Midterm Exam 1

SIT IN YOUR ASSIGNED ROW! A seating chart will be displayed on the screen.

PHOTO ID REQUIRED!

No Calculators

- Wednesday Feb 1
- 30-35 multiple choice questions.
- About material covered in lectures.
- Study:
  - Notes.
  - Weekly review questions.
  - Study guide is at www.pa.msu.edu/courses/isp205/sec-3
  - Use textbook to help you understand the lectures.
- Review session
  - Monday 6:30PM
  - BPS 1410 (this room)
  - Led by Kristen (the TA)

My office hours (BPS 3270)
- Tu 2:00-3:00
- Or by appointment

TA:Kristen Garofali (BPS 1248)
- Mo 3:00-4:00
- Fr 11:10-12:10

Seating Chart for Wednesday

Section 3, 10:20-11:10

FRONT

B		B
C	Aardvark - Bishop	C
D	Blalock - Calleson	D
E	Calzada - Davis	E
F	Degraw - Gadsby	F
G	Gallant - Holland	G
H	Holiday - Kogelmann	H
I	Krist - Li	I
J	Liles - Moyet	J
K	Mumphery - Poskey	K
L	Powers - Sciarini	L
M	Shaver - Theis	M
N	Thomas - Wiesemann	N
O	Williams - Zzzzzz	O

BACK

PHOTO ID REQUIRED!

SIT IN YOUR ASSIGNED ROW!
(this seating chart is in the Study Guide on Angel)

WHEN THE TESTS ARE HANDED OUT, TAKE ONLY THE TEST WITH YOUR NAME PRINTED ON IT!

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.

Midterm 1 study guide – page 1

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

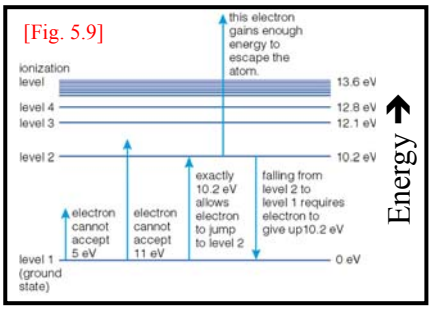
The lectures covered:

- Units, etc used in astronomy; relative size scales.
- History of astronomy from ancient Greeks until mid-1600'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 – *what did he see, and why did it show that geocentric model was wrong? What are the basic advantages of telescopes compared to the naked eye?*
- The nature of science.
- How things move
  - Kepler's 3 laws
  - Newton's 3 laws + law of gravity
  - Conservation of energy
    - "Conservation" means that the total energy stays 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

Midterm 1 study guide – page 2

The lectures covered (continued):

- 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?

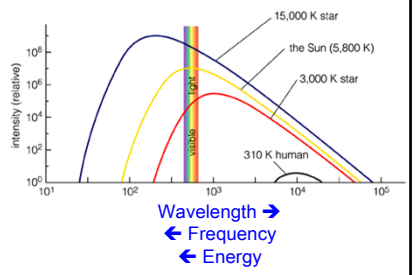


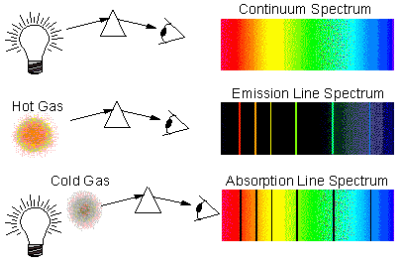
Midterm 1 study guide – page 3

The lectures covered (continued):

- 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?
- Telescopes (but only if I actually talk about them on the Monday before the exam)
  - Visible light telescopes
  - Radio telescopes
  - Telescopes in space. *Why put them there?*

[Fig 5.11]



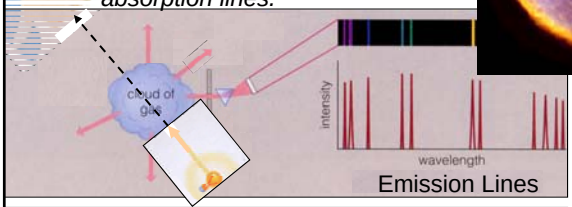


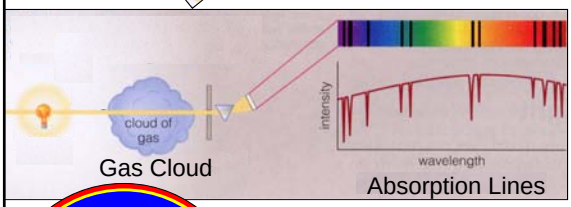
See [Fig 5.8]

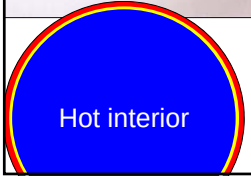
Formation of spectral lines

[Fig 5.8]

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

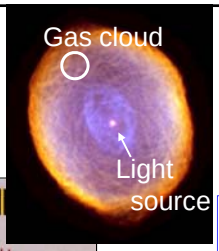






Stars: absorption lines

- Inner layers
  = hot light source.
- Outer layers
  = cooler gas cloud.



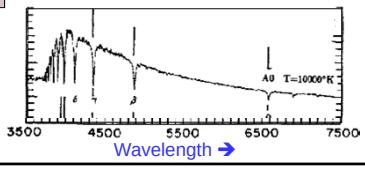
Emission spectrum: Planetary nebula shell.

Emission-Line Spectrum

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

Absorption-Line Spectrum

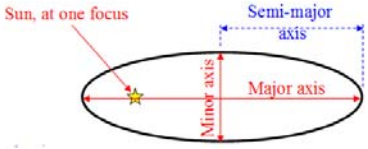
Atoms in gas cloud remove photons that have correct energy to move electrons between energy levels.



Some "laws" to know

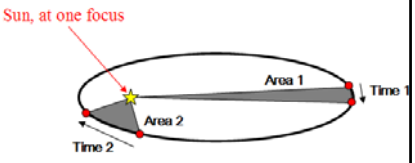
Kepler's laws [pgs. 67-68]:

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

(these will *NOT* be provided to you on the exam)

Motion:

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

Newton's law of Gravity: $F_{gravity} = \frac{Gm_1m_2}{r^2}$ (r = separation between the two objects)

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

Light:

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

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

Thermal emission per unit surface area = const.× T^4

f = frequency
c = speed of light.
λ = wavelength
h = Planck's constant
const. = other constants
T = temperature

You don't need to know the values of any of the physical constants.
But you should know the formula, and be able to use it to solve simple proportionality problems using the equations. No calculators permitted (or needed). Examples:

1. If I double the force acting on an object, how many times bigger or smaller is its acceleration?
2. If Jupiter were moved 10x farther from the Sun than it is now, how many times bigger or smaller would the Sun's gravitational pull on it become? *ETC.*

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: $v' = (v-u)$

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

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:

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