

Introductory Physics II

Lab 1 Electrostatics

In this lab we will investigate static electricity and electric fields. We will learn to use a simple instrument, the electrometer, and a sophisticated instrument, the digital multimeter (DMM).

Static electricity is something we see in our everyday lives. We often get shocked after walking on a rug, or find our clothes clinging to each other when they come out of the dryer. These phenomena can be investigated using a variety of materials in the lab with the help of an electrometer, an instrument that measures electric charge.

Electric fields are not a phenomena we are aware of in our everyday lives. In the second part of this lab, with a few simple tools, we will visualize an electric field. Our goal is to help you develop an intuition for something, in this case an electric field, which cannot be seen or felt.

Both of these experiments are designed to let you experiment and use your best guesses to lead you toward understanding. Feel free to leave the strict guidelines of the procedures if you think there is knowledge to be gained. Remember above all, to write down all you do and see!

1. Learn to use the electrometer by touching it with various charged rods. Charge the electrometer with a known charge and use it to find the charge on four hard materials after they are rubbed on wool, silk, fur, etc. Your lab instructor will give you a charged object with a known (positive or negative) charge on it to calibrate your instrument. If the stick you chose takes on one charge, can you verify that the rubbing material takes on the opposite charge? What law are we trying to show when we check the sign of the charge of the two materials we are rubbing together? See what items in the room work as a ground for the electrometer. Use a conductor (wire or rod) to connect the electrometer to possible grounds in the room.
2. The second experiment uses conducting paper to create an electric field which we will probe with a hand held voltmeter. Pick two differently shaped conductors to place on the surface of the conducting paper. Connect a power supply to the two contacts on either side of the field tracing apparatus. Turn the voltage up to 12 volts. Using the DMM, find the lines of constant potential on the conducting paper making some sort of indentation through the carbon paper to the tracing paper to record your results. The electric field lines are perpendicular to the lines of equal potential.
3. Using the double probe directly measure the electric field of a point source and a bar at different places on the conducting paper. If you move the red probe around the black probe you will be able to find a direction where the voltage is largest. This is the direction of the electric field. Find the field lines using this method. Plot the magnitude of the electric field vs. distance for the horizontal line between the bar and the point.