March 28, 2011 Physics 122 Prof. E. F. Redish

- **Theme Music:**
  Moby
  Electricity
- **Cartoon:**
  Gary Larson
  The Far Side

Late at night, and without permission, Reuben would often enter the nursery and conduct experiments in static electricity.

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Outline

- Quiz 6: Interference
- This week in Tutorial and Lab
- Recapping Newton's laws: A new force
- Shopping for ideas: Electric phenomena
- ILD 3: Charge and the Electric Force — A Hidden Property of Matter
- Model of Matter
  - Conductors and Insulators
  - Polarization

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This week in tutorial and lab

- The Tutorial this week is an extension of ILD #3 on electric charge. You will work through the reasoning with the Scotch tape more carefully.
- In lab this week we again begin a new topic -- electric currents, although we have not yet discussed the subject in lecture. You will be exploring two related measurements -- voltage drop and current flow. For some substances, these two are directly proportional ("Ohm's Law"). For others, they are not. You will test a variety of substances to see how well Ohm's Law applies -- if it does at all

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Causes of Motion: Newton's Laws

- **N0**: Objects only respond to forces on themselves, at the time those forces are exerted.
- **N1**: Objects change their velocity (perhaps = 0) only if they are acted on by unbalanced forces.
- **N2**: Each object responds to the forces it feels by changing its velocity according to $\vec{a} = \vec{F}^{net} / m$
- **N3**: When two objects touch, they exert equal and opposite forces on each other. $\vec{F}_{A\to B} = -\vec{F}_{B\to A}$

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Kinds of forces

- There are 2 classes of forces
  - Touching
    - Normal — N (perpendicular to surface and pressing in)
    - Tension — T (pulling out of the surface)
    - Friction — f (parallel to surface — opposing sliding)
  - Non-touching
    - Gravity — W
    - Electric — F^{elec}
    - Magnetic — F^{mag}

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Experiencing Electrostatics

http://phet.colorado.edu/simulations/sims.php?sim=Balloons_and_Static_Electricity

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ILD 3: Charge

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What's going on?

- Suppose we have created a number of charged objects (types A and B or + and -).
- Opposite types attract, like types repel.
- Both kinds attract non-electrified matter.
- What's going on?

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Model: Charge
A hidden property of matter

- Matter is made up of two kinds of electric matter (positive and negative) that cancel when they are together and hid matter's electrical nature.
- Matter with an equal balance is called neutral.
- Like charges repel, unlike charges attract.

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Conductors and Insulators

- Insulators
  - In some matter, the charges they contain are bound and cannot move around freely.
  - Excess charge put onto this kind of matter tends to just sit there.
- Conductors
  - In some matter, charges in it can move around throughout the object.
  - Excess charge put onto this kind of matter redistributes itself or flows off (if there is a conducting path to ground).

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Polarization

- Consider a + charge object brought up near an uncharged (neutral) conductor. What happens?

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Polarization

- Consider a + charge object brought up near an uncharged (neutral) insulator. What happens?

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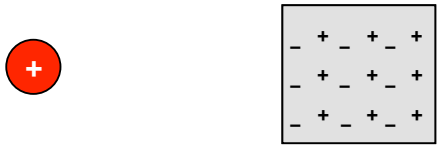

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