Assignment1

Monte-Carlo Modeling of Electron Transport

ELEC4706A
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Feb 7th, 2021

Part1: Electron Modelling

a) Thermal velocity vth

$v_{th} = \sqrt{(KT/(0.26m))} = 132242.59 m/s$

b) MFP

$MFP = v_{th} \times 0.2ps = 2.64 \times 10^{-8} m$

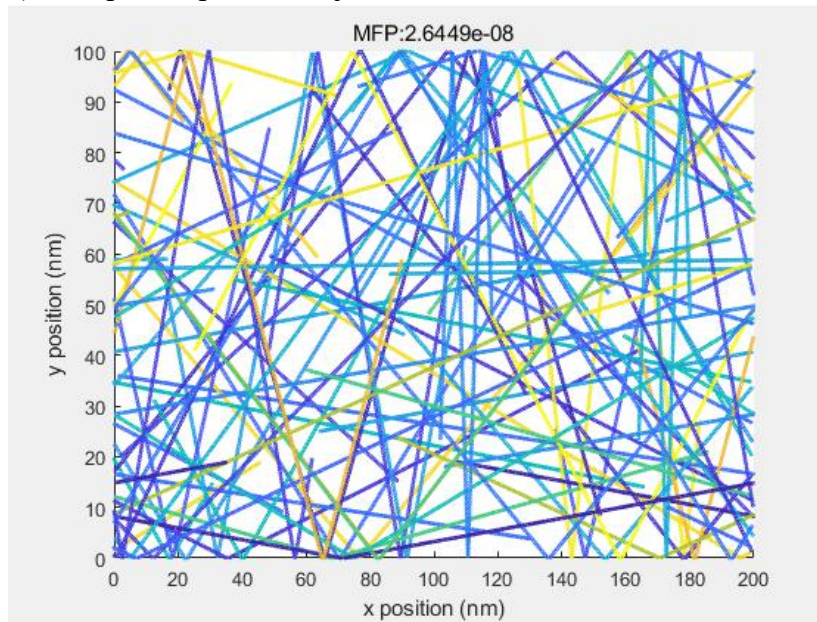c) 2-D plot of particle trajectories is shown below

Figure1: Particle trajectories.

According to the figure above, particles will bounce off when they touche the X boundary and pass through when they touche the Y boundary.
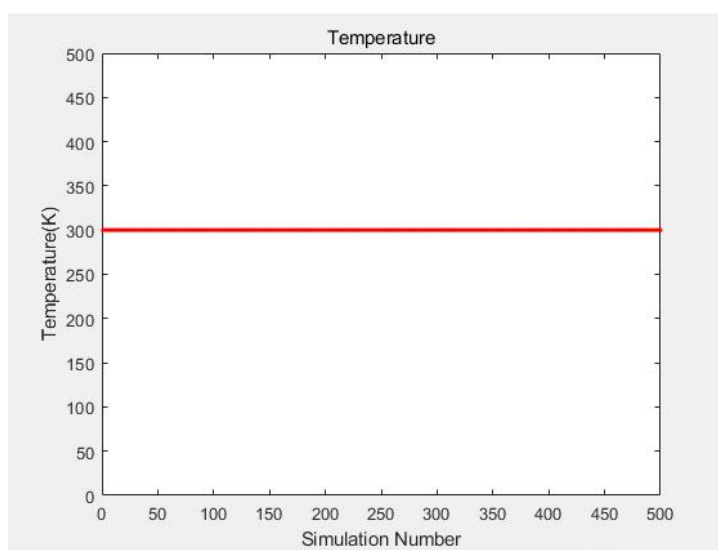
d) Temperature plot is shown below

Figure2: Temperature plot.

According to the figure above, the temperature stays constant at 300K.

Part2: Collisions with Mean Free Path (MFP)

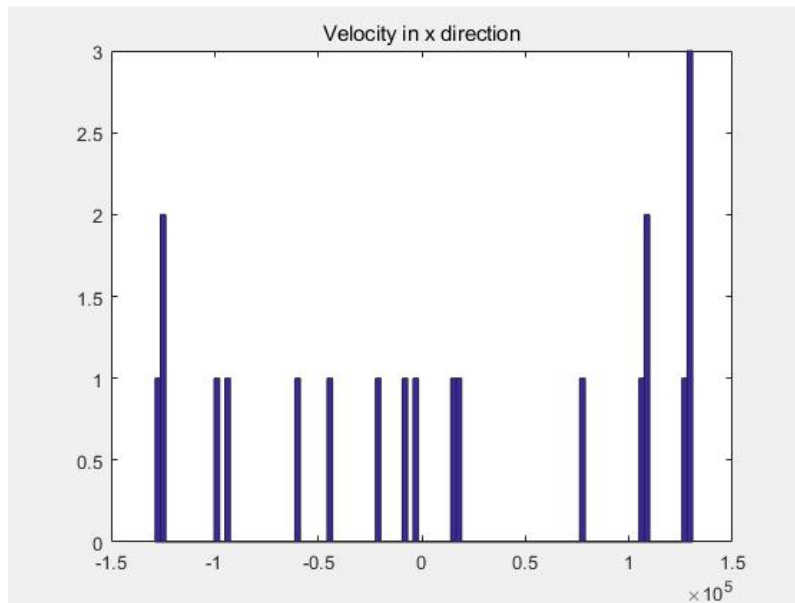a) Plot of the distribution is shown below.
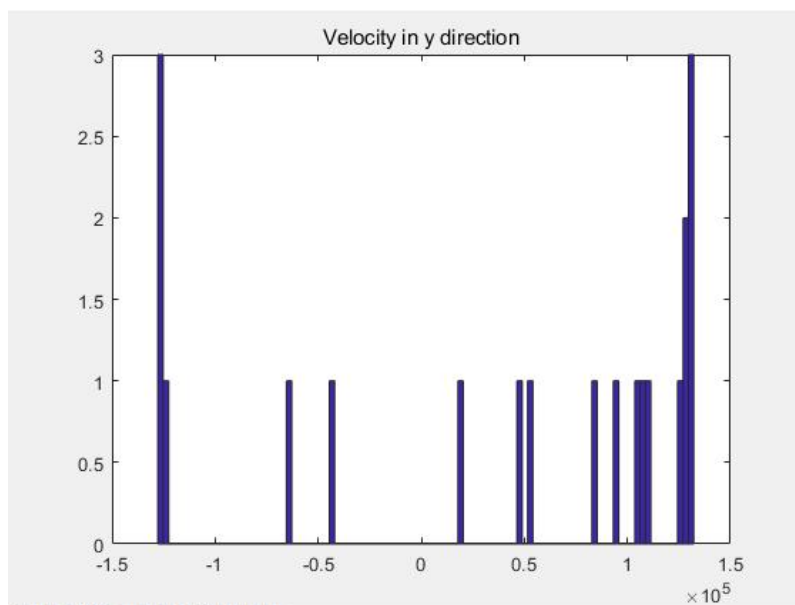

Figure3: x direction velocity.

Figure4: y direction velocity.

According to figures above, the velocity of particles does not stay constant, which means when a particle scatters , it will have a new velocity from the Maxwell-Boltzmann distributions.

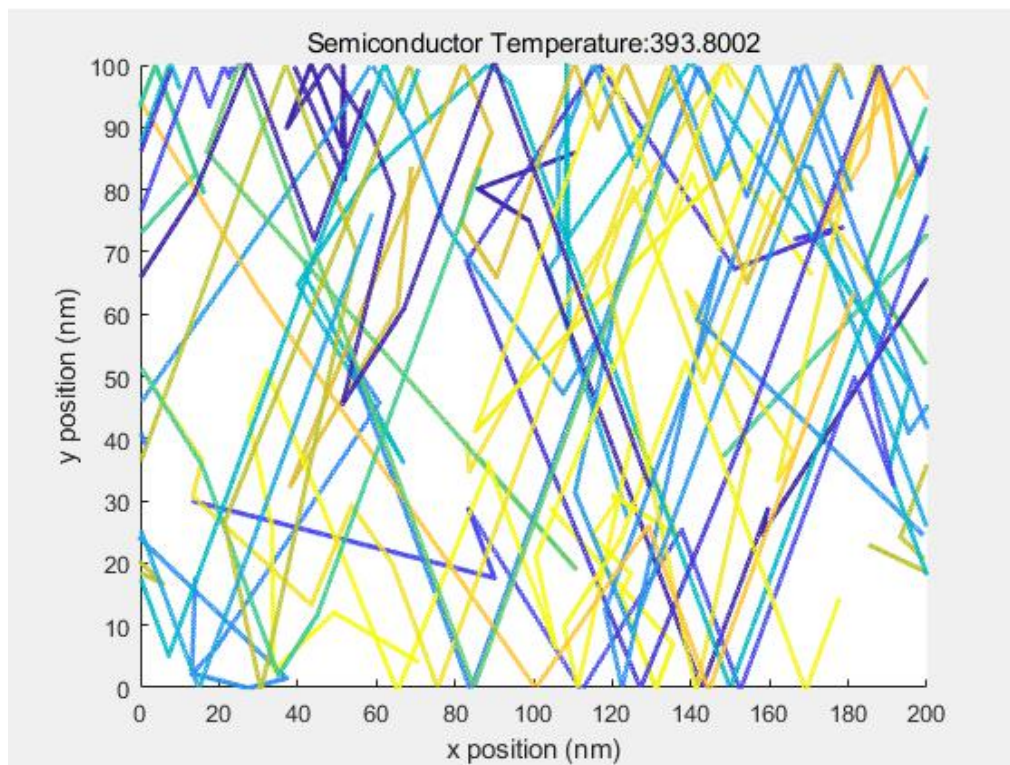b) 2-D plot of particle trajectories is shown below

Figure5: Particle trajectories plot2.
According to the figure above, particles scatter randomly during their trajectory.
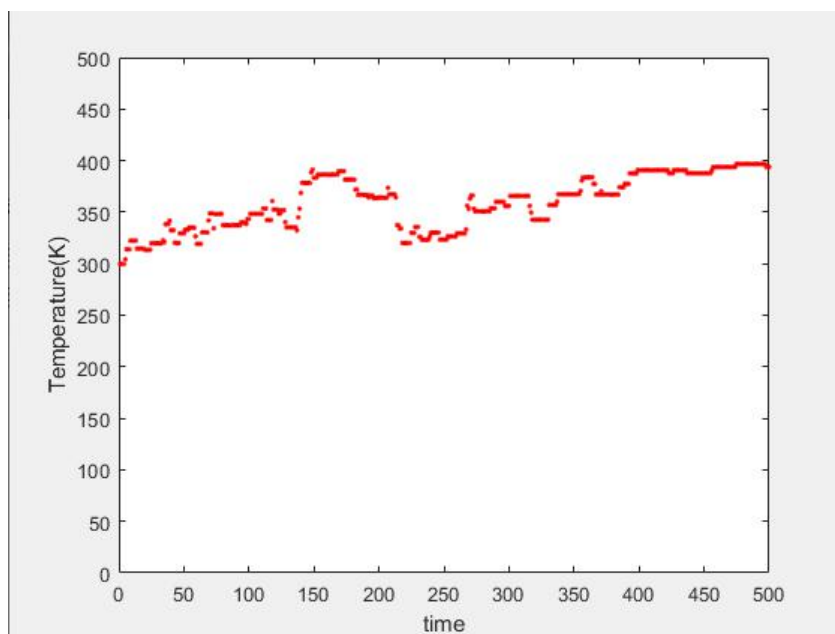
c) Temperature plot

Figure6: Temperature plot2
According to the figure above, the temperature does not stays constant and it changes over the time.

c) MFP and τmn

MFP=2.64×10^{-8}m

Tmn=0.2ps

These two values are same as part1.

Part3: Enhancements
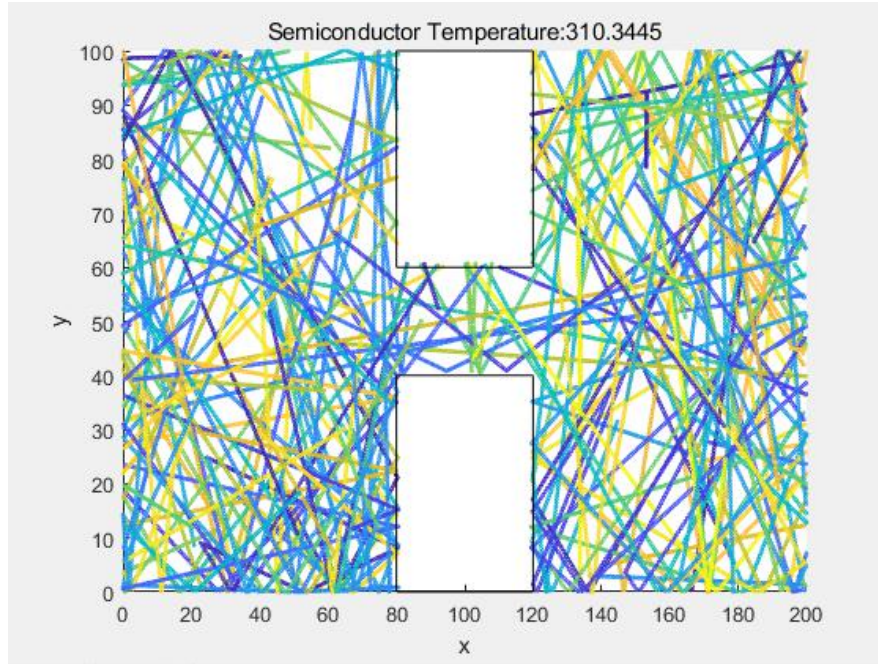
a) 2-D plot of particle trajectories

Figure7: Particle trajectories with boxes.

According to the figure above, no electrons are leaking through the boxes.

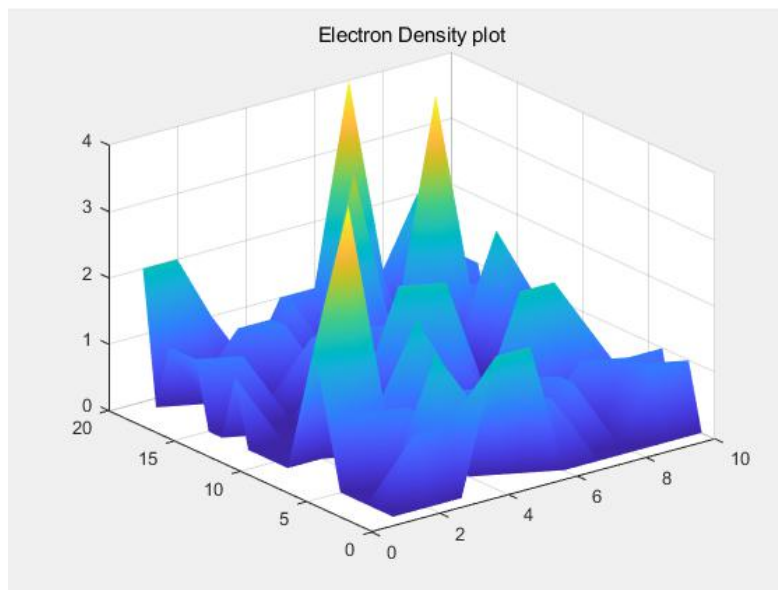b) Electron density map is shown below

Figure8: Electron density map
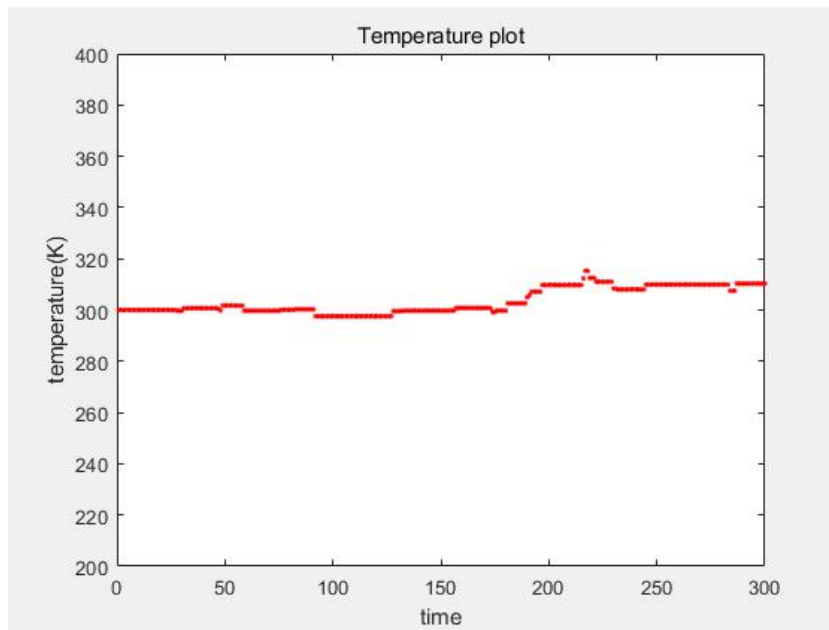
c) Temperature map

Figure9: Temperature map3

According to the figure above, the temperature does not stays constant and it changes over the time. However, its changing amplitude is smaller than that in part2.