

# Virtual Measurement of $e/m$

## Curriculum Module

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*Created with R2020b. Compatible with R2020b and later releases.*

## Description

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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

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### `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`.