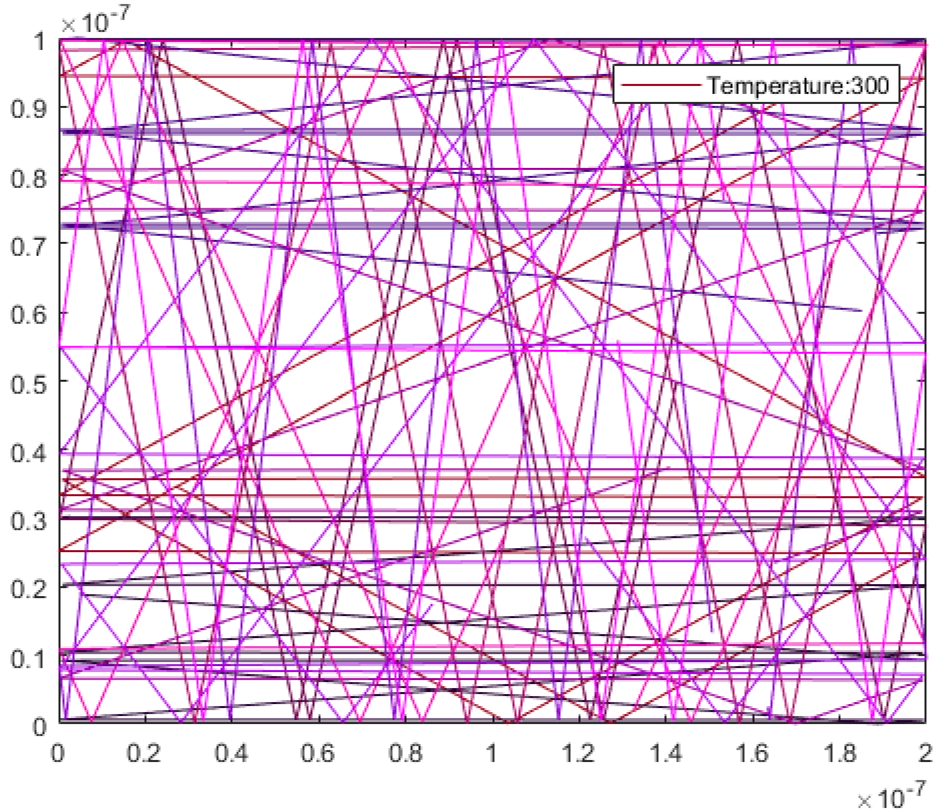
```
%clear all

clearvars
clearvars -GLOBAL
close all

global C
global X Y

    C.q_0 = 1.60217653e-19;             % electron charge
    C.hb = 1.054571596e-34;             % Dirac constant
    C.h = C.hb * 2 * pi;                % Planck constant
    C.m_0 = 9.10938215e-31;             % electron mass
    C.kb = 1.3806504e-23;               % Boltzmann constant
    C.eps_0 = 8.854187817e-12;          % vacuum permittivity
    C.mu_0 = 1.2566370614e-6;           % vacuum permeability
    C.c = 299792458;                    % speed of light
    C.g = 9.80665;                      % metres (32.1740 ft) per s²

mn=0.26*C.m_0; %electron mass
Temp = 300; %Given in kelvin
rTime=10000; %run time in timesteps
MTBC = 0.2e-12;

%thermal velocity
Vth = sqrt(2*C.kb*Temp/mn);

%establish inital electron positions
%working area 200nm x 100nm
workX=200*10^-9;
workY=100*10^-9;

size=1000;
displaySize=10;

X= rand(2,size);
Y= rand(2,size);

%positions initialize
Xpos(1,:)= X(1,:)*workX;
Ypos(1,:)= Y(1,:)*workY;

colour = rand(1,displaySize);
%initial direction of each particle
angle(1,:) = X(2,:)*2*pi;

Xvel(1,:) = Vth*cos(angle(1,:));
Yvel(1,:) = Vth*sin(angle(1,:));

%hist(velocity)
%set timestep of function
spacStep = 0.01*workY;
```

```
dt = spacStep/Vth;
steps = 1000;

%variable change
Xvel(1,:) = Xvel(1,:)*dt;
Yvel(1,:) = Yvel(1,:)*dt;

figure(1)
%main function
for i = 1:1:steps
    %position advance
    %logical indexing
    checkXright = Xpos +Xvel>2e-7;%right side period
    Xpos(checkXright) = Xpos(checkXright)+Xvel(checkXright)-workX;
    checkXleft = Xpos +Xvel<0;%left side period
    Xpos(checkXleft) = Xpos(checkXleft) +Xvel(checkXleft)+workX;

    %leftover x
    leftover = ~(checkXright | checkXleft);

    Xpos(leftover) = Xpos(leftover) +Xvel(leftover);

    %reflect Y boundary
    checkY = (Ypos+Yvel>1e-7 | Ypos+Yvel<0);
    Yvel(checkY) = Yvel(checkY).*(-1);
    Ypos(1,:) = Ypos(1,:)+Yvel(1,:);

    %temperature calculations
    Ysum = sum((Yvel/dt).^2);
    Xsum = sum((Xvel/dt).^2);
    calcTemp = mn*((Ysum)+(Xsum))/(2*C.kb);
    averageTemp = calcTemp/size;

    %plotting here
    prevX(i,:) =Xpos(1,:);
    prevY(i,:) =Ypos(1,:);
%     for j = 1:1:displaySize
%         plot(prevX(:,j),prevY(:,j),'color',[colour(1,j) 0 j/
displaySize])
%
%         xlim([0 workX])
%         ylim([0 workY])
%         legend(['Temperature:' num2str(averageTemp)])
%         drawnow
%         hold on
%     end


end



for j = 1:1:displaySize
```

```
        plot(prevX(:,j),prevY(:,j),'color',[colour(1,j) 0 j/
displaySize])

        xlim([0 workX])
        ylim([0 workY])
        legend(['Temperature:' num2str(averageTemp)])
        drawnow
        hold on
end
```



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