Electric Field around a Conductor (Gauss's Law)

TOPICS AND FILES

E&M Topics

Electrostatic charge distribution

Electric field

DataStudio Files

65 Charge Distribution.ds

66 Electric Field.ds

EQUIPMENT LIST

Qty	Items	Part Numbers
1	PASCO Interface (for one sensor)	
1	Charge Sensor	CI-6555
1	Charge Producers and Proof Planes	ES-9057A
1	Faraday Ice Pail	ES-9024A
1	Conductive Spheres (set of 2)	ES-9059B
1	Electrostatics Voltage Source	ES-9077
1	Voltage Sensor	CI-6503
1	Equipotential and Field Mapper Kit	PK-9023
1	Power Supply, 15 VDC	SE-9720
1	Pencil	
1	Tape, sticky	

INTRODUCTION

This lab has two parts.

The purpose of Experiment 1 is to investigate electric charge distribution on a conductive sphere. Use a charge sensor, proof plane, Faraday 'Ice Pail', and the *DataStudio* software to record and plot the distribution of charge on the sphere.

For Experiment 2, the purpose is to determine the shape of the electric field around charge configurations on a piece of conductive paper. Use a voltage sensor and the *DataStudio* software to detect the electric field lines between two conductors.

BACKGROUND

Like electric charges repel and unlike charges attract. The distribution of electric charge on the surface of an object illustrates this principle. If electric charge is transferred to an object that is electrically neutral, the transferred charge will tend to distribute itself evenly over the surface of the object *IF* the surface is conductive and allows the charges to move freely. The transferred electric

charges repel each other and move as far from each other as possible. However, if the surface is non-conductive, the charges cannot move as freely and won't distribute evenly. The arrangement of charges in a non-conductive surface tends to attract or 'hold' the transferred charges to that part of the object where they were transferred.

An electric field is the effect produced by the existence of an electric charge, such as an electron, ion, or proton, in the volume of space or medium that surrounds it. Another charge placed in the volume of space surrounding the "source" charge has a force exerted on it. The electric force applied by two charges on each other can be obtained from Coulomb's law.

$$F_{\mathrm{e}} = k\frac{q_1 q_2}{r^2} \tag{1}$$

