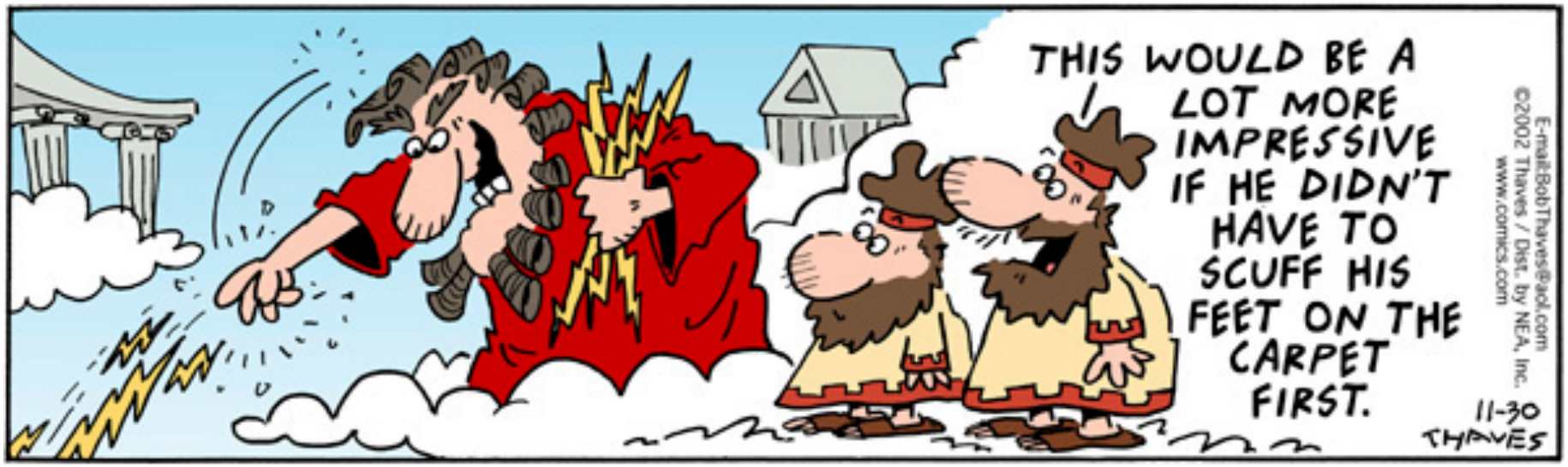
- **Theme Music: U2**

  Electric Storm

- **Cartoon: Bob Thaves**

  Frank & Ernest



Outline

- Recap: Newton's Laws
- More than two charges: Superposition
- Examples
- ILD 4: Representation as Communication

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. $\vec{F}_{A \to B} = -\vec{F}_{B \to A}$

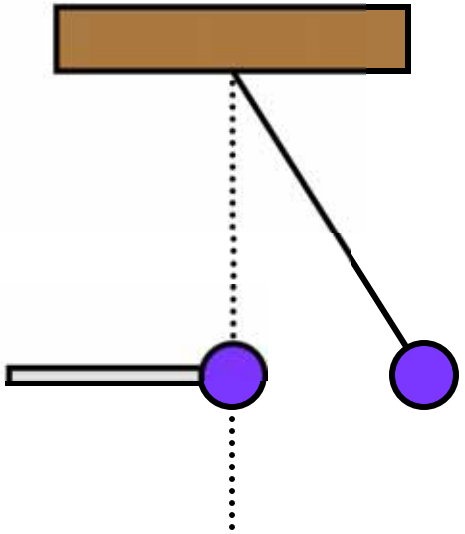
Foothold ideas: Coulomb's Law

- Depends on the "test" charge
- Depends on the "source" charge
- Depends on the distance between the charges
- The sign gives direction

$$F_{Q\to q} = F_{q\to Q} = \frac{k_C qQ}{R^2}$$

Sample problem

- A rod is rubbed so that it has a charge of 4 μC on the tip. It is brought up near to a charged pith ball hanging from a string. As the rod approaches, the ball is repelled. When the end of the rod is just below the point where the string is attached, the pith ball hangs at $\theta = 30^{o}$. The pith ball has a mass of 10 grams. How much charge is on the pith ball?

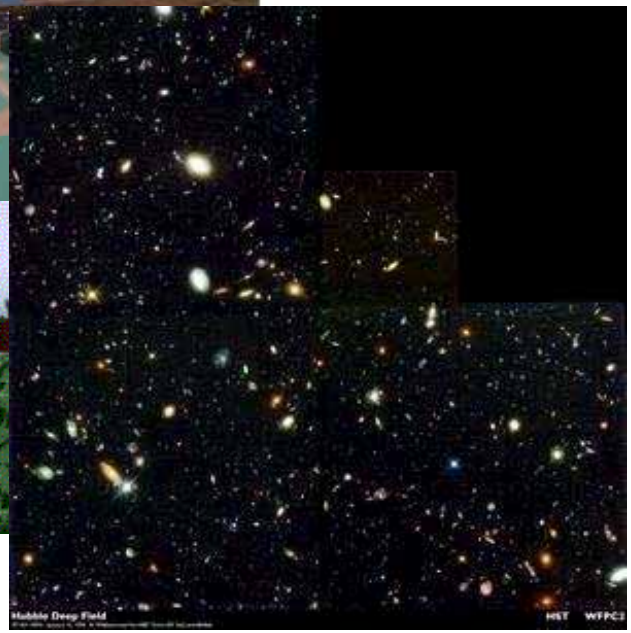


Multiple Charges: Superposition

- One charge is too simple.
  Most of the time there are lots of charges.
- What do we do if we have more than one source charge creating forces on our test charge?

Superposition: We calculate the force each charge produces and add them like vectors – just like we would any forces.

ILD #4:
Fields




Wind Speed/Direction 8:11AM EST
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