# Electrostatics and Electric Fields

We spent the last week developing ideas and concepts that are very abstract:

- Charge, $q$
- Coulomb's Law, $\vec{F}_{AB}^{elec} = \frac{k\, q_A\, q_B}{r_{AB}^2}\hat{r}_{AB}$
- Electric field, $\vec{E}$
- Superposition

# Charge

- What is charge? Why the name “charge”? Does the concept of charge have the same “feel” as other ideas we have studied previously?
- What observations/evidence have led us to conclude objects can have charge?
- How do we know that there are 2 types (or states) of charge (observations/experiments)?
- Why are the 2 types called “negative” and “positive”? Would a different name pair work just as well?
- How would we know if we stumbled upon a 3$^{rd}$ type of charge? What would we possibly observe (consistent with our previous observations/experiments)?

## Coulomb's Law (for a "point" object)

$$\vec{F}_{AB}^{elec} = \frac{k\, q_A\, q_B}{r_{AB}^2}\hat{r}_{AB}$$

- What does each term in the equation represent?
- How did your observations/experiments support this relationship?
  - $q_A\, q_B$
  - $\frac{1}{r_{AB}^2}$
  - $\hat{r}_{AB}$

# Electric Field

- In general, what is meant by the term "field"? How is the concept of a field different than, say, the mass or velocity of an object?
- What are some examples of other vector fields? Is it possible to have a scalar field? If so, what are some examples of a scalar field?
- Why have we introduced the concept of an electric field?
- What is an electric field? Is it real?
- We've seen two formulas for electric field:

$$\vec{E} = \frac{k q_A}{r^2}\hat{r} \qquad \text{and} \qquad \vec{E}_s \equiv \frac{\vec{F}_{test}}{q_{test}}$$

Why are there two equations and why are they different?