Physics 106 – Mini-Lab
Quantum Mechanics and Atomic Physics


This lab does not require you to go to the MSLC.
Make sure to do both parts and answer all questions. If you have problems running the simulations, contact me ASAP.

**Part 1: Double Slit Experiment and Wave Particle Duality**

Go to the PHET simulation called Wave Interference:

- Select “Slits”.
- Select the light generator by clicking on the laser icon the right (You will find 3 options: water, sound, and light. The right most icon looks like a laser and generates light.)
- Select two slits, and make sure that you turn on the “Screen” and “Intensity” graph. Click on the green button on the left to start the light generator.
- *In your own words, describe your observations of the double-slit experiment with light and its outcome. In particular, make sure you describe the interference pattern (constructive, destructive) and where they are occurring and why.*
- Next change the slit width, slit separation, and amplitude frequency. *Describe your observations as each of these change. Explain.*

Next, answer the following *general* questions:

- In the double-slit experiment with light, suppose that the light source could be turned on so briefly that only a single quantum of energy (a single photon) passes through the double slits. What would you observe on the screen? How would this compare if you conducted the double-slit experiment with electrons instead?
- The double-slit experiment was also conducted with electrons and it revealed a surprising feature. In your own words, describe those results and why they were important.
- In your own words, describe the wave particle duality and how that relates to the double-slit experiments.
Part 2. Build an Atom

Go to the PHET Simulation called ”Build an atom”:

- Select “Atom”.

- Protons and neutrons into a nucleus (ignore electrons for this problem, we are interested only in the nuclear structure).

- In the bottom right in a box labeled ”Show” make sure the Element Name and Stable/Unstable boxes are checked.

- Start adding protons to the nucleus and note that the atomic number increases, and element name goes up the Periodic Table on the upper right.

- At each element, add enough neutrons to make the element stable.

- Describe your observations. Explain.

Answer the following general questions:

- What can you say about the ratio of protons to neutrons needed in order to make a nucleus stable?

- Why is a nucleus full of just protons unstable?

(Hint: think of the forces acting to push the nucleus apart, as well as hold it together)