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A map of the stars

Activity 3 answer sheet

1. **What trends do you observe between temperature and luminosity on your diagram?**
   - Most stars lie along a diagonal curve called the main sequence with hotter stars (blue/white) generally more luminous than cooler stars (red/orange).

2. **Which stars do not follow this trend, and what might their positions reveal about their stage of life?**
   - Red giants and white dwarfs are the main exceptions. Their positions indicate later stages of stellar evolution, unlike main sequence stars which are fusing hydrogen.

3. **How do your plotted results compare with Gaia's billion-star H-R diagram?**
   - Gaia's diagram shows the same main trends (main sequence, red giants, white dwarfs) but with far more detail and density.
   - Some features like subgiant branches, binary star sequences, and faint dwarf clusters appear clearly in Gaia's diagram.
   - Small classroom datasets show the overall pattern, but Gaia reveals the full complexity of the galaxy's stellar population.

4. **How could limited or uncertain data change the apparent shape of the H-R diagram and what biases might this introduce?**
   - Smaller sample size may miss rare types of stars, making the diagram incomplete.
   - Measurement errors in temperature or magnitude could scatter stars away from the main sequence, creating apparent anomalies.
   - Bias toward brighter stars could make the main sequence appear more prominent, obscuring less luminous stars.

5. **How does metallicity (element composition) influence star colour and brightness?**
   - Stars with higher metallicity tend to be slightly cooler and redder than with lower metallicity at the same mass.
   - Metal-poor stars may appear bluer and more luminous at the same mass.
   - Metallicity affects opacity, which changes the star's energy output and spectral characteristics.

6. **What surprised you most about your plotted data, and why?**
   - Some stars appear off the main sequence, like Betelgeuse (red giant).
   - Differences in luminosity/brightness are more dramatic than expected.
   - Seeing the small dataset resemble Gaia's diagram was impressive, showing that even limited data reveals patterns.

7. **If you had to explain the H-R diagram to someone using only three sentences, what would you say?**
   - The H-R diagram plots stars' temperature against their luminosity.
   - Most stars fall along the main sequence, where hotter stars are brighter.
   - Other regions show stars at later stages of life, like red giants and white dwarfs.