Computational Physics: Homework #1

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In this homework we worked on visualizing Mandelbrot sets and fitting a straight line to Millikan's photoelectric data using least-squares method.

I. INTRODUCTION

Running `do.py`, will generate all the figures in this report. Various functions for verifying Mandelbrot sets and generating plots are defined in `mandelbrot.py`. Loading Millikan's data and least-squares fitting method are implemented in `millikan.py`.

II. THE MANDELBROT SET

Figure 1 visualizes Mandelbrot sets for a 2D plane of complex constants ($c = x + iy$). As we increase the number of grid points N from 40 (top left) to 2000 (top right), the fractal becomes more precise. The colored version of the fractal is also illustrated in both linear scale (bottom left) and log scale (bottom right). The computation time is proportional to N^2.

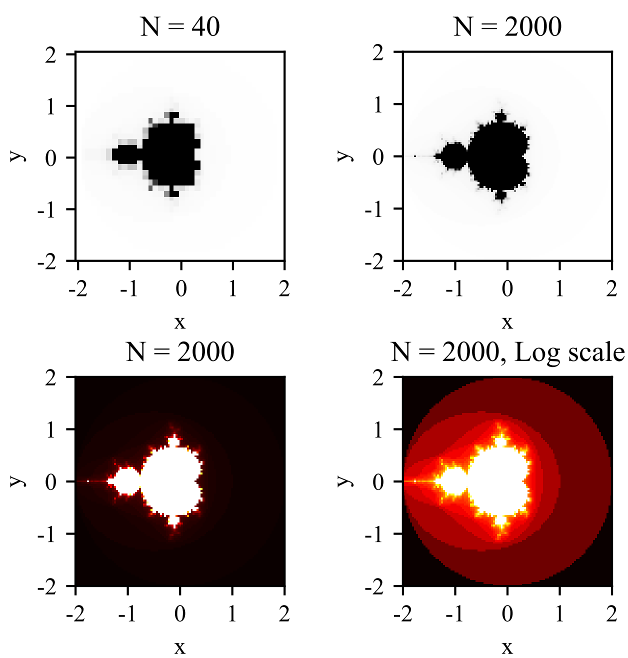

FIG. 1. Visualizing Mandelbrot sets.

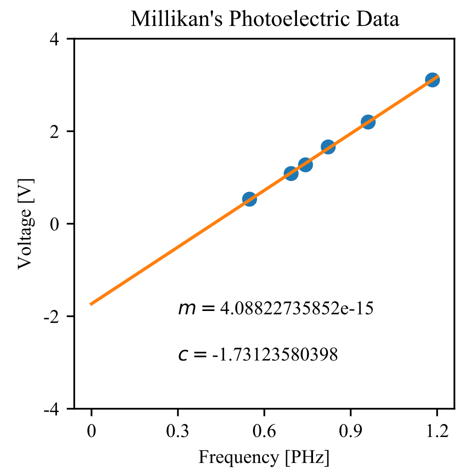

FIG. 2. Fitting a straight line to Millikan's phototelectric data. Millikan's data are determined using blue dots. The fitted line is denoted as the solid orange line. The slope m and y-intercept c of the fitted line are shown.

III. THE PHOTOELECTRIC EFFECT

Figure 2 illustrates Millikan's photoelectric data along with the least-squares fitted line. The value for Planck's constant derived from this plot is equal to 6.55×10^{-34} which shows a -1.15% error with respect to its accepted value.

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