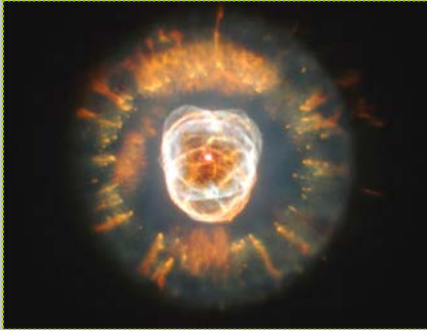


ASTR 1040: Stars & Galaxies



Eskimo
Planetary
Nebula

Prof. Juri Toomre TAs: Daniel Segal, Max Weiner
Lecture 10 Thur 13 Feb 2020
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 (start 11:20am) -- 50 minutes
- **Homework #4** due today, new HW #5 out
- **Please pickup earlier graded HWs, if not already**

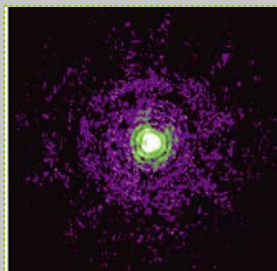
Chap 15 – SURVEYING THE STARS



- **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?

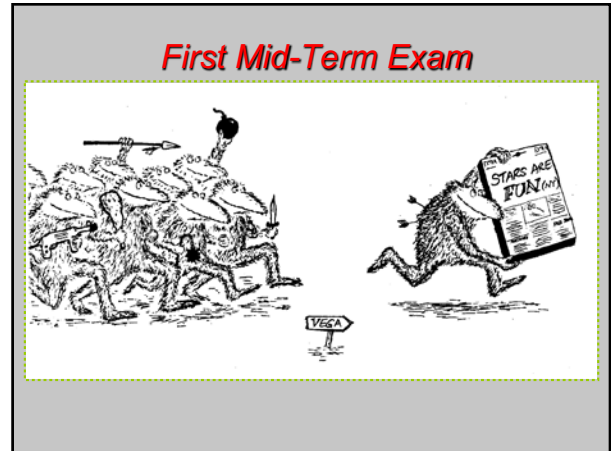
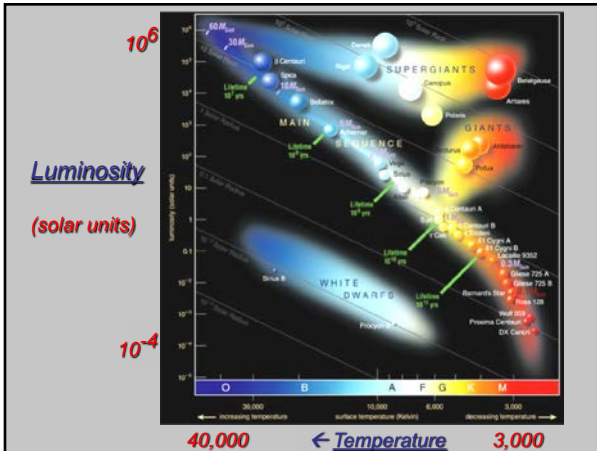
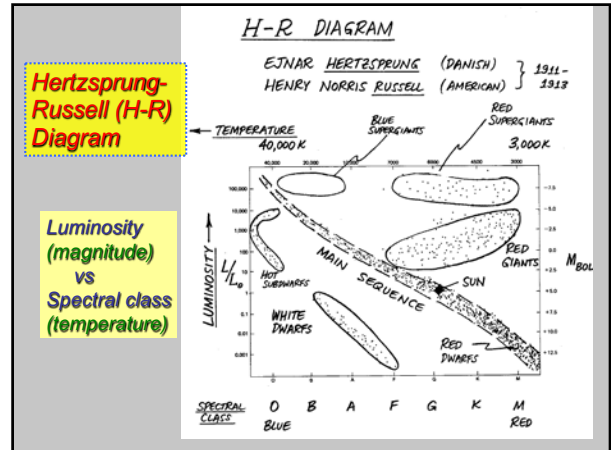
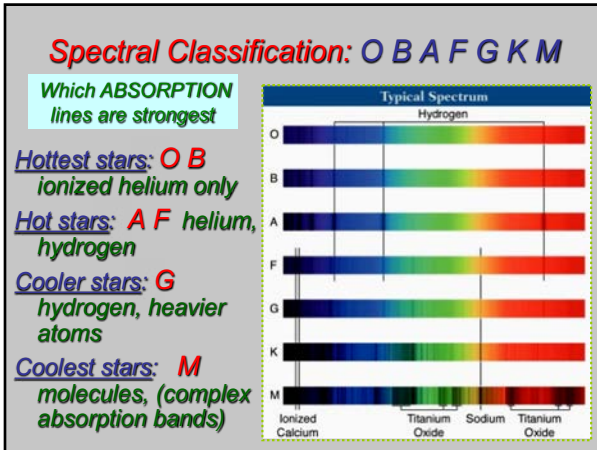
APPARENT BRIGHTNESS

POSITION

SPECTRUM

WHAT CAN WE MEASURE IN OTHER STARS?

1. **APPARENT BRIGHTNESS** (OR INTENSITY)
MEASURED IN FUJIKY 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)**