation Science Standards: High School, Earth & Space Sciences, 1-3)

Common Core Math Standards:

- Scatterplots & Relationships between 2 variables (Grade 8, Statistics & Probability, 1, High School, Stats. & Prob.-Interpreting Categorical & Quantitative Data, 6),
- Represent data on a number line (High School, Stats. & Prob.-Interpreting Categorical & Quantitative Data, 1),
- Problem Solving & Reasoning (Math Practices Grades 7-12)

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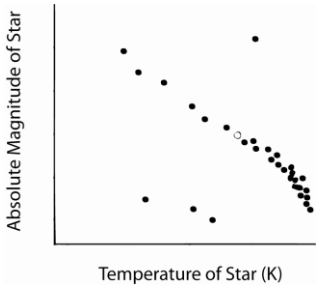
Stars on the HR Diagram

Plotting data in two variables to gain understanding.



Plot star data to create an HR Diagram and use the diagram to discover information about the relationship between the temperature and brightness of stars.

To Do and Notice

1. Plot the Absolute Magnitude (luminosity/intrinsic brightness) versus Temperature (measured in degrees Kelvin) of stars on the Chart for H-R Diagram (page 3) using data from the Table of Star Data (page 2).
2. Use one colored pencil to plot the nearest stars, 15 light years from the sun or closer, and another color for the stars that are more than 15 light years from the sun. Alternative method – attach chart to foam or cardboard backing and use 2 colors of push pins to mark the stars.
3. With a 3rd color, circle the brightest stars - absolute magnitude 3 or smaller. The **smaller** the absolute magnitude, the **brighter** the star. Stars with a negative absolute magnitude are brighter than stars with a positive absolute magnitude.
4. Review the HR Diagram. What is the relationship between temperature and brightness observed for **most** of the stars in the HR plot?
5. Compare the brightest stars and nearby stars; what differences and similarities are observed? What do you think causes these differences and similarities?

The Content Behind the Activity

Since stars cannot be observed in a scientific laboratory, the vast majority of knowledge astronomers acquire about stars is through mathematical comparison of data derived from the light (radiation) from stars. The Hertzsprung-Russell (HR) Diagram, widely used in astronomy, is a scatter plot with a distribution of data points that describe a relationship between physical aspects of stars. The HR Diagram became the key to understanding the life cycles of stars and giving a large hint to what kinds of stars are most populous throughout the universe. Astronomers call the plot of stars from the upper left to the lower right of the HR diagram, the "main sequence" and 90% of all stars plot along this curve.

Comparing the physical aspects of a number of stars is much like an alien visiting Earth for 20 minutes and attempting to understand a human life cycle by observing individuals from the different stages of the human life cycle.

Taking it Further

- Create a 3-D model of the nearest stars – See Raft Idea Sheet ***The Closest Stars***
- A very few stars plot off the main sequence in the upper right and lower left of the HR Diagram; explore what these stars might be.

Web Resources (Visit www.raft.net/raft-idea?isid=644 for more resources!)

- General on HR diagram - http://zebu.uoregon.edu/~soper/Stars/hrdiagram.html
- Interactive HR - http://aspire.cosmic-ray.org/labs/star_life/hr_interactive.html
- Teacher designed math courses – https://njctl.org/courses/math

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TABLE OF STAR DATA

NOTE: In absolute magnitude, the SMALLER the number, the BRIGHTER the star. Stars with a NEGATIVE absolute magnitude are BRIGHTER than stars with a POSTIVE absolute magnitude.
1 light year = 9,460,528,400,000 km (5,580,000,000,000 mi).
Stars labeled A and B are binary (double), e.g., Sirius A and Sirius B.

NAME	ABSOLUTE MAGNITUDE measure of luminosity	TEMPERATURE K^o on the radiating surface of the star	DISTANCE from Sun in light years
Sun	+4.8	5840	0
61 Cygni	+7.6	4130	11.4
Achernar	-2.4	20500	69
Alpha Centauri	+4.5	5840	4.3
Alpha Crucis	-4.0	28000	510
Altair	+2.2	8060	17
Antares	-5.2	3340	520
Arcturus	-0.4	4590	34
Barnard's Star	+13.2	2800	6
Betelgeuse	-5.7	3200	643
Canopus	-3.1	7400	74
Capella	-0.6	5150	41
Deneb	-7.2	9340	1550
Epsilon Eridani	+6.1	4590	10.5
Fomalhaut	+2.0	9060	22
Luyten 726-B	+16.0	2670	8.73
Procyon A	+2.6	6600	11.4
Procyon B	+13.0	9700	11.4
Regulus	-0.8	13260	69
Rigel	-7.2	12140	773
Ross 128	+13.5	2800	10.9
Ross 248	+14.8	2670	10.3
Sirius A	+1.4	9620	8.6
Sirius B	+11.2	14800	8.6
Struve 2398 A	+11.2	3070	11.5
Tau Ceti	+5.7	5150	11.9
Vega	+0.5	9900	25

Chart for H-R Diagram