

Curve Fitting

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Note:

In the file "curveFit.ipynb", I have run the code for "d1.txt". To analyse the behaviour for the other files, comment that line out and uncomment the required one in code block [2]. Then re-run all the cells.

Ensure the 4 txt files are in the same folder as the jupyter notebook.

Objective

Estimate various physical parameters using raw data (from the datasets) and Planck's formula.

We do this in 2 ways:

1. Curve fit all 4 parameters at once
2. Perform the partial application method and curve fit 1-2 parameters at a time

Part 1: Fitting all 4 parameters at once

I first tried fitting all parameters at once directly, this resulted in overflow errors. Upon inspection, I realised these errors occur due to the ratio of variables present in the exponential term of the planck function. This has the potential to blow up into very large numbers which exceed the value floating point numbers can store. To avoid this, I had to give a good initial guess for the optimiser to work with.

In this form of fitting, the output is very sensitive to the initial guess provided. Varying the initial temperature from 4000K to 5000K (keeping h , c and k the same) causes the output to change drastically. (the curve however, seems to fit reasonably in both cases)

This is also understood from viewing the standard deviation of the outputs, In this case we get extremely high standard deviation indicating a very low confidence in our answer.

Part 2: Fitting 1 or 2 parameters at a time

Here too, if the initial guess is very off, it causes overflow errors in some cases. I have chosen to take reasonably initial guesses for this reason.

While estimating 1 parameter assuming we know the others, we get a very accurate output which settles to the same value even for different initial guesses. This is also expected as the standard deviation we get is very low compared to the value of the parameter itself.

While estimating 2 parameters, the standard deviation increases significantly, but not near the value as we get while estimating 3 or 4 parameters at once. This causes the outputs to differ slightly while changing initial guesses, especially for the more noisy data (d2.txt and d4.txt)