# Problem Set 2: Electrostatics

Instructions:

1. Answer all questions below. Show your work for full credit.
2. All problems are due Tues 13 July 2010 by the end of the day.
3. You may collaborate, but everyone must turn in their own work.

1. The end of a charged rubber rod will attract small pellets of Styrofoam that, having made contact with the rod, will move violently away from it. Describe why that happens.

2. A charge of q and a charge of 5q sit a distance d away. Where could a third charge of magnitude 2q sit between them and experience no net force?

3. Three charges q sit at the vertices of an equilateral triangle whose sides are length d. What is the net force on each charge? Roughly sketch the electric field lines around the set of charges.

4. An ion milling machine uses a beam of gallium ions ($m = 70 \, u$) to carve microstructures from a target. A region of uniform electric field between parallel sheets of charge is used for precise control of the beam direction. Single ionized gallium atoms with initially horizontal velocity of $1.8 \times 10^4 \, m/s$ enter a 2.0 cm-long region of uniform electric field which points vertically upward, as shown below. The ions are redirected by the field, and exit the region at the angle θ shown. If the field is set to a value of $E = 90 \, N/C$, what is the exit angle θ?
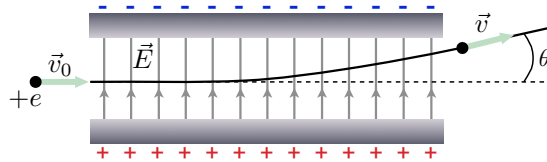
5. A charge of 1.8 nC sits at the center of a cube. What is the electric flux out of one face? Over the whole surface? Would your answer change if the charge is not at the center of the cube?