

Electron Charge-to-Mass Ratio System

SE-9629

- ▶ Sharp, clearly visible electron beam
- ▶ Phosphorescent mirrored scale eliminates parallax errors
- ▶ Tube rotates for general study of electrons in a magnetic field

In 1897, J. J. Thomson showed that the mysterious cathode rays were actually negatively charged particles—he had discovered the electron. In the same year he measured the charge-to-mass ratio of the electron, providing the first measurement of one of the fundamental constants of the universe.

The Charge-to-Mass Ratio System reproduces one version of Thomson's landmark experiment, providing an accurate measurement of the charge-to-mass ratio of the electron. And, since the electron tube can be rotated through 90°, students can also make a more general study of the behavior of electrons in a magnetic field.

This apparatus also has deflection plates, so students can study the effect of an electric field on moving electrons.



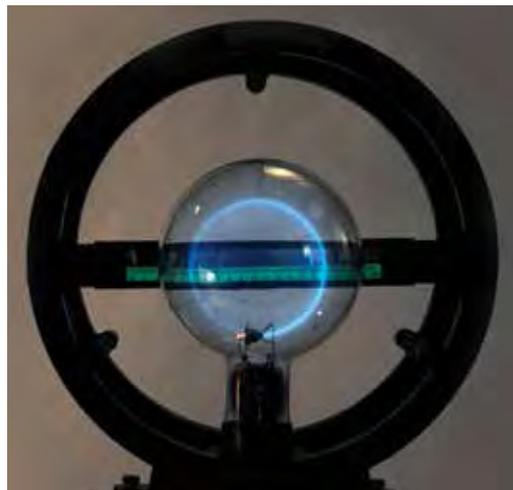
Complete Charge-to-Mass Ratio System includes the power supplies, which can also be used in other experiments (such as Franck-Hertz experiment, see page 305).

How It Works

A large, helium-filled electron tube is mounted between a pair of Helmholtz coils. The tube contains an electron gun, which generates a focused beam of electrons. A measured current is applied to the Helmholtz coils so that the magnitude of the magnetic field within the electron tube can be calculated. A measured accelerating potential (V) is then applied to the electron gun. The magnetic field (B) deflects the electron beam in a circular path with a radius (r) that is measured using the illuminated mm scale. From these measured values, the charge-to-mass ratio of the electron is calculated:

$$e/m = 2V/B^2r^2.$$

(The details of the calculations are fully described in the manual.)



Fluorescent scale shows behind the electron beam in a dark room.

Specifications

Helmholtz Coil Radius: 16 cm

Number of Turns: 130

Maximum Current: 3.5 A

Filament Voltage: 6.3 VAC

Acceleration Voltage: 0 - 200 V

Tube Diameter: 15.5 cm

For more information about power supplies, see page 253.

Electron Charge-to-Mass Ratio System (SE-9629) includes:

- Helmholtz Coils *without tube* (SE-9626)
- e/m Tube (SE-9651)
- Tunable DC (Constant Current) Power Supply I (SE-9622)
- Tunable DC (Constant Voltage) Power Supply II (SE-9644)
- Red and Black Patch Cords

Order Information

Electron Charge-to-Mass Ratio System..... SE-9629

If you already have power supplies, you will need:

Helmholtz Coils (without tube) SE-9626

e/m Tube SE-9651

Replacement Parts:

Replacement Mirror Scale SE-9649