ELEC 4700 - Assignment 1

# Electron Modeling

1. The thermal velocity is
2. If then the mean free path is [1]

1. Please see code on GitHub. The required figures can be seen below

Calculate and display the semiconductor temperature on the plot at a fixed time interval and verify that it stays constant



Figure 1: Particle trajectories



Figure 2: Temperature plot

# Collisions with Mean Free Path

MBfunc = @(c) 4\*pi.\*c^2\*(Melectron/(2\*pi\*k\*T))^(3/2)\*exp(-Melectron.\*c^2/(2\*k\*T))

1. Maxwell Boltzmann distribution:



Figure 3: Histogram showing distribution of velocities

1. Scattering of particles with probability



Figure 4: Scattering particles based on probability given above

1. Temperature change over time can be seen in the figure below



Figure 5: Temperature change over time of scattering particles

1. Measurement of the MFP and time between collision should show the model is correct.

# Enhancement

1. Particle trajectories must move around the “boxes”



Figure 6: Rectangular bottleneck for the particles

3) Electron density map



Figure 7: Electron density map

1. Temperature map



Figure 8: Temperature map displayed with colours

# References

[1] Wikipedia “Mean Free Path”, [Available: February 3 2018] Online: https://en.wikipedia.org/wiki/Mean\_free\_path