

Virtual Measurement of e/m

Curriculum Module

Created with R2020b. Compatible with R2020b and later releases.

Description

This curriculum module contains a [MATLAB app](#) and a [live script](#) that follow J.J. Thomson's landmark experiment to measure the charge to mass ratio of the electron, e/m . The app is a virtual replacement for the experimental apparatus commonly used in physics laboratories. The live script contains a manual for conducting the experiment. This lab includes background, pre-lab, virtual experiment, and data analysis sections and concludes with an application of the theory to mass spectrometry.

Learning Goals:

- Explain the forces present in the experimental apparatus
- Derive the physical relationships required to compute the e/m ratio
- Use the app to perform the experiment
- Estimate the value of e/m
- Compute the experimental error and discuss its sources
- Relate the underlying theory to mass spectrometry

Details

`emLab.mlx`

Products: MATLAB, Symbolic Math Toolbox, Curve Fitting Toolbox

Contents: A lab manual for the virtual experiment. This live script includes a background description, pre-lab questions, a guide to the virtual experiment, and details on how to process and analyze the data.

`emApparatus.mlapp`

Products: MATLAB

Contents: A MATLAB app that contains a virtual reproduction of the experimental apparatus. Details concerning how to use the app are included in `emLab.mlx`.

`emLabSoln.mlx`

Products: MATLAB, Symbolic Math Toolbox, Curve Fitting Toolbox

Contents: Completed solution for the virtual lab, `emLab.mlx`.

`emExpSoln.mat`

Products: MATLAB

Contents: Example measurements taken from the app used in the solution script, `emLabSoln.mlx`.