

Intro:

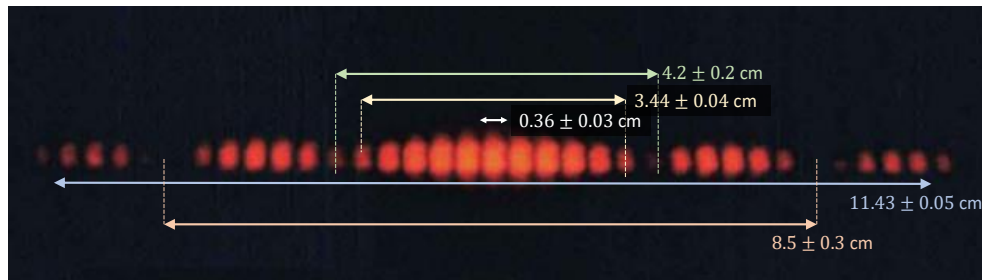
We have now moved into the mechanics of quantum mechanics, computing energy levels for two 1D potentials. We have also discussed superposition in k yielding localized wavefunctions. We discovered that this localized “group” travels at the group velocity. We’ve also started to work with expectation values such as $\langle x \rangle$.

Reading: (“T” stands for Townsend’s text)

- T: Chapter 4 Sections 1, 2, and 3. We may get to section 7 later in the week.
- Looking ahead - Principles of QM Chapter 5

Problems: Due Friday, October 10 at the beginning of class

- (1) 2.26 group and phase velocities
- (2) 2.28 Relativistic group velocities
- (3) 2.33 Uncertainties for the particle in a box wavefunction $u_1(x)$
- (4) 3.12 Transitions in a sudden change in potential
- (5) In class we found the symmetric solutions (cosine) for a particle in a finite square well.
 - (a) Find the condition for the energy levels for the antisymmetric solutions (sine)
 - (b) Solve this for the 2 energy levels when $\xi_o^2 = 25$.
- (6) 4.8 Finding a particle outside the well.
- (7) Double slit review! A red laser with wavelength 662.0 nm illuminates a double slit pattern. The following fringe pattern appears on a wall 2.15 meters away from the slit.



- (a) Find the width of each slit with uncertainty
 - (b) Find the slit separation with uncertainty.
- Please give both answers in standard form.

- (8) Python code: Feel free to use the lab computers for this. Also if this is really new, please stop by. I’d be happy to help you get started.

An array is a way to store a series of numbers. As you may have seen, if you “import numpy as np” then you will be able to use the numpy commands for working with arrays with “np”, and if you “import matplotlib.pyplot as plt” then you will be able to graph your array with “plt”.

- Create an array of at least 5 zeros using the command `np.zeros()` and save that array as a variable called `y`.
- Change the elements of your array `y` using a loop to set `y[0] = 0` then setting `y[1] = 12`, `y[2] = 22` etc. Keep going until there are no zeros in your array.
- Use a for loop or a numpy command to create an array called `x` that has the numbers 1,2,3,4,5. (Or more if your `y` variable has more.)
- Plot the graph with `plt.plot(x,y)`. Use the command `plt.xlabel("x")` to label the x axis with the label `x`. Use a similar command to label the y axis. At the end of your script, you usually need to have a line `plt.show()` in order to tell python to show the graph.

For your solution submit your script and your graph.

Tip: If you are not familiar with matplotlib then you can learn about it using Chapter 6 of the free Introduction to Scientific Programming with Python book. There is also a Python book in the lab. If you just want a quick reminder, try this matplotlib plotting link.

General coding tip: Add a print statement, like `print(y)`, anytime you update a variable. You can remove it later, but it helps you to keep an eye on what you are changing while you are writing your computer code.

Thanks to Viva for earlier versions of these last two problems.