Visualisation of Electron Double-Slit Experiment: Numerical Solution to Schrödinger Equation in 2D [In Work]

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Time Dependent Schrödinger Equation

The equation is:

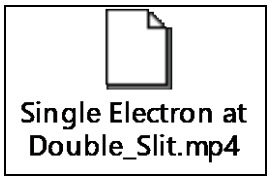
$$-\frac{\hbar^2}{2m}\nabla^2\psi + V\psi = i\hbar\dot{\psi}$$

where $\hbar$ is Planck's constant over 2π, m is the electron mass, V is the potential and ψ is the electron wavefunction and dotted the time variation. This is numerically solved using Matlab (1).

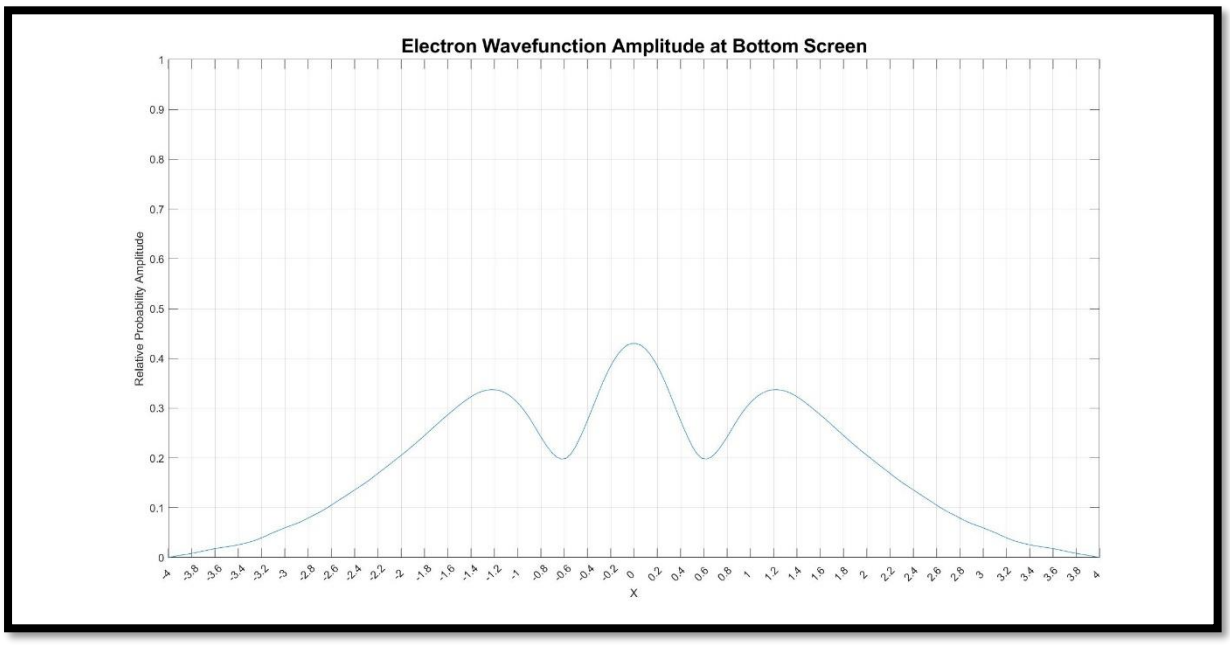
The dimensions are arbitrary.

Double-Slit with Single Electron Wavefunction

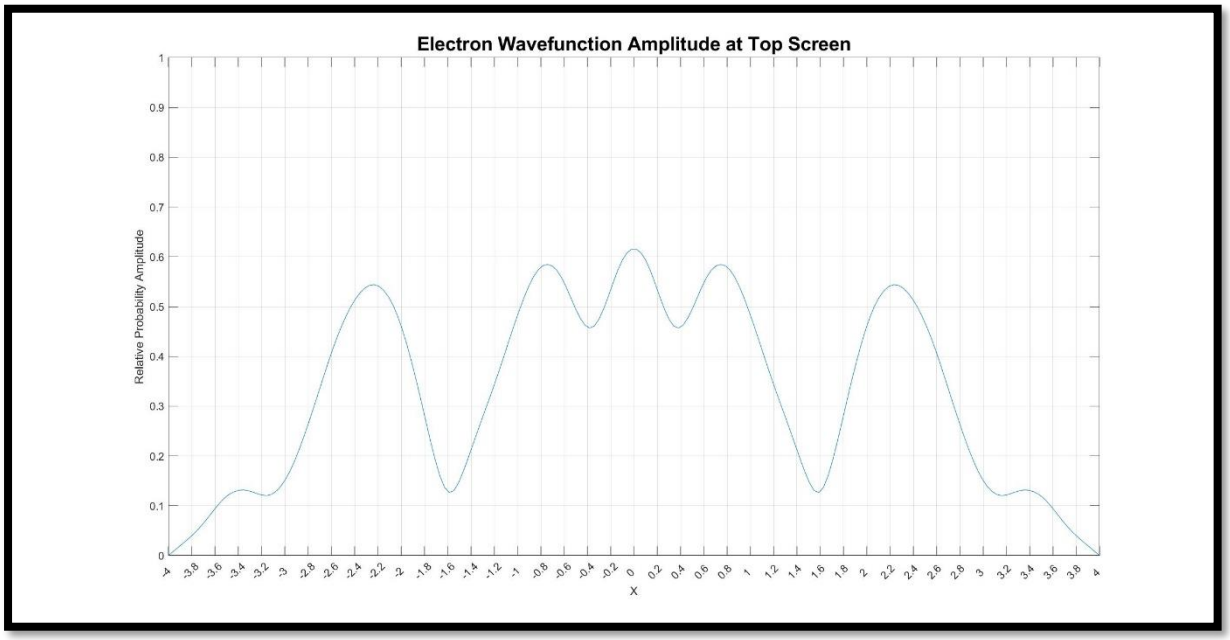
Initial wavefunction: Equal probability across both slits



The probability amplitude of the electron location at the bottom screen is shown below.



Note, if a screen is placed at the top near the source there should also be an electron interference pattern as below.

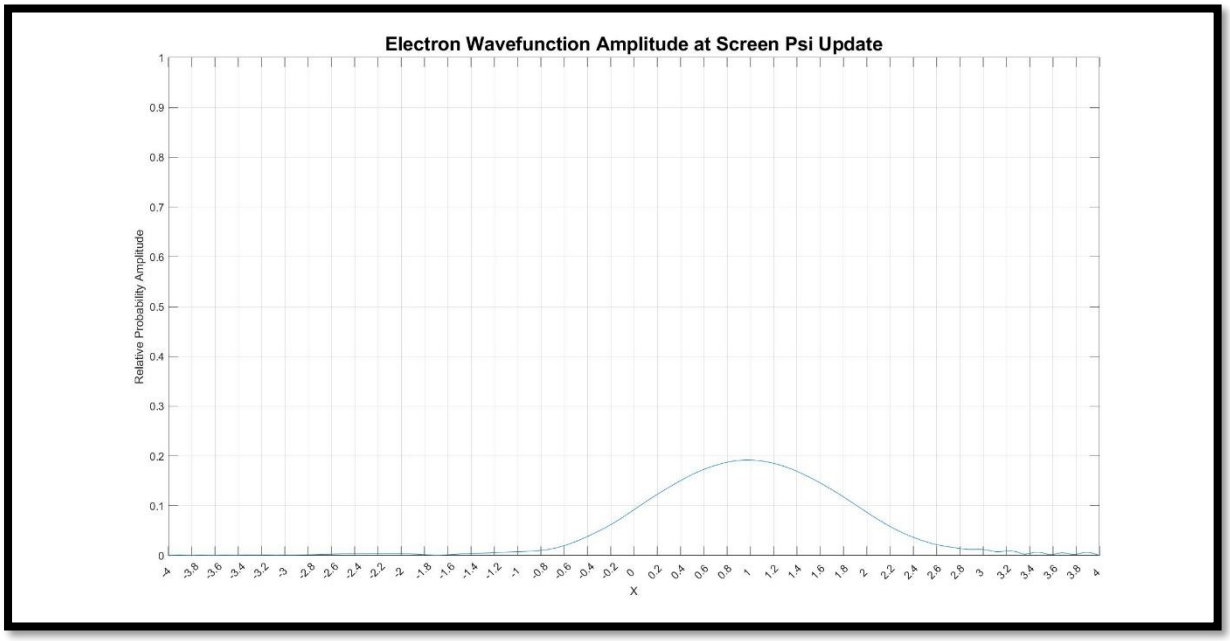


Electron Detected at One Slit – Wavefunction update (or collapse)

Since the electron is detected at one slit the information on the wavefunction is updated near the slit. Since probability is not a 'thing', collapsing seems a misnomer.

Double slit electron detected at slit.mp4

The probability amplitude of the electron location at the bottom screen is shown below.



(1) Matlab code based on Scilab code from the brilliant ViaScience YouTube channel.