DOING PHYSICS WITH MATLAB

APP DESIGNER

GUI SIMULATIONS

QUANTUM MECHANICS

SQUARE / SLOPING POTENTIAL WELL

EIGENVALUES, EIGENFUNCTIONS,

EXPECTATION VALUES

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DOWNLOAD DIRECTORY FOR MATLAB SCRIPTS

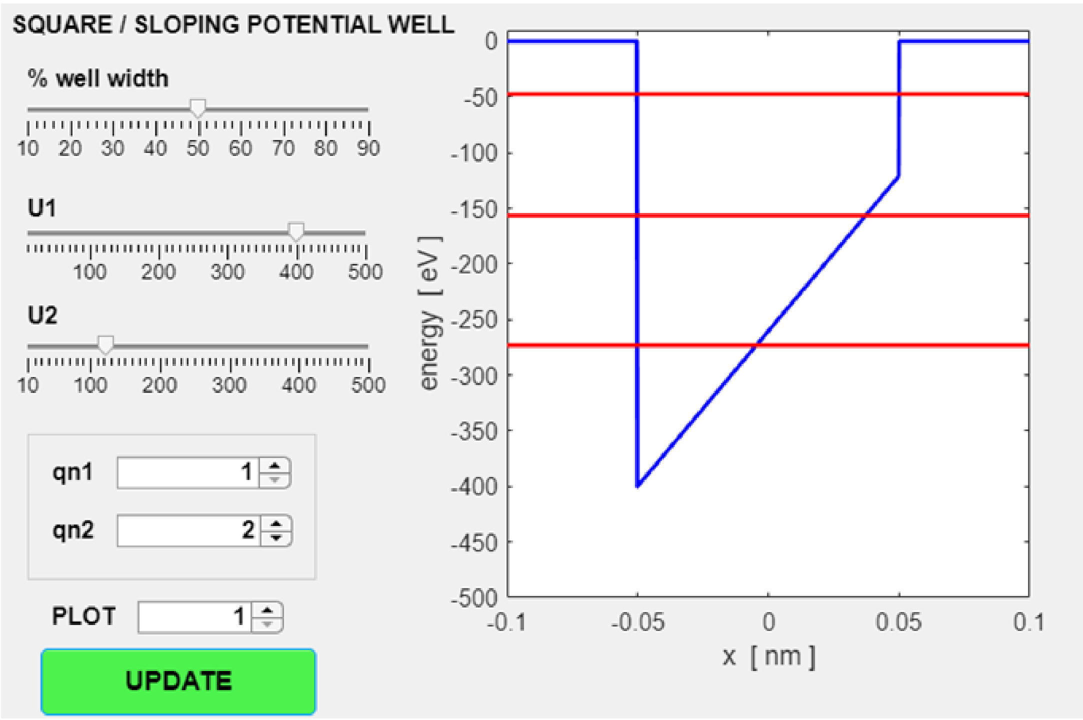
https://github.com/D-Arora/Doing-Physics-With-Matlab/tree/master/mpScripts

https://drive.google.com/drive/u/3/folders/1j09aAhfrVYpiMavajrgSvUMc89ksF9Jb

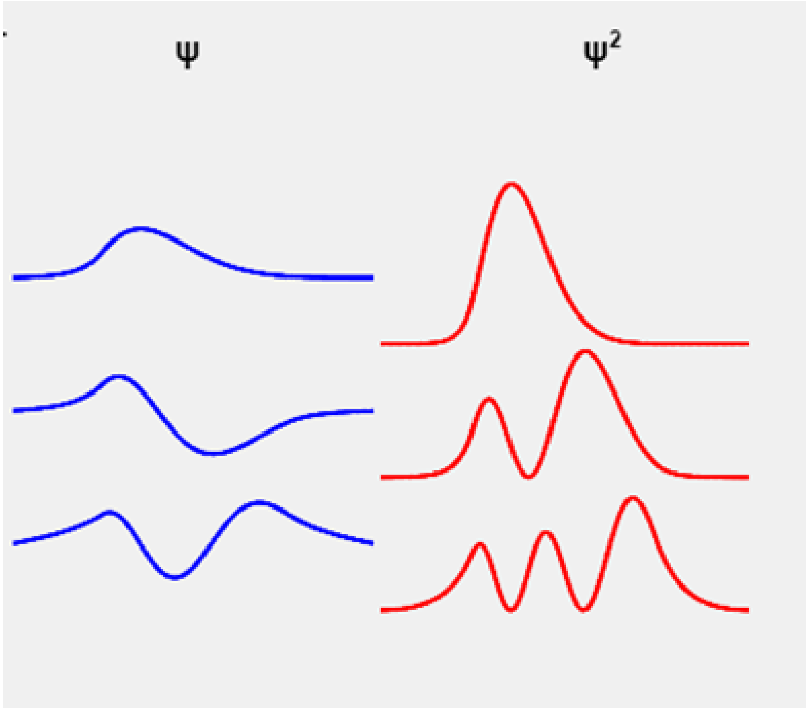
ad_002.mlapp

App Designer GUI to simulate an electron bound within either a square well or a well with a sloping base. The Schrodinger equation is solved using a matrix method to find the eigenvalues and eigenfunctions for the allowed bound states. Expectation values are calculated for a number of physical quantities. In the GUI you can select values for the width of the well and the well depth at the two boundaries of the well. You can explore the solution of the Schrodinger equation for two quantum numbers qn1 and qn2. To start a simulation, press the **UPDATE** button. Different plots are shown by using the PLOT scroll bar.

Plot 1

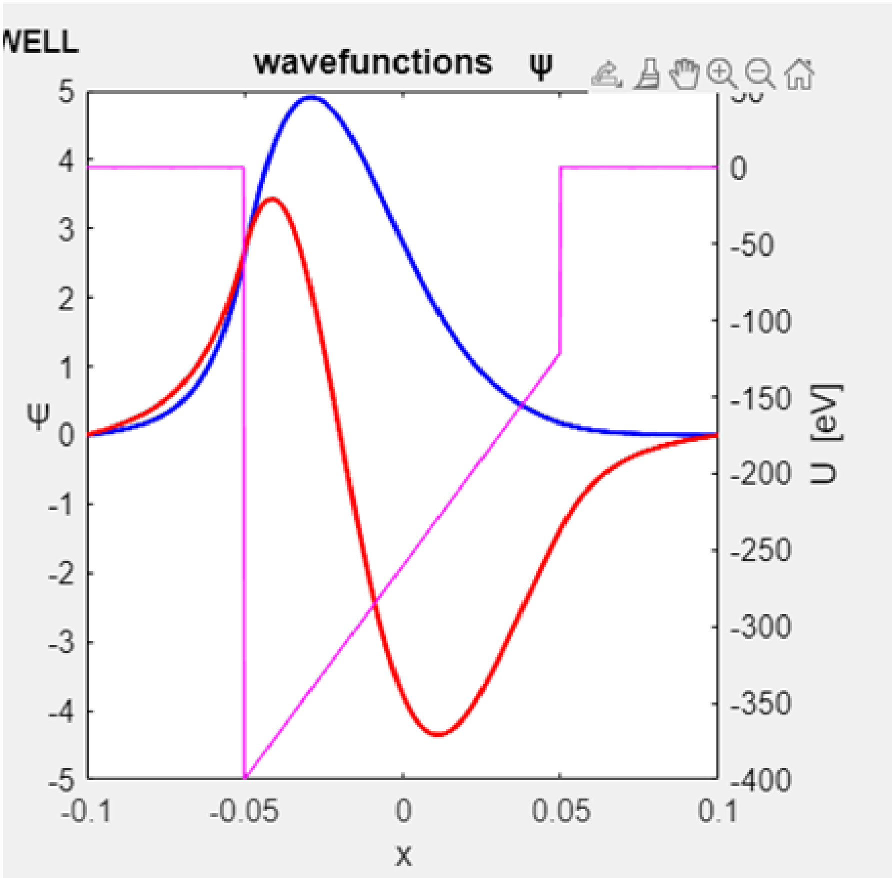


Plot 2



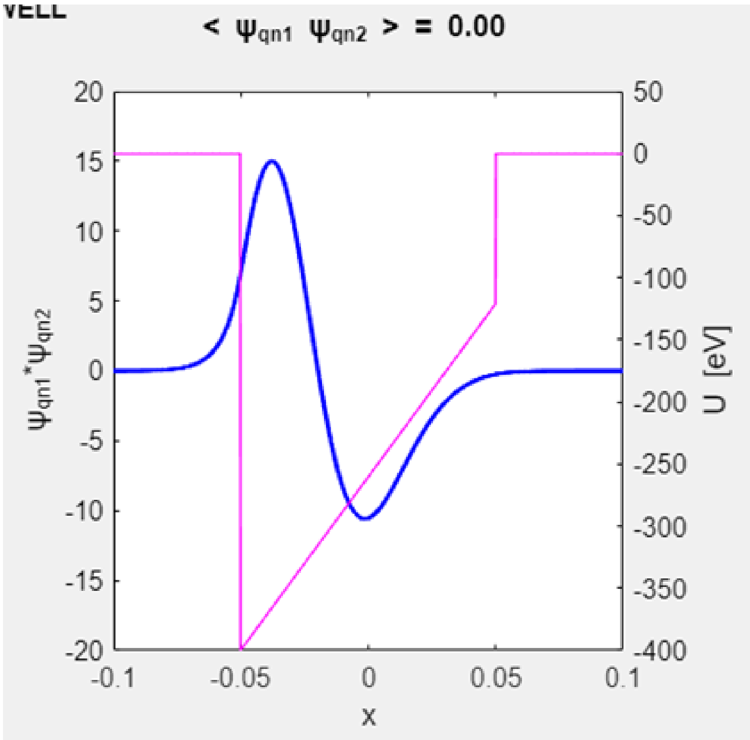
ψ
ψ²

Plot 3

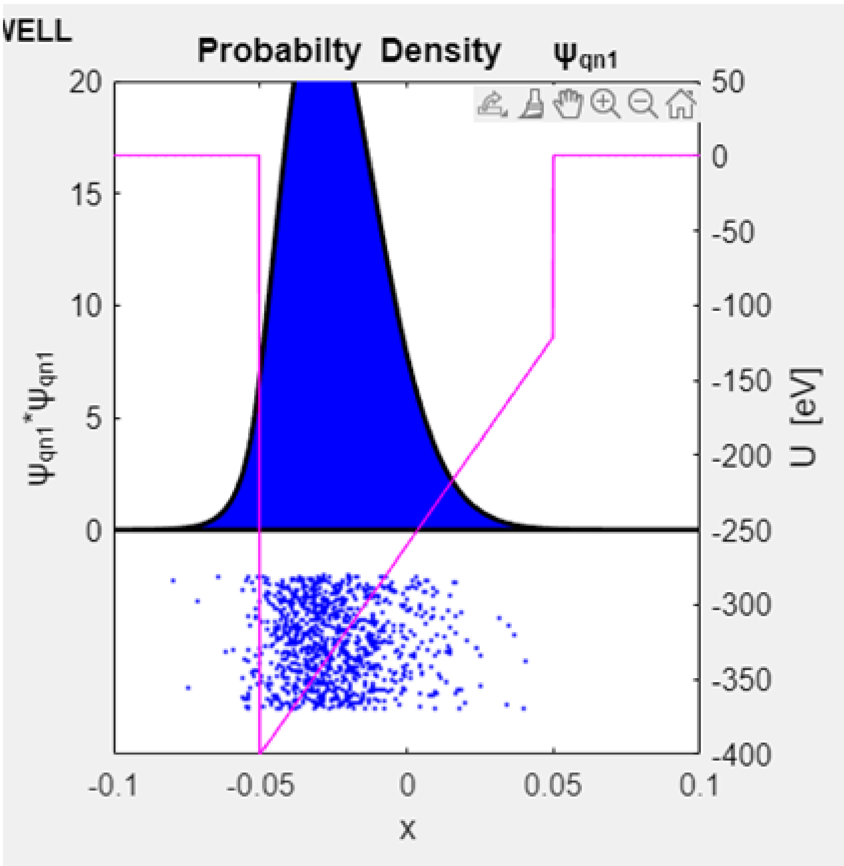


WELL
wavefunctions ψ
5
4
3
2
1
0
-1
-2
-3
-4
-5
ψ
0
-50
-100
-150
-200
-250
-300
-350
-400
U [eV]
-0.1
-0.05
0
0.05
0.1
x

Plot 4


VELL
< ψqn1 ψqn2 > = 0.00
20
15
10
5
0
-5
-10
-15
-20
ψqn1*ψqn2
50
0
-50
-100
-150
-200
-250
-300
-350
-400
U [eV]
-0.1
-0.05
0
0.05
0.1
x

Plot 5


VELL
Probabilty Density ψqn1
20
15
10
5
0
ψqn1*ψqn1
50
0
-50
-100
-150
-200
-250
-300
-350
-400
U [eV]
-0.1
-0.05
0
0.05
0.1
x

Plot 6

BINDING ENERGIES [eV]

EB_1 = 273.128 EB_2 = 156.614 EB_3 = 47.521

EB_4 = 0.000 EB_5 = 0.000 EB_6 = 0.000

EB_7 = 0.000 EB_8 = 0.000 EB_9 = 0.000

EXPECTATION VALUES quantum state qn1 = 1

$< x > = -0.024$ nm

$< ip > = 4.37e-31$ N.s $< ip^2 > = 1.09e-47$ $N^2.s^2$

$< U > = -310.48$ eV $< K > = 37.26$ eV

$< E > = -273.22$ eV

HEISENBERG UNCERATINTY PRINCIPLE

Δx = 1.71e-11 nm Δip = 3.30e-24 N.s

Δx Δp) / hbar = 0.54

ORTHONORMAL STATES qn1 = 1 qn2 = 2

$< \Psi_{qn1} \Psi_{qn2} > = 0.00$

For more details on bound states, view the following link

[Documentation]