

# PHYS 115

Contemporary Physics - Spring '07

Rec. Assignment #1

## Charges in a Uniform Field

Given a force,  $\vec{F}$  you've already learned how to model it's dynamics (movement). For a more complete reference, see a previous recitation assignment where we talked about velocity verlet.

The force in this case will be the Lorentz force law:

$$\vec{F} = q(\vec{E} + \vec{v} \times \vec{B}) \quad (1)$$

As a pedagogical convenience, we will set the particles mass and charge to be 1 kg, 1 C respectively. Please leave them as variables in your programs however.

Give the particle an initial velocity (m/s) and position (m):

$$\vec{v}_0 = \langle 3, 0, 0 \rangle$$

$$\vec{r}_0 = \langle 0, 0, 0 \rangle$$

Model the following four scenarios, restarting the particle at it's initial velocity and position after  $t = 10$ . Do not clear the scene, but overlay each scenario with a trail of a different color.

- No electric or magnetic field (boring!):

$$\vec{E} = \vec{B} = 0$$

- An electric field in the  $\hat{y}$  direction:

$$\vec{E} = \langle 0, 1, 0 \rangle$$

- A magnetic field in the  $\hat{z}$  direction:

$$\vec{B} = \langle 0, 0, 1 \rangle$$

- Ready for the crazy one? Try to predict what the motion will be before you run the code. After you've got them all, rotate the camera to see each interaction:

$$\vec{B} = \langle 1, 1, 1 \rangle$$