SIT IN YOUR ASSIGNED ROW!

Midterm 1

PHOTO ID REQUIRED!

- 34 multiple choice questions.
  - Sample questions on course web site.
- Closed book, closed notes.
- No calculators or cell phones.
- Will include a few problems like the homework problems.
  - I will give you a table of numbers raised to various powers and roots that you might need. But almost all of you won't need it.
- Exam must be completed within the class period.

Seating Chart

FRONT

B		B
C	Aardvark - Blakely	C
D	Bradley - Cook	D
E	Corlett - Gaddy	E
F	Gaudino - Guntupalli	F
G	Gurski - Howard	G
H	Howe - Kowalski	H
I	Kubus - Mccarty	I
J	Mccombs - Nykamp	J
K	Oconnell - Roncelli	K
L	Rosenson - Stokes	L
M	Suffety - Vanderschaaf	M
N	Vandoorne - Wickes	N
O	Wierenga - Zzzzzz	O

BACK

If your name falls in alphabetical order between the two names listed for a row, sit in that row.

Can't figure it out?
On exam day, a name-by-name list will be posted just inside the door.

SIT IN YOUR ASSIGNED ROW!

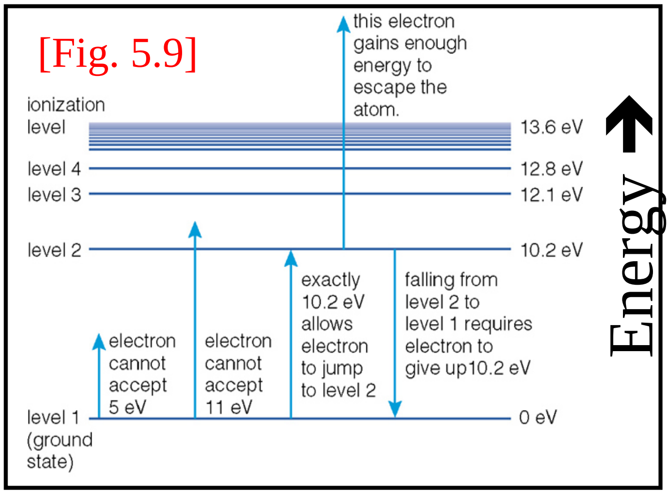
Midterm 1 study guide – page 1

Exam will cover *everything* that was in the lectures, not just what is in this study guide.

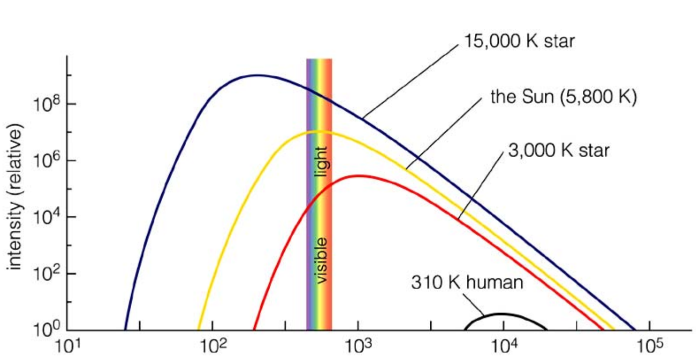
The lectures covered:

- Units, etc used in astronomy
- History of astronomy from ancient Greeks until mid-1800's.
  - What did the ancient Greeks have right? What did they have wrong?
  - How we went from geocentric (Earth at center) models to heliocentric (Sun at center) models of Solar System.
  - Ptolemy's system – epicycles, etc. Why were these complications needed?
  - Retrograde motion.
  - Copernican revolution.
  - Galileo's observations.
- The nature of science.
- How things move
  - Kepler's 3 laws
  - Newton's 3 laws + law of gravity + using them to derive Kepler's laws.
  - Conservation of energy, angular momentum
    - "Conservation" means that these quantities stay constant unless something is done to the system from the outside..
    - Be able to use the concept to reason your way through what will happen in simple situations such as those described in class.
  - Escape velocity & orbits
- Electromagnetism & Light
  - The electromagnetic wave
  - Dual wave/particle nature of light
    - What is meant by this?
  - The electromagnetic spectrum
    - Different names for light at different wavelengths
    - Measuring the spectrum of an object
  - Emission & absorption lines
    - What are they?
    - How do we interpret them in terms of energy level diagrams?
  - What can they tell us about the gas that does the absorbing or emitting?

[Fig. 5.9]

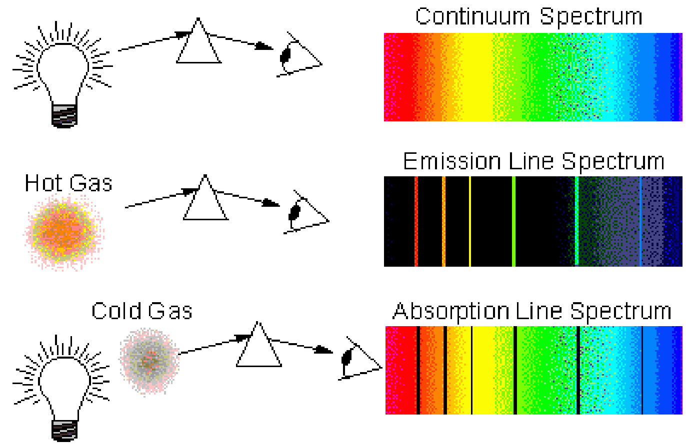


- Continuous radiation
  - What is it due to?
  - How can it tell us the temperature of the emitting object?
- Under what circumstances do we see emission lines, absorption lines, continuous radiation?
- Doppler Effect
  - What is it caused by?
  - What is a redshift? What is a blueshift?



Wavelength →
← Frequency
← Energy

[Fig 5.11]

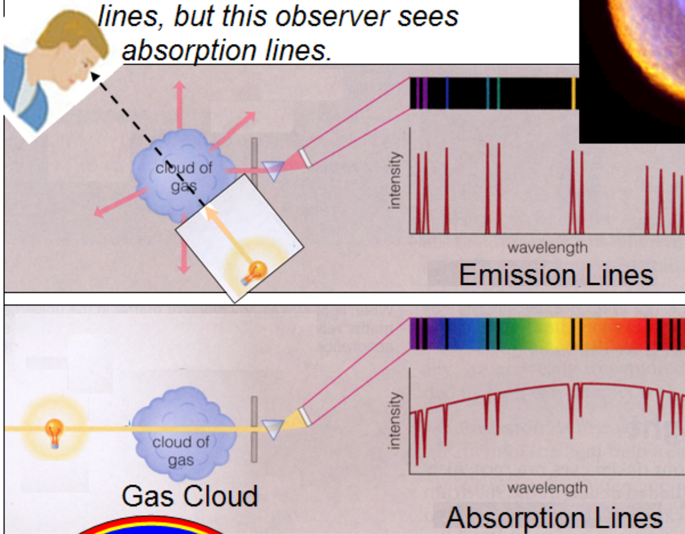


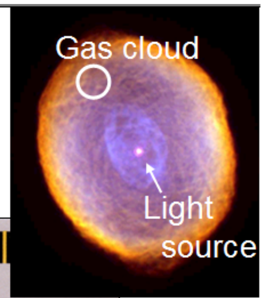
See [Fig 5.8]

- Telescopes
  - Not on exam *unless* I cover this topic on Monday Feb. 1
  - Visible light telescopes
  - Radio telescopes
  - Telescopes in space. *Why put them there?*

Formation of spectral lines
[Fig 5.8]

Everybody else sees emission lines, but this observer sees absorption lines.



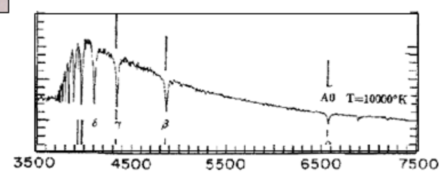


Emission spectrum: Planetary nebula shell.

Emission-Line Spectrum
- Collisions or absorbed light moves electrons to higher energy levels.
- Electrons then fall to lower energy levels.

Absorption-Line Spectrum
Atoms in gas cloud remove photons that have correct energy to move electrons between energy levels.

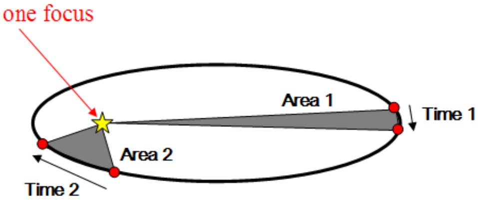
Stars: absorption lines
- Inner layers
  = hot light source.
- Outer layers
  = cooler gas cloud.

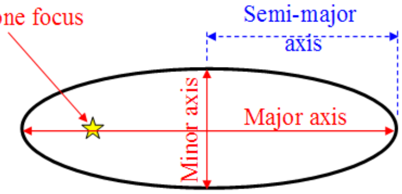


Kepler's laws [pgs. 67-68]:

1. Each planet moves around orbit in ellipse, with sun at one focus.
2. The straight line joining the planet and the sun sweeps out equal areas of space in equal amounts of time.

   What does this tell us about speeds of planets in different parts of their orbits?
3. $P^2 = a^3$
   - P = period of orbit, in years
   - a = semi-major axis of orbit, in au.





What does this say about planets' orbital periods and average speeds in their orbits?

Newton's Laws of Motion [pgs. 91-92]:

1. In the absence of a net (overall) force acting upon it, an object moves with constant velocity.
2. Force = mass × acceleration
3. For any force, there is an equal and opposite reaction force.

…and Newton's law of Gravity [pg. 98]:

$$F_{gravity} = \frac{Gm_1m_2}{r^2}$$

Some formulae to know

(and to know how to use at the level of the homework):

Motion:

Newton's 2nd Law: $F = ma$ (F = force)

Newton's law of Gravity: $$F_{gravity} = \frac{Gm_1m_2}{r^2}$$

Kinetic energy $= \frac{1}{2} mv^2$

Kepler's 3rd law: $P^2 = a^3$

Plus know what additional important quantity is added to this equation when derived using Newton's laws. [pg. 100]

Light:

Frequency f, wavelength λ: $f = c/\lambda$

Energy of photon: $E = hf = hc/\lambda$

Thermal spectrum: $\lambda_{max} = \text{const.} / T$

Thermal emission per unit surface area = const.$\times T^4$

c = speed of light.

h = Planck's constant

const. = other constants

You don't need to know the values of any of the physical constants.
You just need to know how many times bigger one quantity gets if another quantity is made some number of times bigger... just like for the homework.

We may cover special relativity on Monday Feb 1. If not, it will not be on the midterm.

Special Relativity

[pg. 364]

Einstein postulated (1905):

- **The Principal of Relativity.** The laws of physics are the same in all inertial reference frames.
- **The constancy of the speed of light.** Light travels through a vacuum at a speed *c* which is independent of the light source.

➔ distance, time, velocity add up in funny ways

Note regarding the Midterm:
You don't need to know these equations or how to use them.
But I include them here to illustrate what the words mean.

u = 70 mph →

v = 100 mph →

Classical: $v' = (v\text{-}u)$

Special relativity: $$v' = \frac{v - u}{1 - \frac{uv}{c^2}}$$

For slow speeds:

u = 70 mph v = 100 mph

c = 669,600,000 mph

$1 - uv/c^2 = 1 - .00000000000001$

v' = (v-u)/0.99999999999999

But all observers see light move at same speed:

$$v' = \frac{c - u}{1 - \frac{uc}{c^2}} = c$$