

Hertzsprung-Russell Diagram—key to understanding properties of stars. 26 Sept



Annie Jump Cannon
1863-1941



Einar Hertzsprung
1873-1967



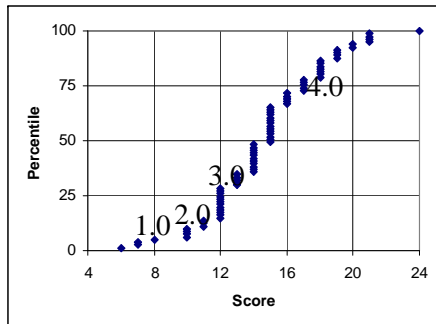
Henry N Russell
1877-1957

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University of Chicago

- Sit close to the front to see the demo.
- Find out about the astrophysics major
 - Planning for undergraduate degree
 - Plan for graduate school (usually free with a stipend)
 - Mon, 29 Sept, 6:00pm, 1400 BPS
 - Pizza
 - Need headcount
- Bob Victor's sky preview 2008-2009
 - September 26-28, Fri & Sat at 8:00 pm, Sun at 4:00 pm.
 - A show highlighting the current sky, spectacular gatherings of Venus with the moon and other planets in coming months. See what Galileo saw through his telescope 400 years ago— the Milky Way and the Pleiades, details on the moon, the four moons of Jupiter, the phases of Venus, and the mysterious disappearance of Saturn's rings.
 - See Venus before the show and Jupiter after the show.

Test 1

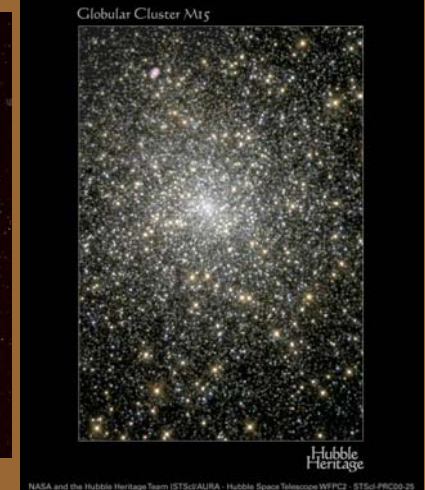
- Average on test 1:
 $14.7/24=61\%$



Orion Constellation



Globular Cluster M15



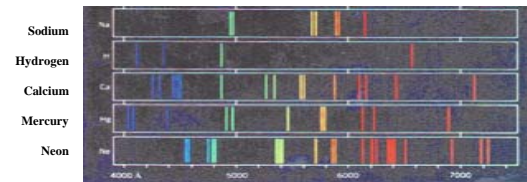
- You are a young astronomer in 1890, and you want to study stars. The distances to a few dozen stars are known. How do you attack this problem?
1. What characteristics of stars do you see in the pictures of the Orion constellation and a globular cluster (taken 100 years later)?

- You are a young astronomer in 1890, and you want to study stars. The distances to a few dozen stars are known. How do you attack this problem?
1. What characteristics of stars do you see in the pictures of the Orion constellation and a globular cluster (taken 100 years later)?
 - A. Yes, I noticed a real characteristic.
 - B. No, I did not see any differences between the stars.
 2. What properties depend on the distance of the star?
 - A. Color & brightness
 - B. Color only
 - C. Brightness only
 3. Can you tell which stars in the Orion Constellation are close and which are far?
 - A. Yes
 - B. No

- You are a young astronomer in 1890, and you want to study stars. The distances to a few dozen stars are known. How do you attack this problem?
- New developments in 1890
 - Spectrometers analyze the colors of light
 - Photographic plates allow imaging of a large number of stars.

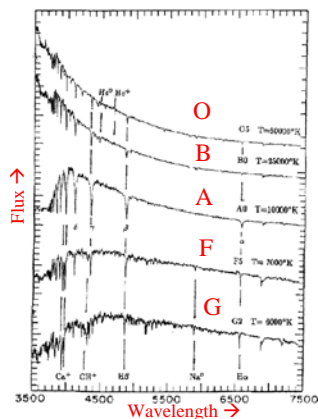
Fingerprint of an element

- A grating bends light. Blue light is bent more than red light.
- Heated hydrogen produces red, cyan, and several blue “lines.”
- Heated neon produces a rich set of lines.
- Heated mercury produces its own set of lines.
- Each element produces its own set of lines.



What elements are in stars?

- Each element produces its own set of lines.
- The spectrum of the “A” star shows strong lines of hydrogen and weaker lines of many other elements.



- You are a young astronomer in 1890, and you want to study stars. The distances to a few dozen stars are known. How do you attack this problem?
- New developments in 1890
 - Spectrometers analyze the colors of light
 - Photographic plates allow imaging of a large number of stars.
 - The distances to a few dozens of stars have been measured.

Annie Jump Cannon

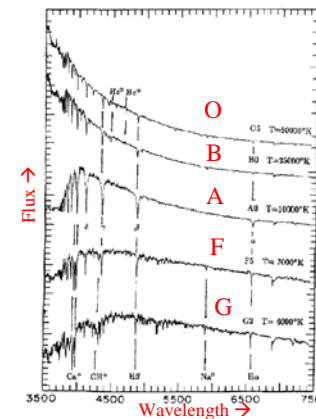
- Annie Jump Cannon devised the spectral classification.
- AJC
 - BA, Wellesley, 1884
 - Pickering’s assistant, 1896
 - Henry Draper catalog of stars, 1918-1924
 - Astronomer 1938



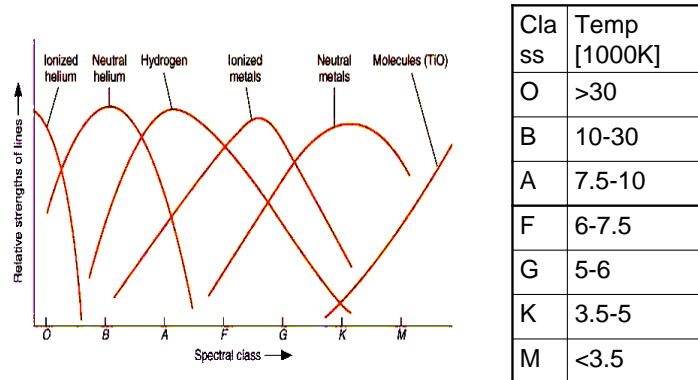
Pickering's team 1913; from Barbara L. Welther, 1982, Isis 73, 94.

Spectra of Stars

- Spread light by color
- Each element has characteristic colors (called lines)
- Classify stars by their spectra.
 - Originally by strength of hydrogen lines
 - ABCDEFGHIJKLM
 - Now in order by temperature
 - OBAFGKM
 - Oh, be a fine girl; kiss me.
 - October Brings A Football Game; Kill Michigan — Emy Ibrahim
 - Our Blessings Are From God’s Kingdom Majestic — Latoya Baker



A temperature sequence



Draper Catalog

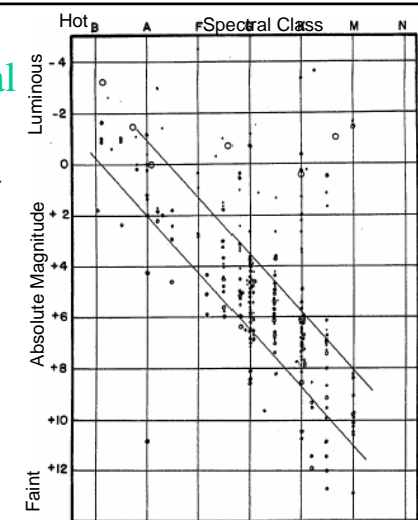
- 250,000 stars with classifications



1. Why would a plot of the spectral class and brightness not reveal intrinsic properties of stars?
 - A. Stars change color depending on distance
 - B. Some stars may be bright because they happen to be nearby.
 - C. No, such a plot does reveal intrinsic properties of stars.

Russell's Original H-R Diagram

- Are color and luminosity unrelated?
 1. Is a hot star as likely to be luminous as faint?
 - A. Yes
 - B. No
 2. What characteristics of stars does the H-R Diagram reveal?



Astrophysics and twentieth-century astronomy to 1950, O Gingerich, ed., Cambridge, 1984