

Physics II: 1702

Gravity, Electricity, & Magnetism

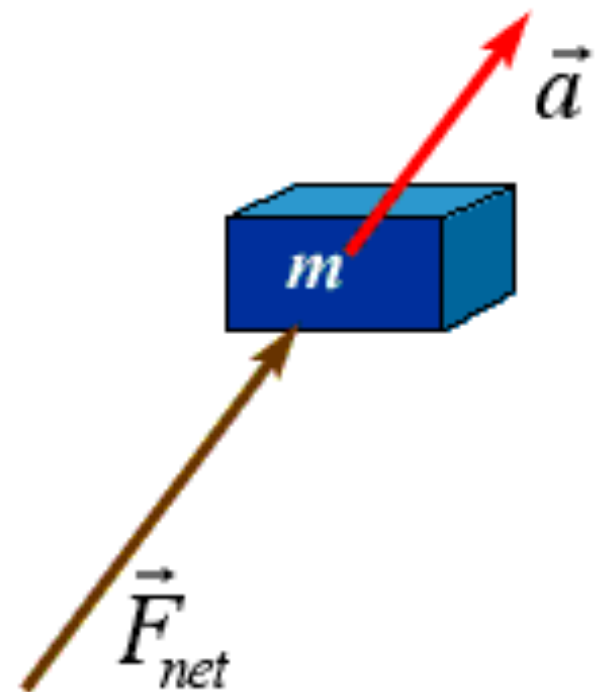
Professor Jasper Halekas

Van Allen 70 [Clicker Channel #18]

MWF 11:30-12:30 Lecture, Th 12:30-1:30 Discussion

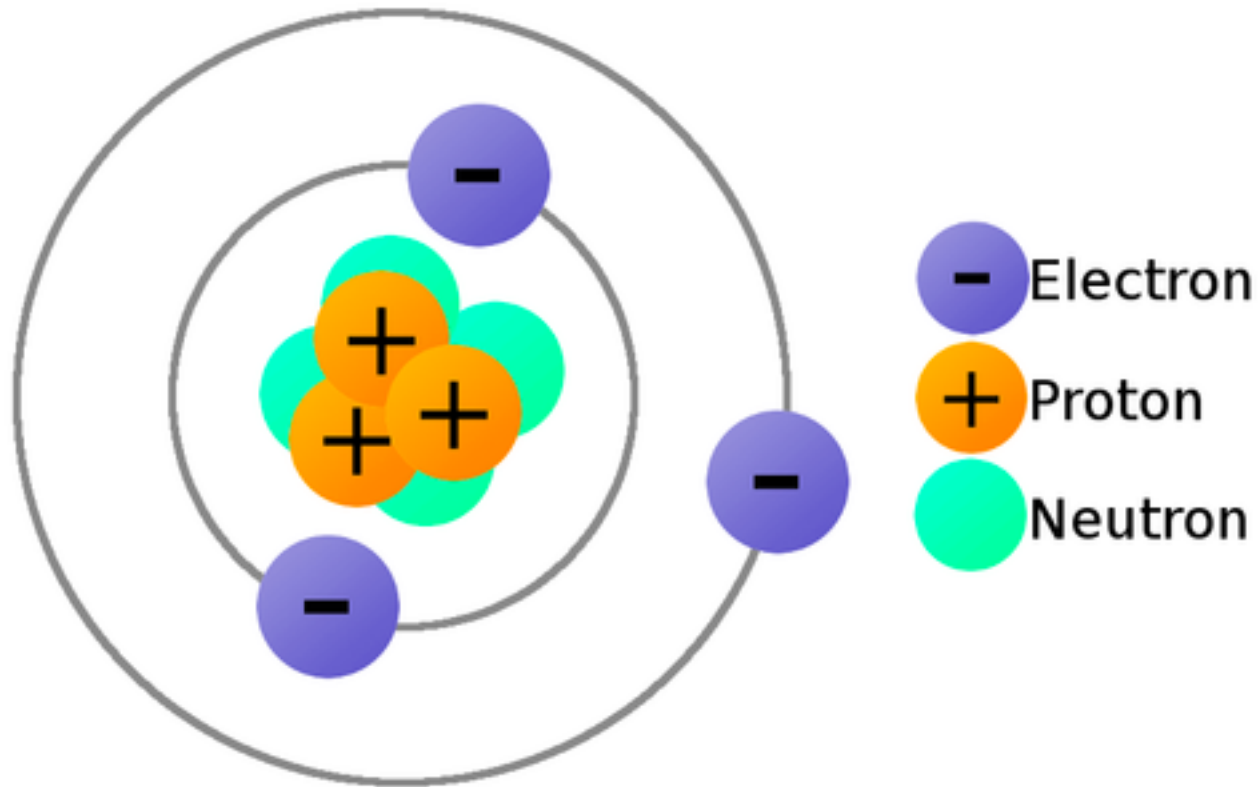
Inertia and Newton's Laws

- Objects have mass (inertia)
- Applying an unbalanced force to a mass causes it to accelerate

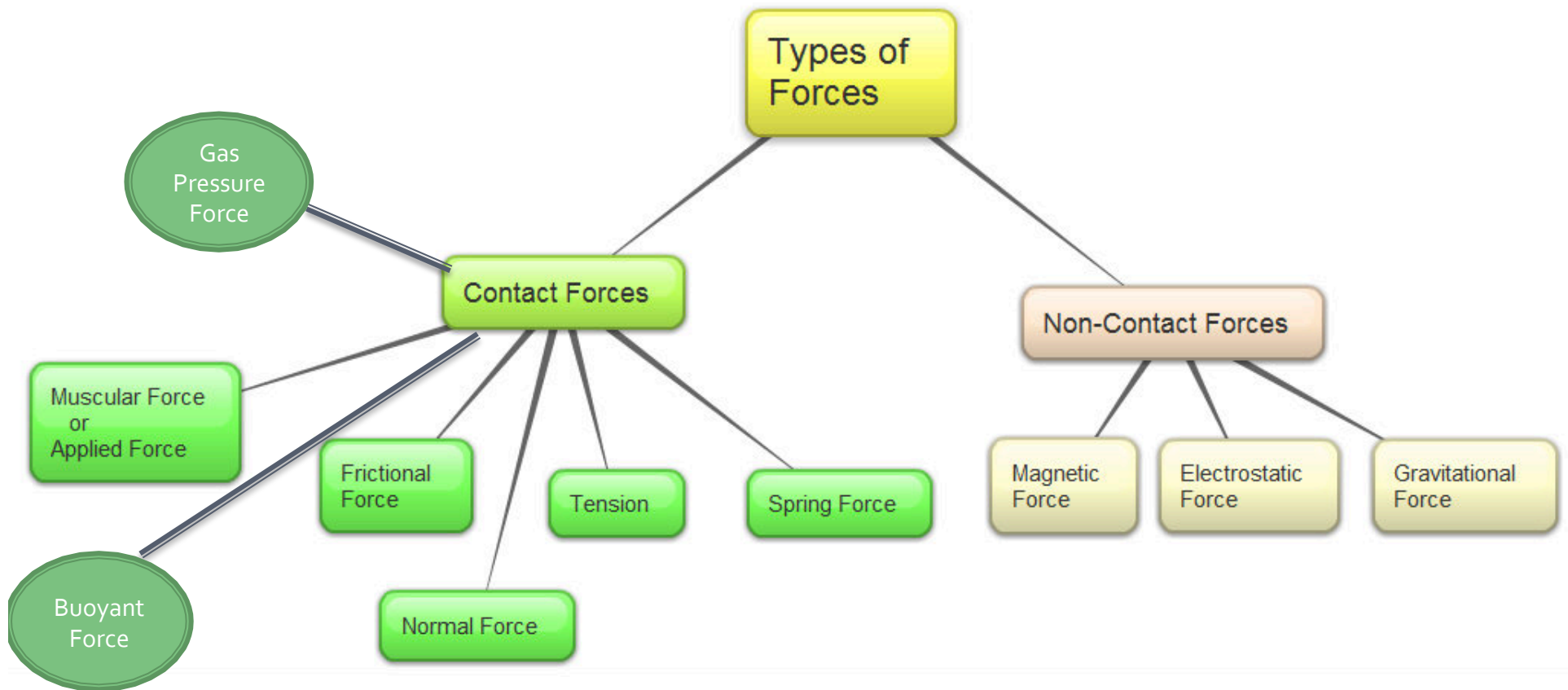


Electric Charge

- Objects can have not only mass, but charge

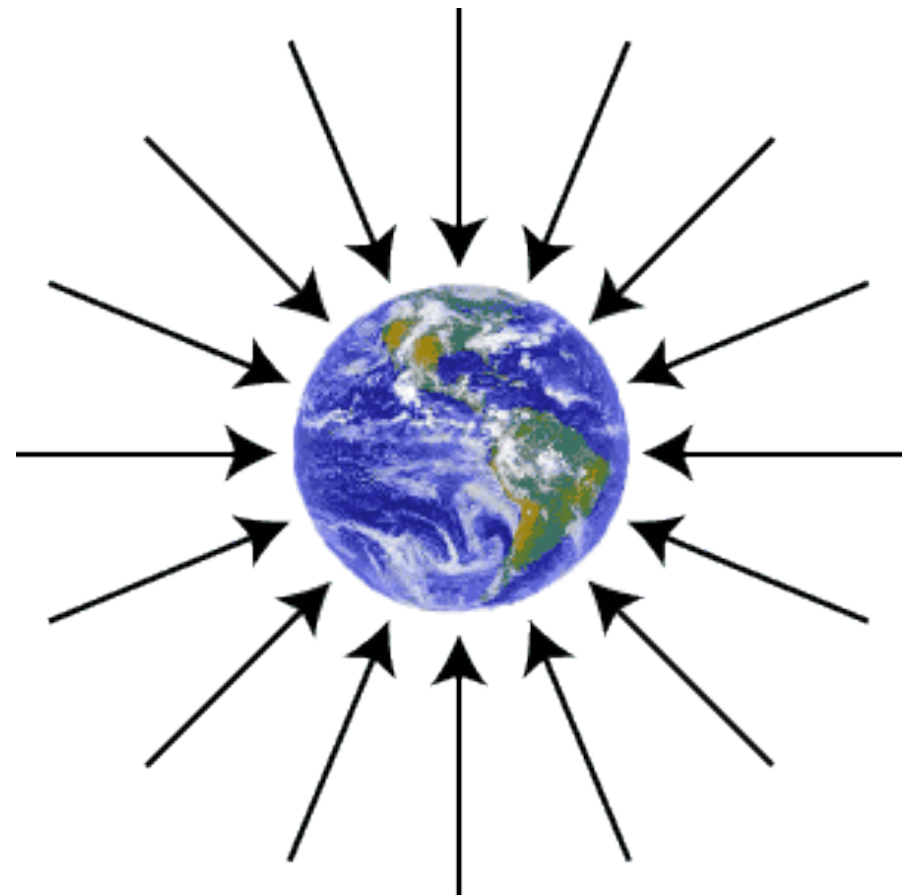


Forces



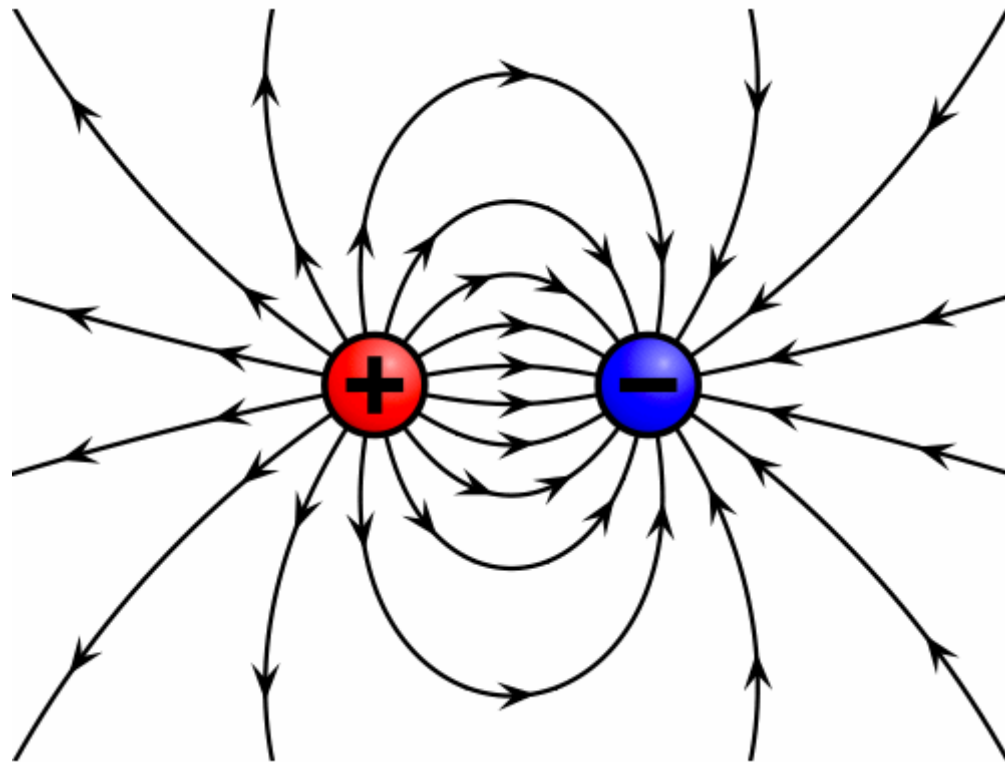
Gravitational Forces

- Gravitational forces act on mass, and are themselves caused by concentrations of mass
- The gravitational force can be thought of as caused by a field that fills all of space



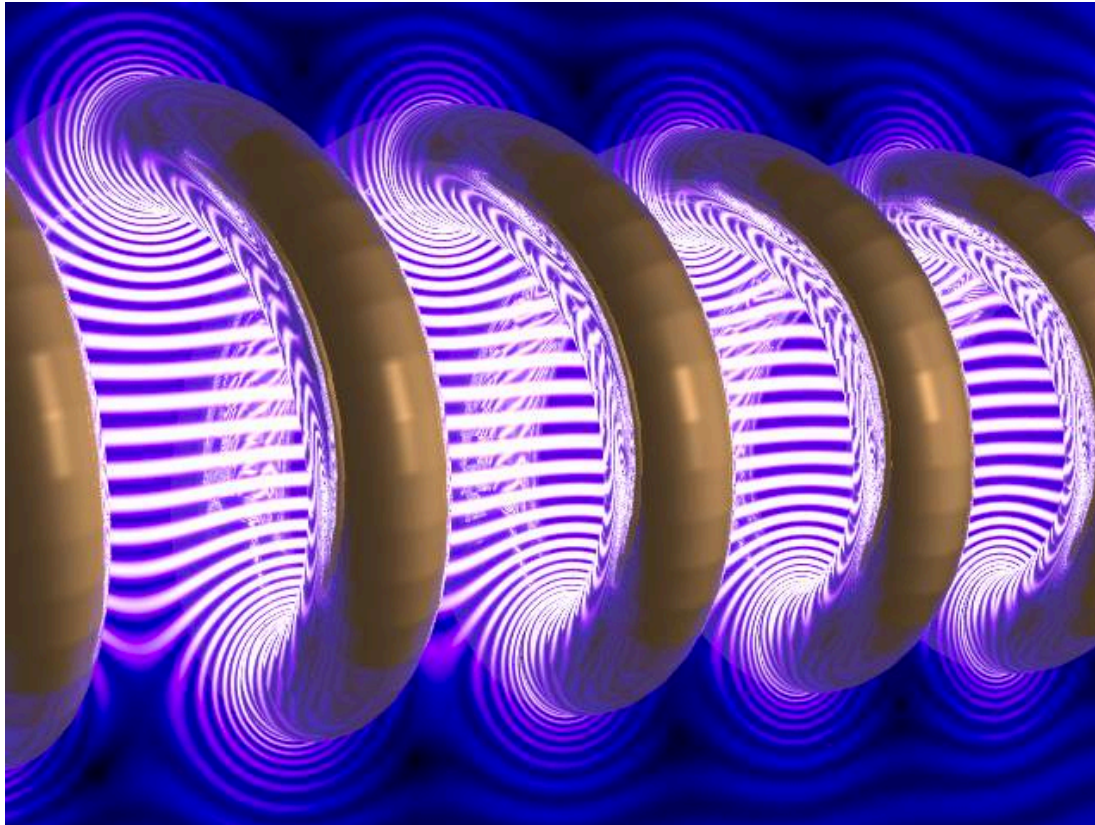
Electrical Forces

- Electrical forces act on charged particles, and are caused by charged particles

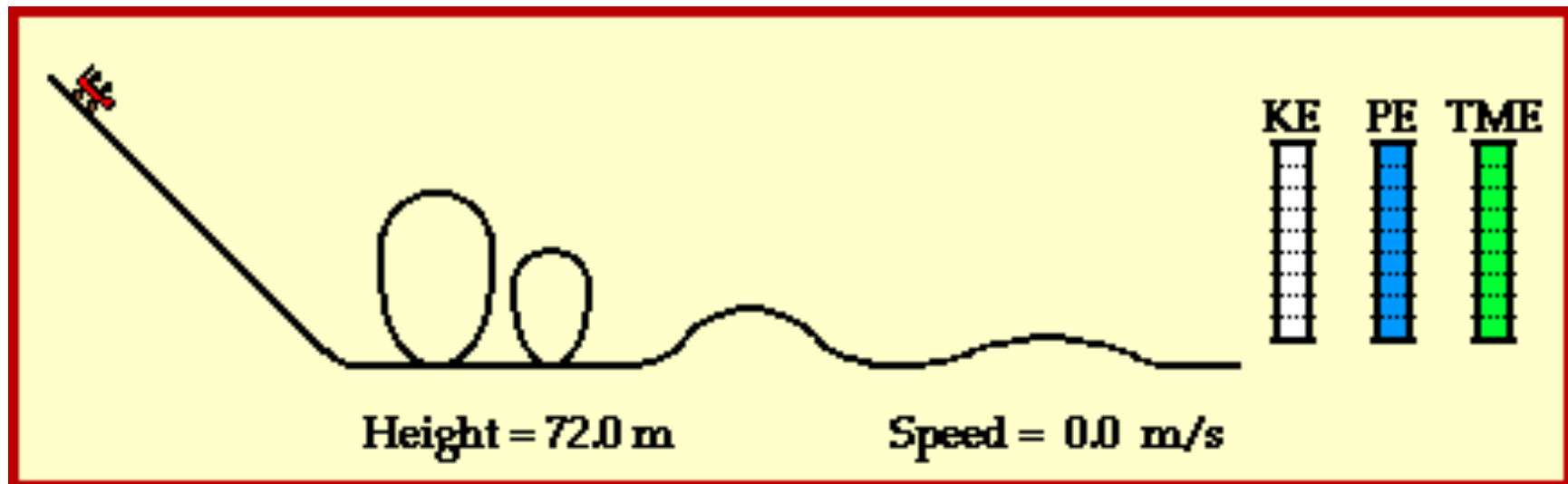


Magnetic Forces

- Magnetic forces act on moving charges, and are caused by moving charges

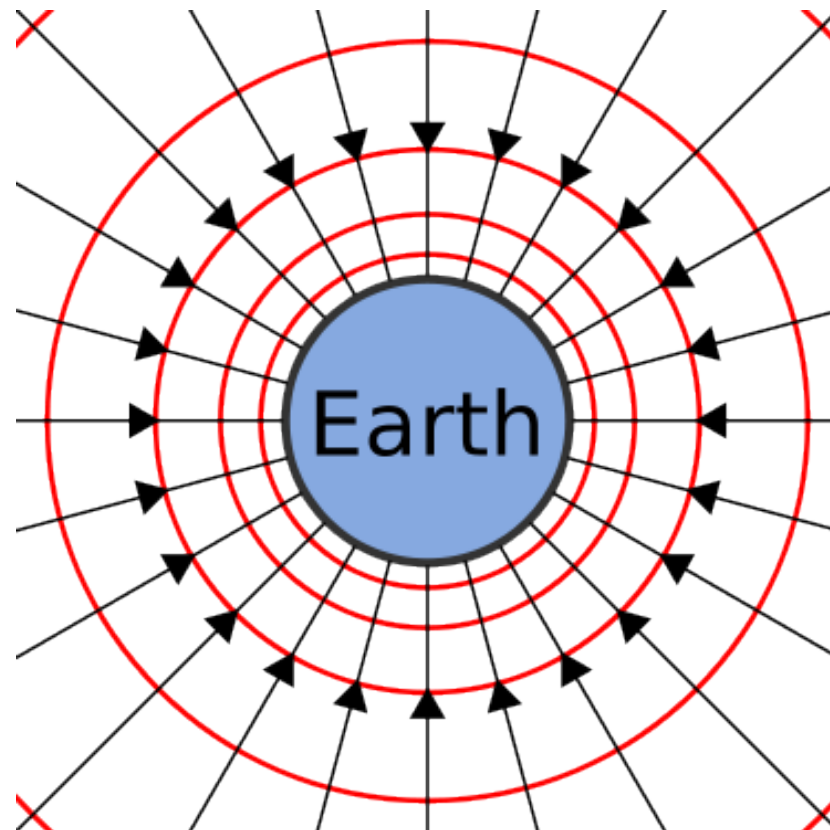


Conservation of Energy



Gravitational Potential

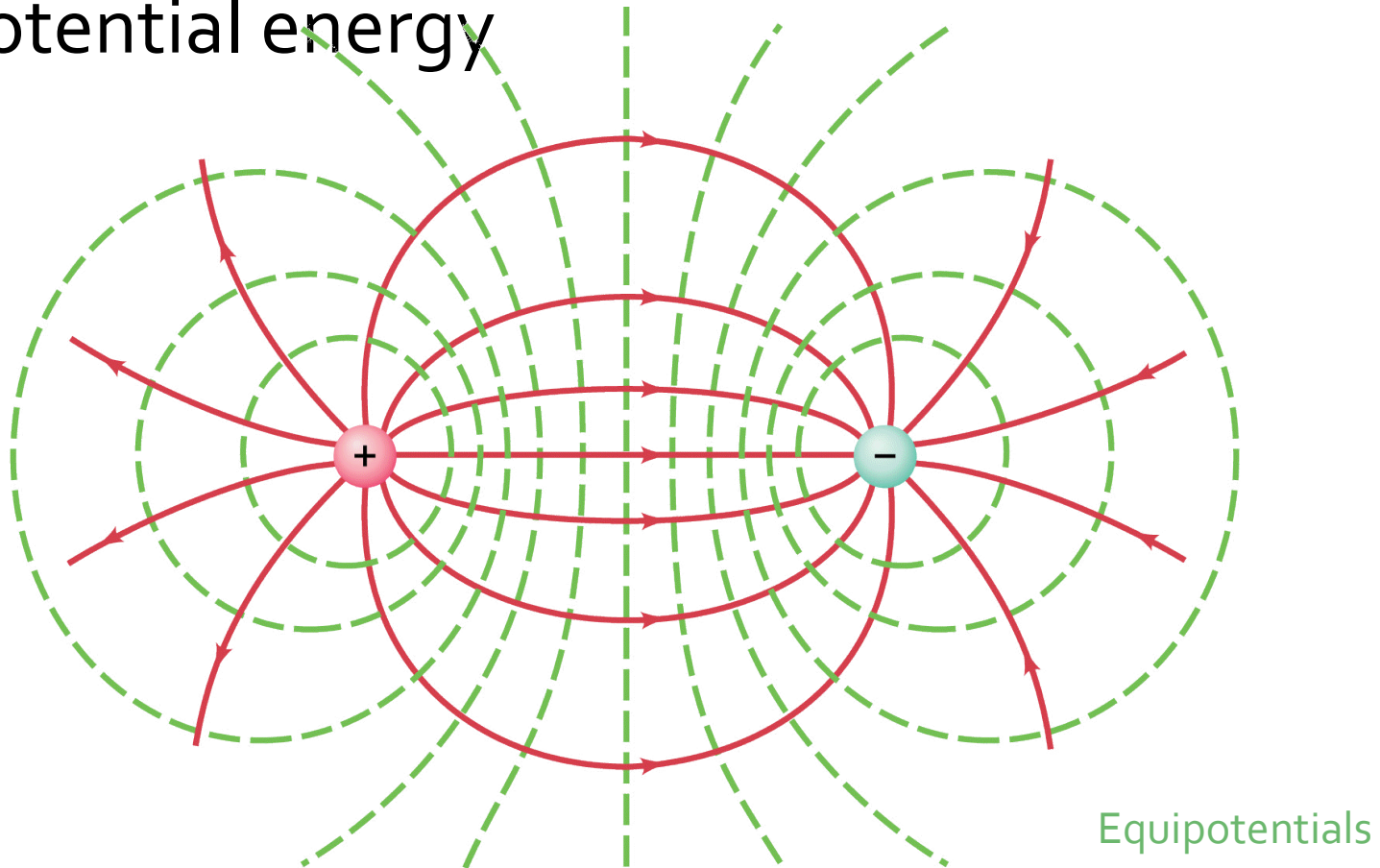
- Gravitational forces are associated with gravitational potential energy



Equipotentials

Electric Potential

- Electrical forces are associated with electric potential energy



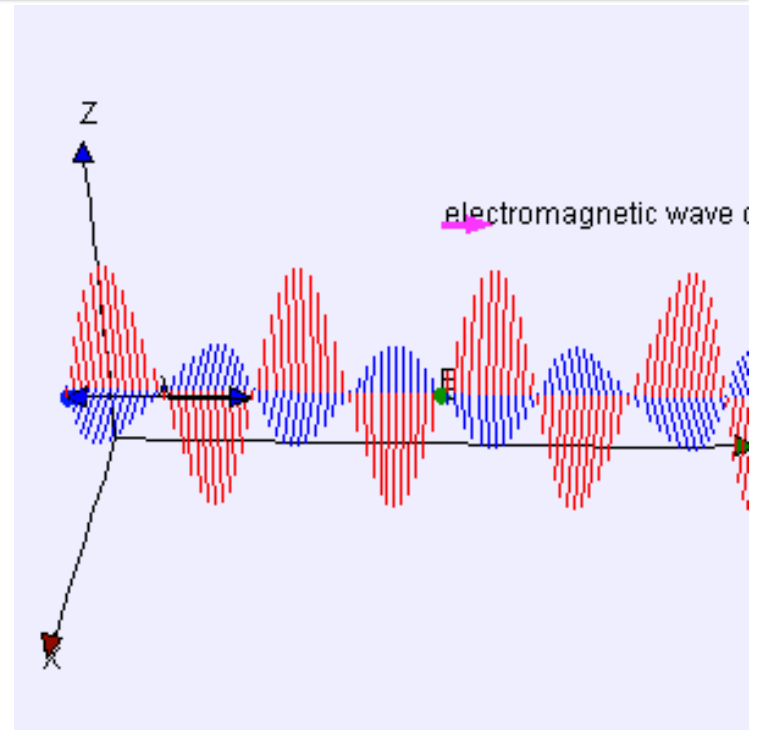
Magnetic and Electric Fields

$$1. \oint \mathbf{E} \cdot d\mathbf{A} = \frac{q_{enc}}{\epsilon_0}$$

$$2. \oint \mathbf{B} \cdot d\mathbf{A} = 0$$

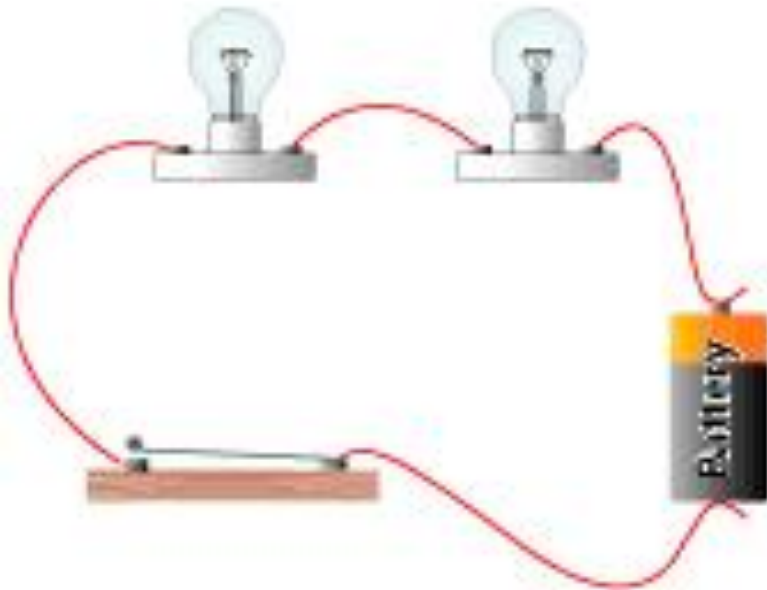
$$3. \oint \mathbf{E} \cdot d\mathbf{s} = -\frac{d\Phi_B}{dt}$$

$$4. \oint \mathbf{B} \cdot d\mathbf{s} = \mu_0 \epsilon_0 \frac{d\Phi_E}{dt} + \mu_0 i_{enc}$$

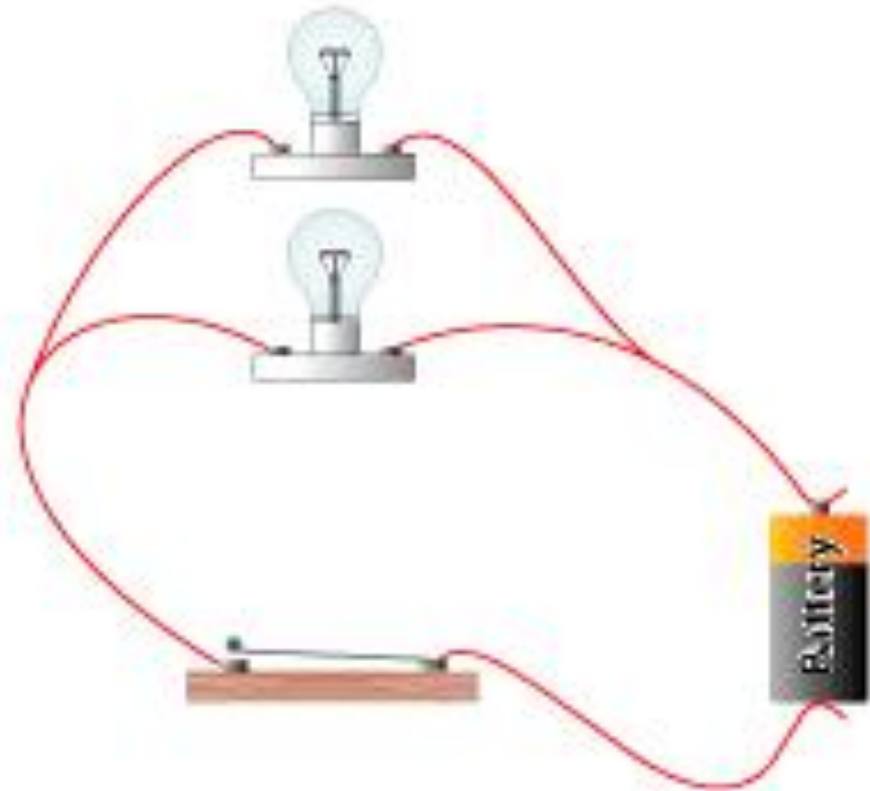


Simple Electric Circuits

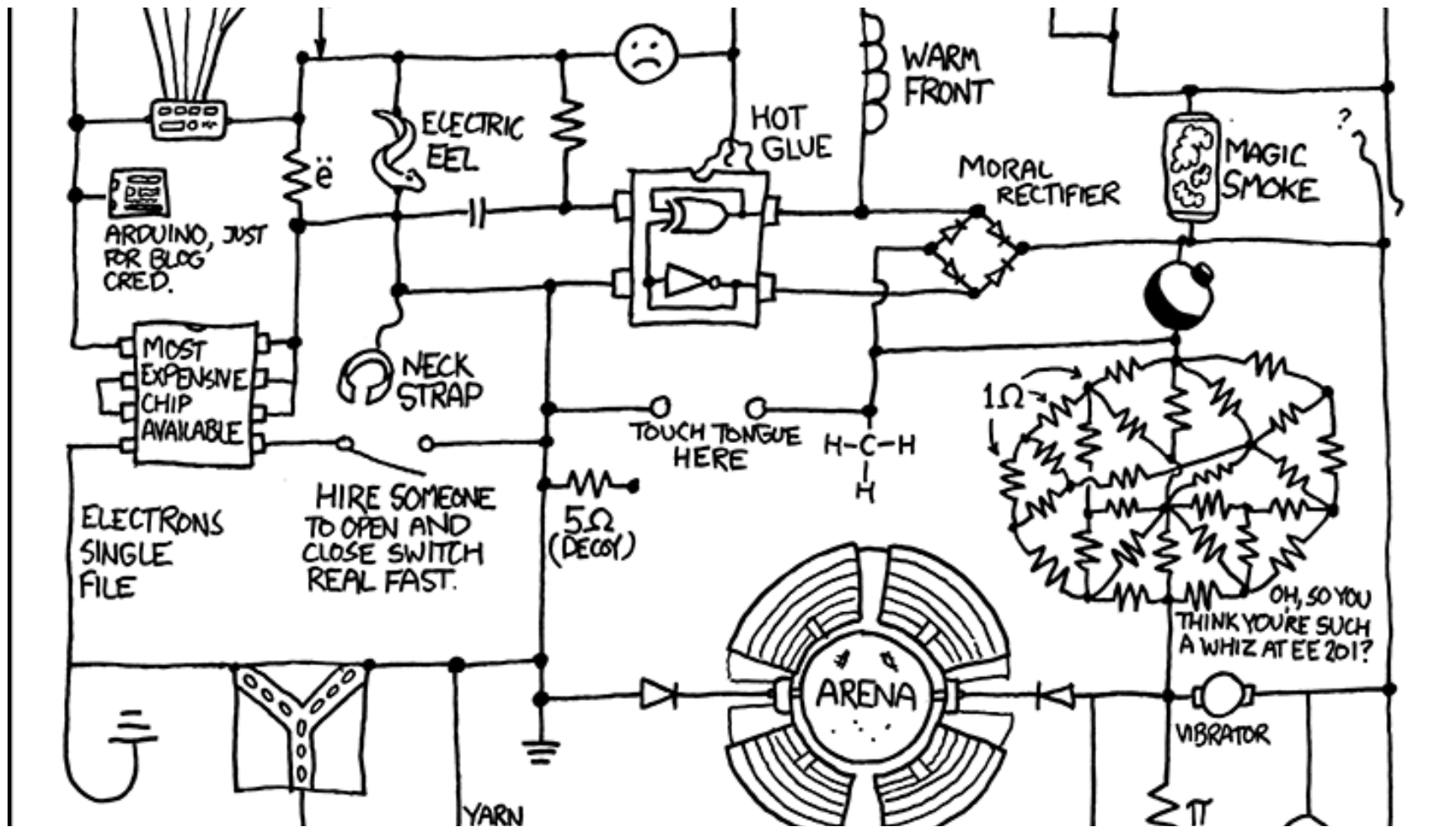
Series Circuit



Parallel Circuit



More Complicated Circuits



Syllabus & Schedule

- Will not be handed out
- Go to the class ICON page, or the main physics dept. web page, to navigate to the main class page
 - Here you can find the syllabus and class schedule (and a copy of these notes)



Syllabus I: Contacts/Times

- **Instructor:** Jasper S Halekas
- **Office:** 414 Van Allen Hall
- **Phone:** (319) 335-1929
- **E-mail:** jasper-halekas@uiowa.edu
- **Office Hours:**
 - 2:00-3:00 pm Tuesday,
 - 9:00-10:00 am Wednesday,
 - 4:00-5:00 pm Thursday
 - Or by Appointment
- **Lectures:** MWF 11:30-12:20, 70 Van Allen
- **Discussion:** Th 12:30-1:20, 70 Van Allen Hall

Syllabus II: Books/Pages

- **Required Text:**

- *Fundamentals of Physics, Halliday & Resnick, 10th Edition, Volumes 1&2, Jearl Walker, with Wiley Plus.*

- **Required Lab Text:**

- *Experiments in Electricity, Magnetism, & Light + Quantum Physics, John Goree and Anthony Moeller.*

- **Course Web Pages:**

- http://www.physics.uiowa.edu/~jhalekas/teaching/physII_2016/index.html
- <https://icon.uiowa.edu/d2l/home/2448875>
- <http://www.wileyplus.com/class/491564>

Class Notes

- Notes from each class (both PPT and blackboard material) will be merged and placed online in PDF form within one day after the class

Syllabus III: Tests/Grading

- **Exam Schedule:**
 - Wednesday, Feb. 24
 - Wednesday, April 6
 - Final Exam, TBD Date
- **Two Midterm Exams:**
 - Chs. 13, 21-24
 - Chs. 25-29
 - Chs. 13, 21-32
- **Grading:**
 - Homework 20%
 - Labs 20%
 - Two Midterms 15% Each
 - Final Exam 30%
 - Participation Extra Credit (up to 2%)

Syllabus IV: Homework

- Weekly homework assignments are to be completed online using WileyPLUS. All assignments must be completed online by 11:00pm on Wednesdays.
 - Online assignments will have separate conceptual (one chance per problem, no hints) and mathematical sections (two chances per problem, with hints)
- Twice per semester (before each exam), homework solutions will be required in hard-copy format with all work shown.

Syllabus V: Labs

- The laboratory assignments are a key part of the course, to be held under the supervision of your teaching assistant, who will also grade the laboratory reports.
- Only 9 of 10 labs will be counted toward grading, however, there will be *no* make-up labs.

Syllabus VI: Exams

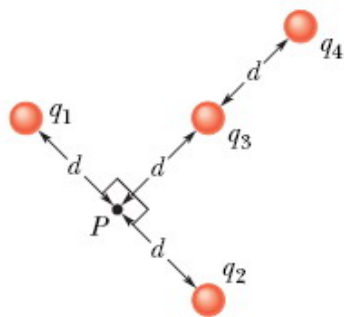
- Midterm exams will be held during regular class hours on the dates specified above. The final exam will be two hours, scheduled during finals week at a time to be announced.
- Exams will be closed book, but each student may bring a single-sided 8.5x11 equation sheet.
- Exams are long-form and require work to be shown. Partial credit may be granted for correct methodology, even if the final answer is incorrect.

Exams Vs. Homework

- Homework and exam questions treat same material, but are slightly different in form

Typical Homework Question:

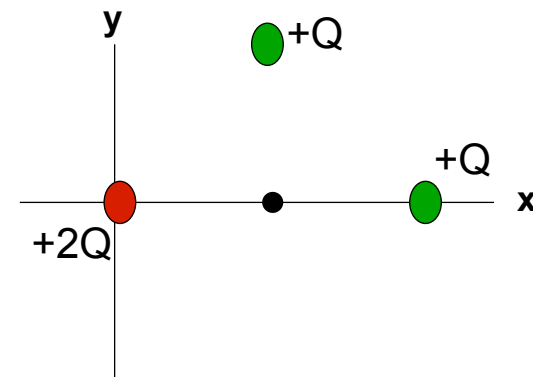
In the figure the four particles are fixed in place and have charges $q_1 = q_2 = 3e$, $q_3 = 2e$, and $q_4 = -8e$. Distance $d = 2.76 \mu\text{m}$. What is the magnitude of the net electric field at point P due to the particles?



Typical Exam Question:

Question 1 (6 points): A point in empty space is near 3 charges as shown. The distances from the point to each charge are identical.

A (2 points). Draw a vector showing the direction the electric field points.



B (2 points). What is the angle between the electric field and the x-axis at the point?

C (2 points). If the distance to each charge is L , what is the magnitude of the electric field at the point?

Exam Preparation

- To help you to prepare for the exams, which require long-form answers, I do two things:
 - Assign two long-form homeworks, which I personally hand grade
 - Provide previous exam questions as a study guide

Syllabus VII: Participation

- Participation will be tracked by your response to clicker questions during lecture. These questions are un-graded, so any response counts as participation.
 - You are all expected to have clickers by Friday

>60% participation
>80% participation
>90% participation

0.5% of overall points
1.0% of overall points
2.0% of overall points



Why are we using clickers?

- To give you a chance to practice tough concepts and check your understanding in real time – physics is tricky!
- To give me feedback on what you get and what you don't – I'm not perfect!
- Because clicker questions can (should) be fun
- Because peer-reviewed research shows that students in the worst classes that use clickers and other interactive learning techniques learn more than those in the best classes that don't

Ask Questions!

- The fact that I ask clicker questions in part to get feedback does not mean that you should not also ask other questions in class
- If you have a question, others may also have the same question
- Don't be afraid to speak up!

Discussions

- Discussions are a chance to get into the details of problem solving and mathematical techniques
 - We will practice problem-solving by going over any questions on previous homework and working through new problems together
 - We will also use this time to review and sometimes introduce mathematical techniques and concepts
 - In our first discussion (tomorrow), we'll discuss vector math

Syllabus VIII. Communication

- Please let me know if you have questions, comments, complaints, or are struggling with particular concepts. This class is for you, and I am here to help.
 - Students may communicate with me by phone, e-mail, or in person
 - Students with issues or questions should if possible raise them in person by attending office hours or by scheduling an appointment
 - If you prefer to give me anonymous feedback there is a comments envelope on my door

Schedule

Dates	Week	Reading Due Monday	Lab Monday	Homework Due Wednesday	Test
Jan 19-22	Week 1		No Lab		
Jan 25-29	Week 2	Chapter 13	No Lab	Online	
Feb 1-5	Week 3	Chs. 21 to 22-3	E1	Online	
Feb 8-12	Week 4	Chs. 22-4 to 23	E2	Online	
Feb 15-19	Week 5	Chapter 24	E3	Hardcopy	
Feb 22-26	Week 6	No Reading	No Lab	No Homework	Midterm 1 Wed. 2/24 Chs. 13, 21-24
Feb 29- Mar 4	Week 7	Chapter 25	E4	Online	
Mar 7-11	Week 8	Chs. 26 and 27	E5	Online	
Mar 14- 18	Spring Break				
Mar 21- 25	Week 9	Chapter 28	E6.5	Online	
Mar 28- Apr 1	Week 10	Chapter 29	E9	Hardcopy	
Apr 4-8	Week 11	No Reading	No Lab	No Homework	Midterm 2 Wed. 4/6 Chapters 25-29
Apr 11-15	Week 12	Chapter 30	E8	Online	
Apr 18-22	Week 13	Chapter 31	OS1	Online	
Apr 25-29	Week 14	Chapter 32	E11	Online	
May 2-6	Week 15	No Reading	No Lab	No Homework	
May 9-13	Finals Week	No Reading	No Lab	No Homework	Final Chs. 13, 21-32