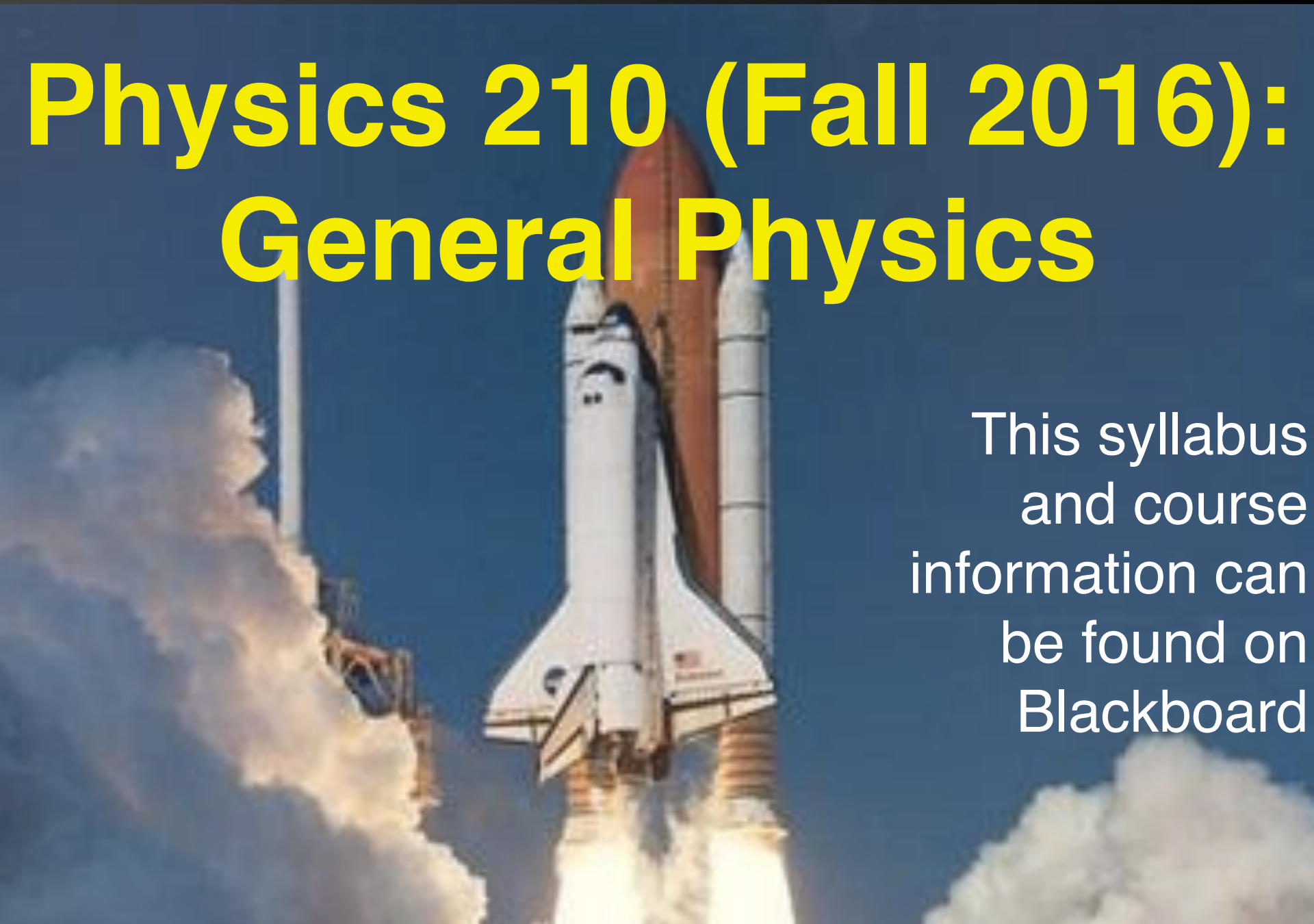
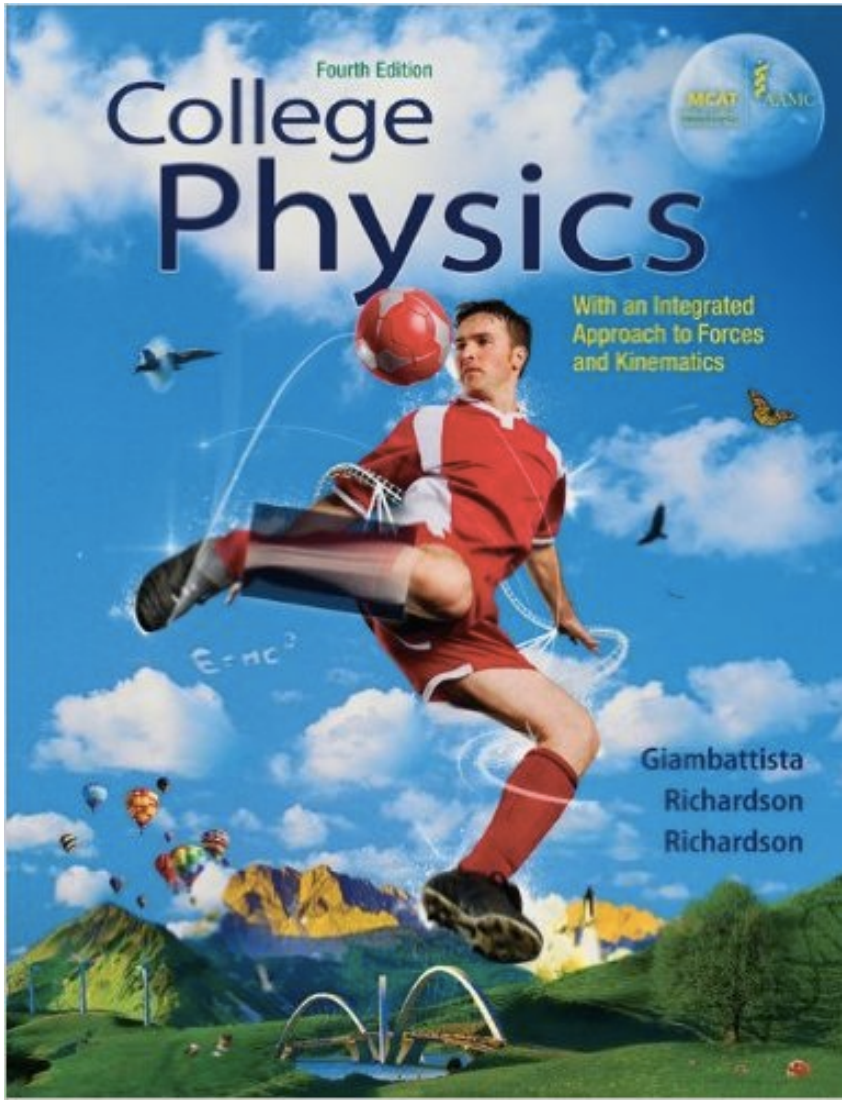
Physics 210 (Fall 2016): General Physics



This syllabus and course information can be found on Blackboard

Some practical information

- Classes Tuesday +Thursday 3:30-4:45 pm LaTourette 200
- College Physics (Giambattista, Richardson), 4th edition 2012 is the required textbook
- Math 155 (or equivalent) pre-requisite or Math 229 co-requisite
- We will cover chapters 1-15 this semester



Sections (for lab, all in Faraday 235):

210A: Tuesday 9-11:50 am

210B: Thursday 12-2:40 pm

210C: Thursday 9-11:50 am

210D: Tuesday 6-8:50 pm

210E: Wednesday 9-11:50 am

210F: Wednesday 4-6:50 pm

210G: Thursday 6-8:50 pm

General course objectives

Aim for students (that would be you!) to:

1. Develop an understanding of the basic concepts and principles in physics.
2. Develop critical thinking skills and a scientific approach to problem solving.
3. Develop and use mathematical formulations of physical principles.
4. Prepare for the MCAT and other professional exams.

More specific course topics

1. How to talk and problem-solve like a physicist
2. The laws of motion (mechanics!)
3. Conservation laws (more mechanics!)
4. Continuous media (sound!)
5. Thermal physics (heat!)

Delving in to those topics

1. How to talk and problem-solve like a physicist
   i. Use significant figures and orders of magnitude to make estimates of physical quantities
   ii. Apply dimensional analysis to an equation involving units of length, time and mass
   iii. Use graphs and tables to record and read data
   iv. Use addition, subtraction, and scalar multiplication of vectors
   v. Convert vectors between angle/magnitude and component form

Delving in to those topics

2. The laws of motion

i. Give examples of Newton's three laws of motion in physical situations
ii. Identify weight, normal force, tension, static friction and kinetic friction in mechanical problems
iii. Draw a vector force diagram in two dimensions, and convert to component equations
iv. Define position, displacement, velocity and acceleration
v. Use one-dimensional kinematic equations for constant acceleration to solve for an unknown variable
vi. Solve equilibrium and dynamic problems with inclined planes and pulleys
vii. Use kinematic equations in two dimensions to solve for quantities in projectile motion

Delving in to those topics

3. Conservation laws

i. Define angular velocity, angular acceleration & centripetal force
ii. Solve problems of horizontal and vertical circular motion
iii. Give examples of Kepler's laws of planetary motion
iv. Define work, kinetic energy, potential energy, and power and their relationships
v. Solve equilibrium and dynamic problems with a spring
vi. Identify conservative forces in mechanical problems and find the potential energy
vii. Define momentum and impulse
viii. Calculate the center of mass of a system of discrete masses or a simple symmetric object
ix. Apply the conservation of momentum to solve problems of collisions between two objects
x. Define torque, moment of inertia, and angular momentum and the relationship between them
xi. Solve problems involving wheels rolling without slipping
xii. Apply linear and rotational equilibrium conditions to solve statics problems

Delving in to those topics

4. Continuous media

i. Define pressure and density.
ii. Apply Pascal's principle and Archimedes' principle to problems of static fluids.
iii. Solve problems of fluid flow.
iv. Describe the difference between stress and strain and how they apply to deformation.
v. Give examples of harmonic motion and graph their physical quantities.
vi. Solve problems of pendulum motion.
vii. Define amplitude, period, phase, wavenumber, nodes and antinodes for oscillations and waves.
viii. Describe the principle features of transverse, longitudinal, traveling and standing waves.
ix. Solve problems of reflecting, refracting, and interfering waves.
x. Find the speed of a wave from the properties of the medium.
xi. Apply the principles of waves to sound.
xii. Solve problems involving the Doppler effect.

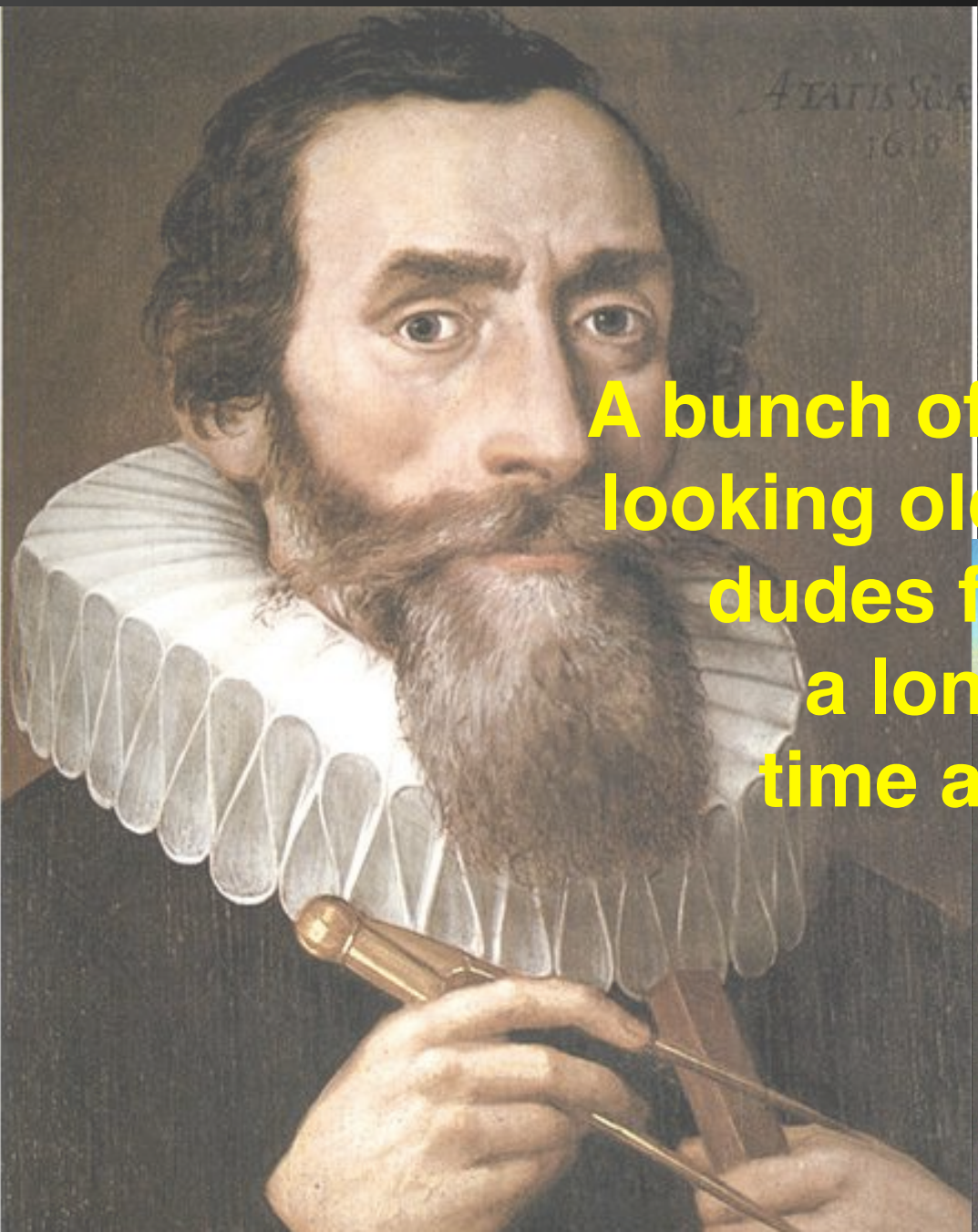
Delving in to those topics

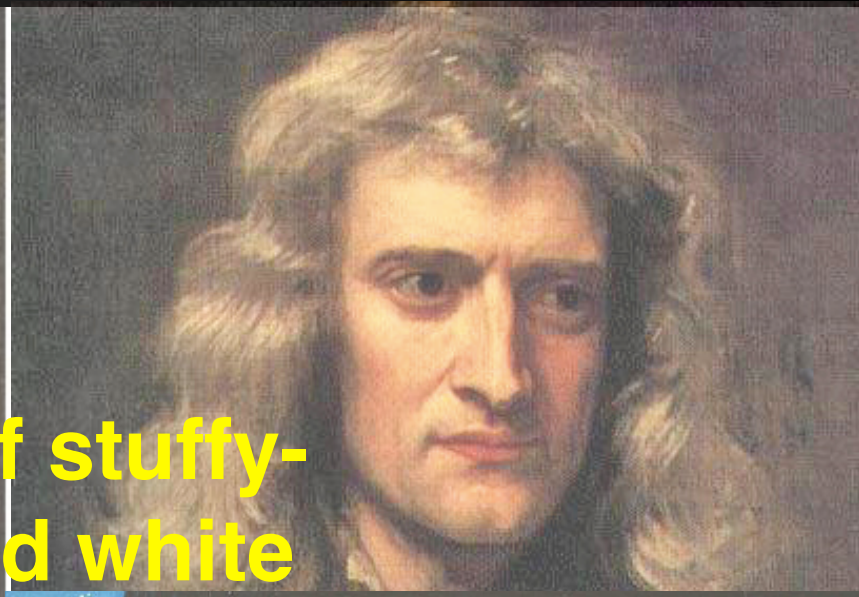
5. Thermal physics

i. Define temperature and its relationship to energy
ii. Describe the macroscopic and microscopic basis for ideal gases
iii. Solve problems involving ideal gases
iv. Define heat and its relation to energy
v. Solve problems using the heat capacity
vi. Calculate heat transfer through conduction, convection, and radiation
vii. Give examples using the laws of thermodynamics
viii. Use a P-V diagram to illustrate different thermodynamic processes
ix. Calculate the efficiency of a heat engine
x. Define entropy as both a macroscopic and microscopic effect
xi. Apply the principles of waves to sound
xii. Solve problems involving the Doppler effect

We'll keep busy this semester :)

Starting out with mechanics - why study this?





A bunch of stuffy-looking old white dudes from a long time ago

Why are we studying this?

- But... classical mechanics underlies all of newer, more modern physics
- The class will teach you key tools necessary for electricity and magnetism in the next course
- The material here also covers relevant physics for our every-day lives!

www.symmetrymagazine.org/article/august-2014/lhc-physicist-takes-on-new-type-of-collisions

Courtesy of EA SPORTS

signal to background

August 21, 2014

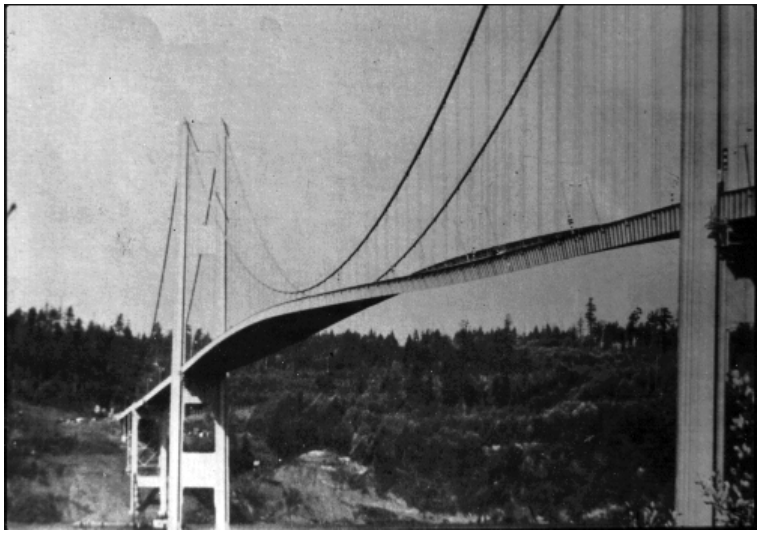
LHC physicist takes on new type of collisions

A former Large Hadron Collider researcher brings his knowledge of high-energy collisions to a new EA SPORTS NHL hockey game.

http://www.symmetrymagazine.org/article/august-2014/lhc-physicist-takes-on-new-type-of-collisions

Sports

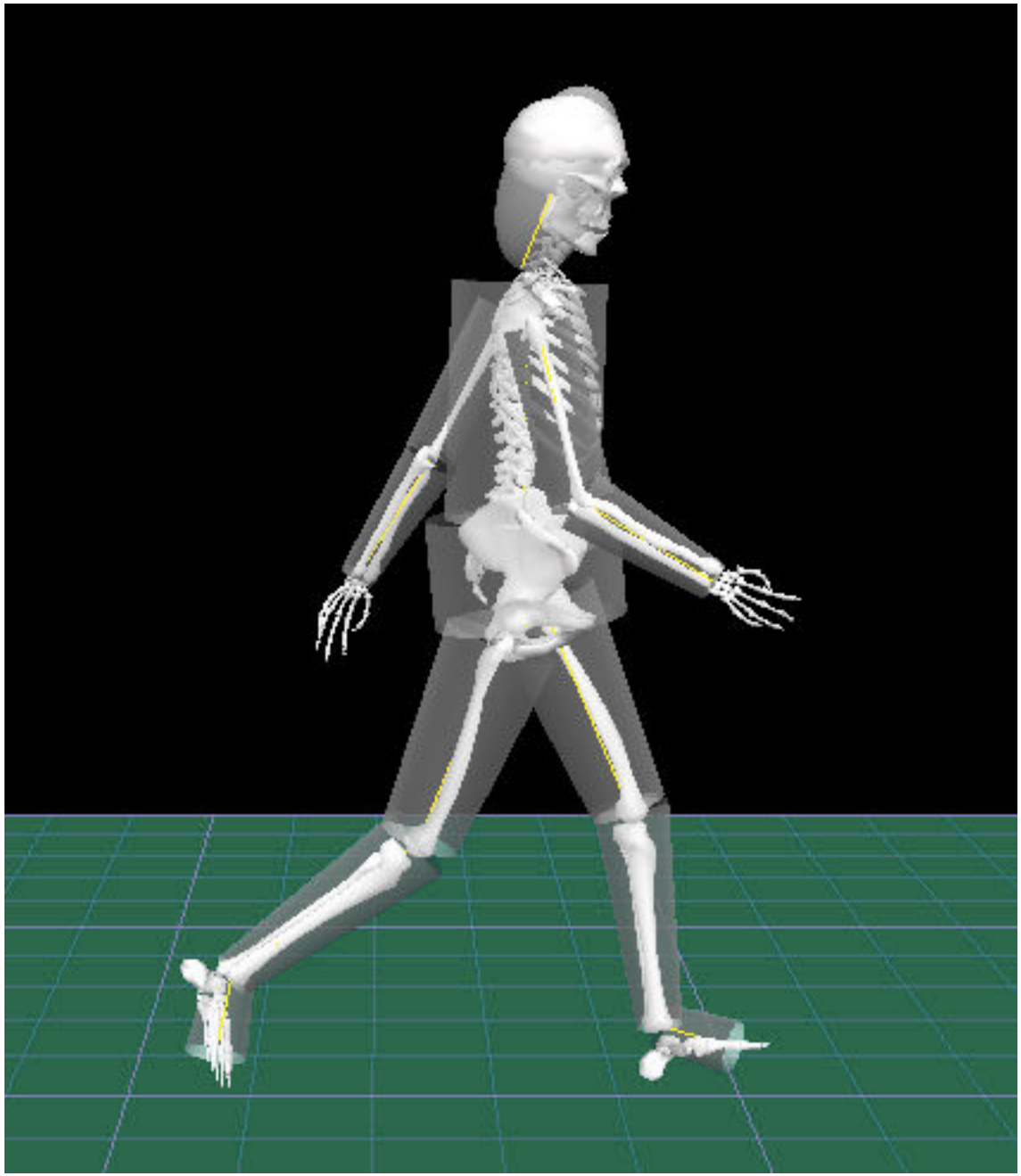
An unfortunate example for the engineers



http://upload.wikimedia.org/wikipedia/commons/1/19/Tacoma_Narrows_Bridge_destruction.ogg

Airplane takeoff

Biomechanics



Some more fun

And then next semester and beyond

Grading

- Problem sets every ~1 week, each with the same weight: combined total, 15% of grade
  - Sometimes overlapping assignments, sometimes overlapping with exams
- Lab reports and lab work, with schedule and rules posted separately, 25% of grade
- Tests **3 per semester (2 + final)**, in class, schedule to be announced in class, total of 60% of grade (20% each)
  - Tests not explicitly cumulative, but you will need to master one set of skills before you will do well on your future exams

On the homework

- Will be using McGraw-Hill Connect, connected to blackboard, for the homework
- You should make sure to sign up and that you can access the homework **AS SOON AS POSSIBLE**
- Let me know if you run into troubles

http://connect.mheducation.com/class/j-adelman-fall-2016

On the homework

- All to be due 1 week after assignment before class starts, or as discussed in class
  - To be announced after we finish a chapter/topic, but you should expect it to be there and due in 1 week whenever we finish a chapter, regardless of exam/other schedule
  - Start the HW early! If you get stuck and need help, please go to the physics help room
  - **NO** late homework will be accepted without penalty
    - Scores reduced by 10% for each day late except last assignment (chapter 14), when late homework not accepted. (No chapter 15 HW)

On the exams

- There will absolutely be no make-up tests, and tests cannot be taken at a different time for any reason
- In the case of convincing and well-documented emergencies the missed test grade may be waived, however, do not assume this is automatic.
  - I need to see some convincing evidence of a valid, good emergency. Faking an emergency is worse than missing an exam, and will be brought to the attention of the appropriate NIU personnel as potential academic misconduct

On electronics

- No electronic devices of any kind allowed allowed during lectures or tests
  - Calculators the sole exception during exams (but only a calculator, nothing beyond that), **definitely useful to have**
  - If you are spotted with your phone or other electric item out during an exam, you fail it
- If you have an electronic version of the book, you can view it at home, but not in class (too distracting, sorry!)
- You can take a **single** “cheat sheet” of material with you to each exam, but no other paperwork

On electronics

- Cell phones need to stay in your pocket and be turned off during class
  - If your phone rings, we will know it was you. It is distracting and thus unfair to your fellow students
- No texting or using your phone, anyway
  - I reserve the right to take points off of future exams if I spot you breaking this policy, even if only in class and not during the exam

On cheating and plagiarism

- This is a serious subject - just avoid it at all costs!
  - If you are spotted cheating on an exam, appropriate measures will be taken up with the Office of Community Standards and Student Conduct (this is serious, folks!)
  - Plagiarism on lab reports is an equally serious offense. We will be using SafeAssign for your lab reports

Grading

- After weighting components as listed previously, the grades will be:
  - A: 90-100%
  - A-: 85-90%
  - B+: 80-85%
  - B: 75-80%
  - B-: 70-75%
  - C+: 65-70%
  - C: 60-65%
  - D: 50-60%
  - F: 50% or less

Office hours

- Office Hours: Faraday 219,
  Tuesday + Thursday 2-3:15 pm or by appointment
- Preferred method of communication: email (jahred.adelman@niu.edu)
  - You can always try and stop by, but you will have better luck if you set up an appointment or come during the above times
  - I am not on campus every day

Attendance and class

- You should come to every class (shouldn't need to ask this of you, but I state it anyway)
  - Please avoid food in the classroom
  - Bottles and cans of liquid are OK (no straws!) so that we can all stay hydrated, but is otherwise disruptive to me and to others
  - Talk to me privately if this is a problem
- Would prefer that you pay attention in class to what I say instead of trying to write down every single thing on slides (you anyway have the textbook, on which these lectures are based!)

The plan of action: We'll go over a full chapter of material without stopping or hopefully pausing for too many breaths, and when we finish (if there is time left before we have to move on), we'll play with some animations and/or do some extra practice problems on the board

BUT feel free to interrupt to ask questions

Tentative schedule

Date	Topics	Sections in book
Aug 23	Introduction+talking physics+measurement	1.1-1.3
Aug 25	Units, dimensional analysis, estimation, recording data	1.4-1.9
Aug 30	Vectors, vector components, equilibrium	2.1-2.4
Sept 1	Gravity, constant forces, friction	2.5-2.9

Tentative schedule

Date	Topics	Sections in book
Sept 6	Displacement, velocity, acceleration	3.1-3.3
Sept 8	Mass + motion, net force, relative velocity	3.3-3.5
Sept 13	Constant acceleration, free fall, apparent weight, projectile motion	4.1-4.5
Sept 15	Uniform circular motion, centripetal force, curved tracks, satellite motion	5.1-5.4
Sept 20	Roller coasters, artificial gravity, work, kinetic energy	5.4-5.7, 6.1-6.3
Sept 22	Potential energy, gravitational energy, elastic + spring energy, power	6.4-6.8
Sept 27	**Exam 1 (Chapters 1-5)**	
Sept 29	Impulse+momentum, momentum conservation, center of mass	7.1-7.5
Oct 4	Finding the center of mass, collisions, elastic collisions, rotational inertia	7.6-7.8
Oct 6	Rotational inertia, torque, statics, rotational motion, angular momentum	8.1-8.7

Tentative schedule

Date	Topics	Sections in book
Oct 11	Angular momentum, angular vectors, states of matter, pressure	8.8-8.9. 9.1-9.5
Oct 13	Buoyancy, fluid flow, viscosity, terminal velocity	9.6-9.11
Oct 18	Stress, strain, material strength, harmonic motion	10.1-10.6
Oct 20	Pendulums, wave motion, harmonic waves	10.7-10.10, 11.1-11.4
Oct 25	Reflection, refraction, interference, diffraction	11.5-11.10
Oct 27	**Exam 2 (Chapters 6-10)**	
Nov 1	Sound waves, intensity, musical instruments, hearing	12.1-12.6
Nov 3	Hearing, Doppler effect, echoes	12.7-12.9
Nov 8	Doppler effect + echoes, temperature, thermal expansion	13.1-13.3

Tentative schedule

Date	Topics	Sections in book
Nov 10	Ideal gas, ideal gas law, kinetic theory	13.4-13.7
Nov 15	Diffusion, Thermal energy, heat capacity	13.8, 14.1-14.2
Nov 17	Heat capacity, latent heat, conduction	14.3-14.6
Nov 22	Convection, radiation, conservation	14.7-14.8, 15.1-15.2
Nov 29	Heat flow, engines, refrigerators	15.3-15.6
Dec 1	Reversibility, entropy	15.7-15.9

Dec 6 (4-5:50 pm) **Exam 3/Final (Chapters 11-15)**

Disability statement

If you need an accommodation for this class, please contact the Disability Resource Center as soon as possible.The DRC coordinates accommodations for students with disabilities. It is located on the 4th floor of the Health Services Building, and can be reached at 815-753-1303 (V) or drc@niu.edu. Also, please contact me privately as soon as possible so we can discuss your accommodations. The sooner you let us know your needs, the sooner we can assist you in achieving your learning goals in this course.

My aim is for you to enjoy this course and to learn the material - please let me work with you so that we can achieve our goals

About me

- I answer to “Jahred”, “Professor Adelman”, “Professor Jahred”, “Dr Adelman”, “Dr Jahred” and occasionally “Professor Dr. Adelman”, if needed
- But I **may not** answer to “hey you” or to emails that do not have an appropriate greeting (such as “Hello XYZ” or “Greetings, ABC”, etc)

About me

- For those who do not know me, I'm a particle physicist working on searches for new physics with Higgs bosons using the ATLAS experiment at the LHC (at CERN)
  - Ask me after class or during office hours about my research. I like to talk about it :)

About me

- I'll try to update my teaching style as the semester goes on, based on my experience, observations and your feedback
  - If I am going too fast... or too slow, or if my style (or hand-writing) is incomprehensible, please speak up