

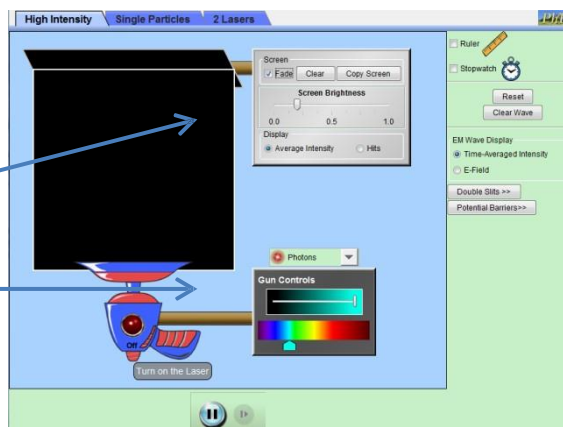
PHET INTERACTIVE ACTIVITY - QUANTUM WAVE INTERFERENCE

Download and run the PhET simulation “Quantum Wave Interference” using the following link:

http://phet.colorado.edu/new/simulations/sims.php?sim=Quantum_Wave_Interference

Set up the simulation using the controls (similar to those in Lesson 8):

- Set the intensity to high
- Set the screen by deselecting fade (No Fade), set the screen brightness to 0.5 and select display Hits
- At the Gun control set the particle to Electrons with $\frac{1}{2}$ intensity (middle of slider)
- Select the ‘Double Slits’ button (on the right) and set this to approximately $\frac{1}{10}$ width, $\frac{1}{2}$ separation and $\frac{3}{4}$ vertical position



ACTIVITY 1 – Firing Electrons

10. The electron gun is set to fire a couple of hundred electrons per second. The screen at the back detects the electrons that make it through the slits. Select the ‘Red button’ on the electron gun and allow it to fire for two second. **How do these electrons appear to hit the screen? Draw a representation of image of the screen in the space provided below.**

SCREEN

11. Clear the screen and reduce the intensity so that there will only be one electron going through the slits at a time. **Where will the next electron land when you fire the electrons out of the gun individually?**

12. Using the ruler divide the screen into five parts. Turn off the gun, clear the screen and then select the gun to fire again. In the space below track which regions the electrons land in over a period of a few minutes. **What do you notice about the pattern?**

SCREEN

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13. With the intensity still set at low so that the electrons are firing one at a time, **what do you notice about the electrons themselves as they approach the slits?** (Do they appear to go through a particular slit?)

14. In order to determine which of the slits the electron actually passes through you will need to place a detector at one of the slits. This detector will be able to tell whether the electrons are passing through the left or right slit. (Please note that the detector will not actually block the slit). **How do these electrons appear to hit the screen? Are the electrons behaving as waves or particles? Draw a representation of image of the screen in the space provided below.**

SCREEN



15. What happens when you turn the detector off?

ACTIVITY 2 – Firing Helium

1. Reset all the settings and set the gun to fire Helium atoms. **How do these atoms appear to hit the screen? Draw a representation of image of the screen in the space provided below.**

SCREEN



2. A Helium atom is much larger than an electron. **Explain using your previous observations why Helium, like an electron, would behave as a wave even though we know it is a particle.**