

# Online Games on Electric Field

## Purpose:

To understand electric field, practice how to calculate its vector form in various charge configurations. The students will also use their understanding of the electric force to play the game of “Electric Field Hockey”.

## Procedures:

### *Charges and Fields*

1. Google “PhET” and click on the first search result. This should take you to the homepage of the Physics Education Technology. Alternatively you can enter the following address to the web browser directly:  
<http://www.colorado.edu/physics/phet/web-pages/index.html>
2. Click on “Simulations” and then choose from the tabs on the left “Electricity & Circuits”. Scroll down to the “Charges and Fields” simulation, double click it to start the program. You should see something similar to the screenshot in Figure 1.
3. Choose the same options in the lower right green box as the screenshot below. You can drag and place more charges or sensors in the region. They can be removed by dragging them back to their cages. Play with the program a little bit to get a feel for its operation.

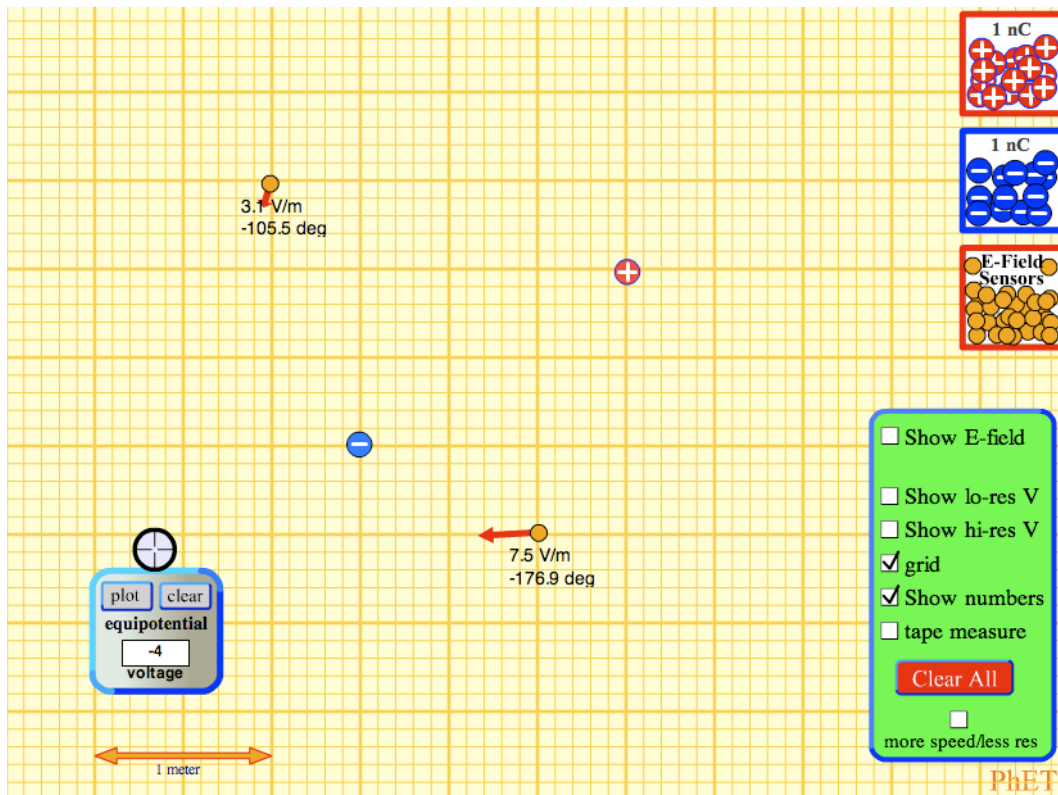


Figure 1

# Online Games on Electric Field

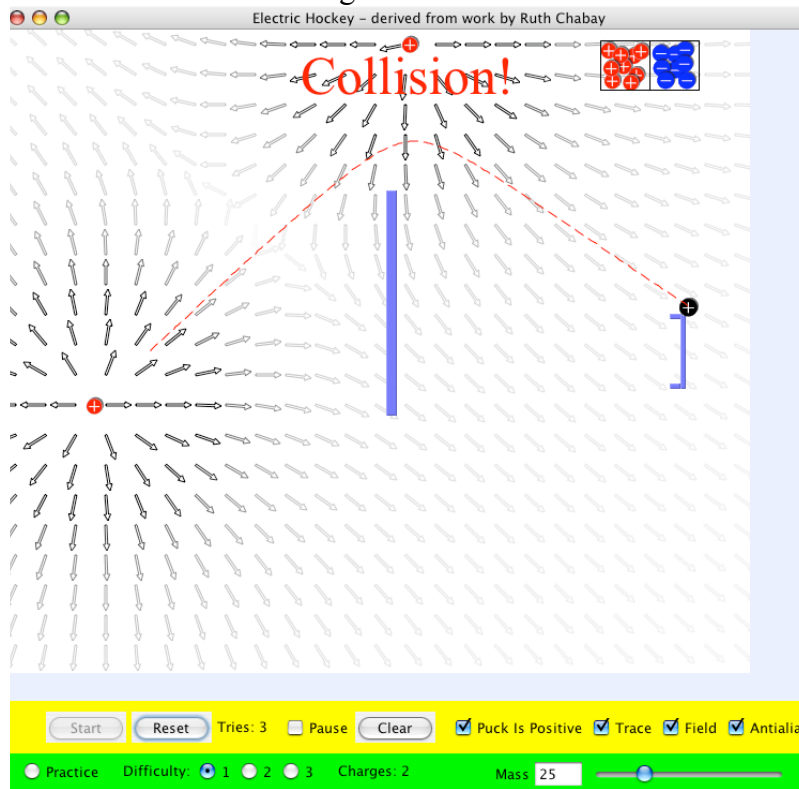
- Click “Clear All” to clean up the screen. Put a negative charge ( $q = -1nC$ ) in the middle and two sensors (we will refer to these two sensors as A and B below) at different places of your choosing (place them at the “junctions” of the grids). You can compute the distances using the grid and Pythagorean theorem. Draw a diagram of the charge configuration. Calculate the electric field *vector* at A and B. Confirm that the magnitudes and angles at these two places are the same as the values given by the program.
- Repeat step 4 for all the charge configurations in Table 1. Sketch (not print!) a diagram for each case, do not forget to write down the distances in the diagram. You can choose where to place the charges and sensors in each case.

**Table 1**

Charge		Electric field vector at A	Electric field vector at B	Magnitude	
Positive	Negative			A	B
0	1				
2	0				
1	1				
1	2				

## *Electric Field Hockey*

- Quit the previous simulation and double click “Electric Field Hockey” instead. Choose the same options as the screenshot in Figure 2 below.



**Figure 2**

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2. Try to put the black charge into the goal by placing charges in the region. How many charges did you use before you succeed?
3. Try to do the same but this time using only the charges in the cases below:
  - i. Two positive charges
  - ii. One positive and one negative charge
  - iii. Three negative charges
4. Sketch (not print!) the electric field lines in each case.
5. (Optional) Care to try level 2 and level 3?