

**ASTR 1040: Stars & Galaxies**



Eskimo Planetary Nebula

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Lecture 10 Thur 27 Sept 2018  
zeus.colorado.edu/astr1040-toomre


**Topics for Today & Tues**

- What can we **measure in other stars?**
- How do we begin to **classify other stars?**
- Vital work by **Annie Jump Cannon** in devising a sensible "spectral sequence" for stars
- Why **temperature and spectral lines** are **closely linked** in classifying stars **O B A...M**

**Logistics**

- Read **Chap 15.1: Properties of Stars** with **some care** -- will need to work on **HW #5**
- **First Mid-Term Exam** in class today (9:50am) -- 50 minutes
- **Homework #4** due today, new **HW #5** out
- **Please pickup earlier graded HWs, if not already**

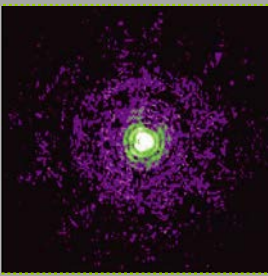
**Chap 15 – SURVEYING THE STARS**



- **Measuring stellar luminosities**
- **Measuring distances**
- **Measuring temperatures**

**Often only seeing a point of light**

- Stars are **so small compared to their distance** that we almost never have the resolution to see their sizes and details directly – **"point sources"**
- We deduce everything by measuring the amount of light (**brightness**) at different wavelengths (**color, spectra**)



**So what can we find out about other stars?**

**APPARENT BRIGHTNESS**

**POSITION**

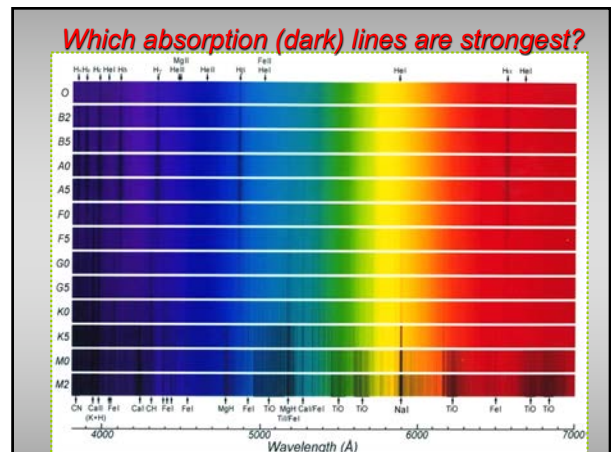
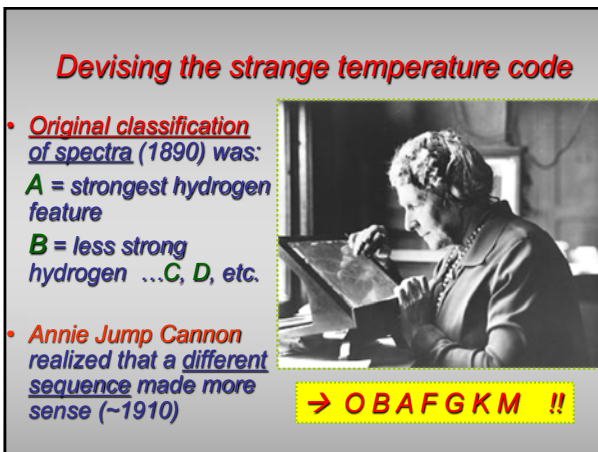
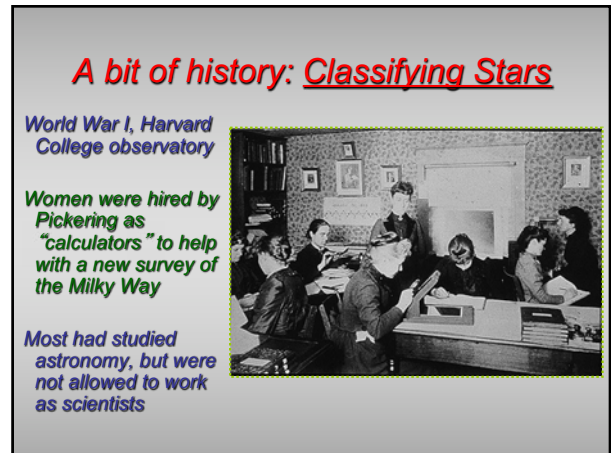
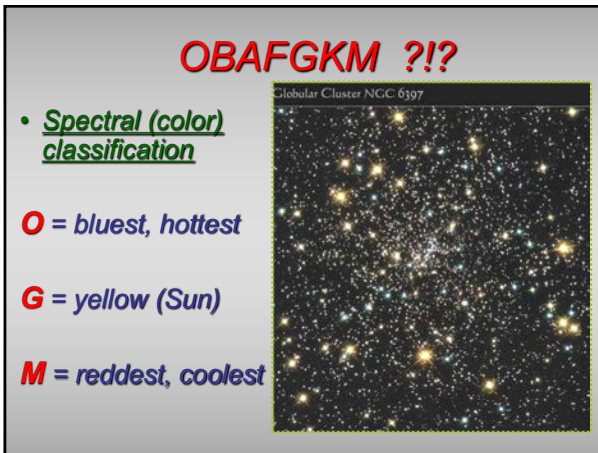
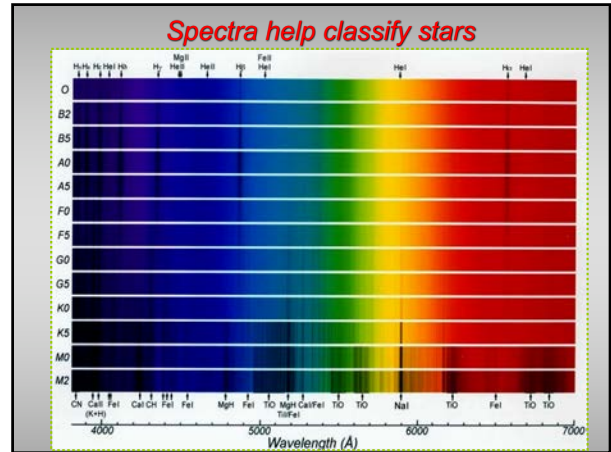
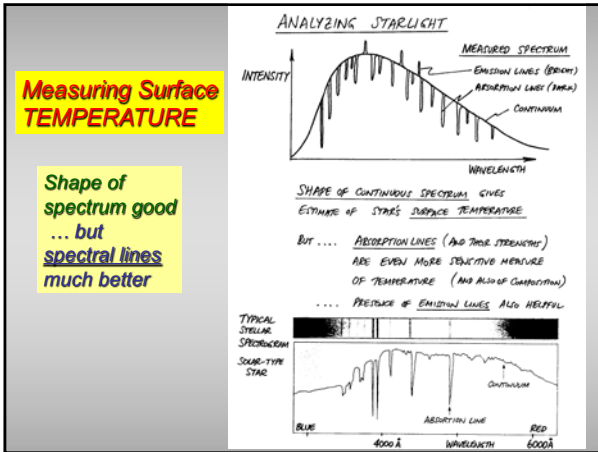
**SPECTRUM**

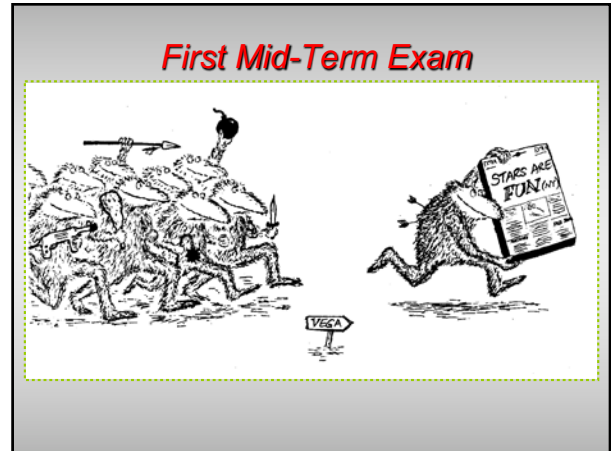
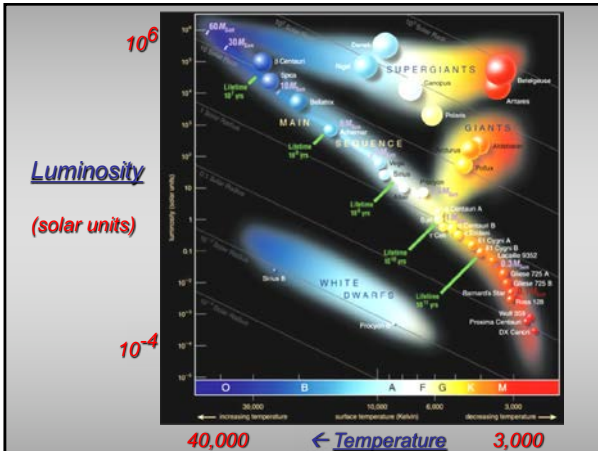
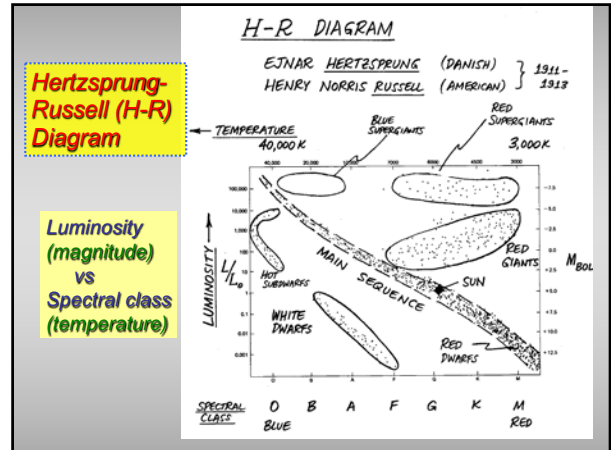
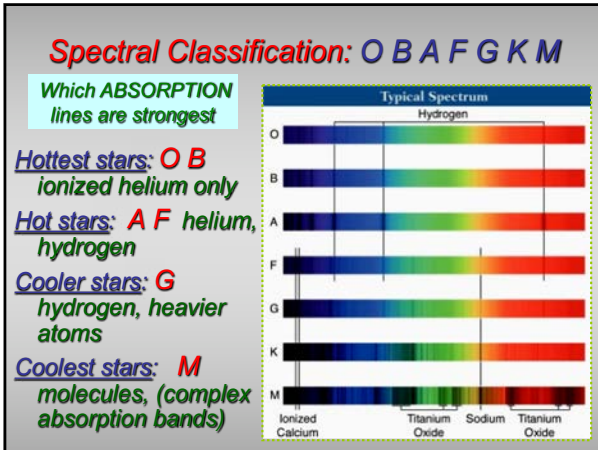
**WHAT CAN WE MEASURE IN OTHER STARS?**

1. **APPARENT BRIGHTNESS** (OR INTENSITY)  
MEASURED IN FUNNY UNITS CALLED "MAGNITUDES"  
⇒ LUMINOSITY, IF KNOW DISTANCE  
RECALL INVERSE SQUARE LAW ...  
$$\text{BRIGHTNESS OF POINT SOURCE} \sim \frac{1}{(\text{DISTANCE})^2}$$
2. **POSITION** (AND CHANGES OF IT WITH TIME)
  - PARALLAX ⇒ DISTANCE
  - PROPER MOTION
3. **SPECTRUM** (MEASURE ITS SHAPE & SPECTRAL LINES)
  - ⇒ TEMPERATURE OF SURFACE
  - ⇒ COMPOSITION (WHICH ELEMENTS CAN BE SEEN)

VIA **DOPPLER SHIFT** OF LINES: RADIAL VELOCITY  
ROTATION

VIA **ZEEMAN SPLITTING** OF LINES: MAGNETIC FIELDS





- ### Rules of the Game
- Closed book, closed notes, can use double-sided handwritten "crib sheet"; 50 minutes
  - Print your name and student ID on top of pages 1 and 6 of exam sheets
  - Print and encode your name and student ID on scan sheet (and nothing else)
  - Use # 2 (soft) pencil for marking your answers on scan sheet (\$ 1 buys you a pencil !)
  - Respond carefully to Essay Question 46, with full and lucid sentences (even a sketch or two)