Assignment 6 : Tubelight Simulation

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April 13, 2021

1 Introduction

In this assignment, we try to simulate a tubelight using Python. The emission intensity, electron density are observed.

2 Simulation

The inputs used for the simulation in this report are:

`n = 100; M = 5; Msig = 2; nk = 500; u0 = 5; p = 0.25`

The simulation is done using the following loop

```
for k in range(nk):
    m = int(pl.randn()*Msig + M)
    nn = pl.where(xx==0)
    xx[nn[0][:m]] = 1
    ii = pl.where(xx>0)
    X.extend(xx[ii].tolist())
    V.extend(u[ii].tolist())
    dx[ii] = u[ii] + 0.5
    xx[ii] += dx[ii]
    u[ii] += 1
    pp = pl.where(xx>n)
    xx[pp] = 0
    u[pp] = 0
    kk = pl.where(u>=u0)[0]
    ll = pl.where(pl.rand(len(kk))<=p)
    kl = kk[ll]
    u[kl] = 0
    xx[kl] -= pl.rand(len(kl))*dx[kl]
    I.extend(xx[kl].tolist())
```

3 Results

The vectors I, V and X correspond to the Intensity, Velocity and the Position of electrons. This data is used to plot histograms of electron density and emission intensity as well as the plot of phase space.

The intensity data is printed out as a table in the file data.txt. Few lines of that file are given below

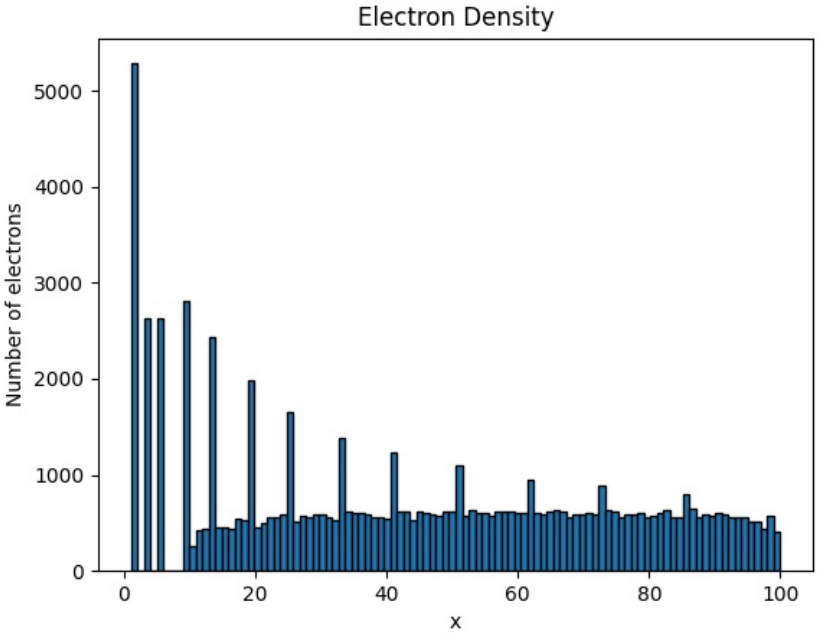

Figure 1: Electron density along the tubelight

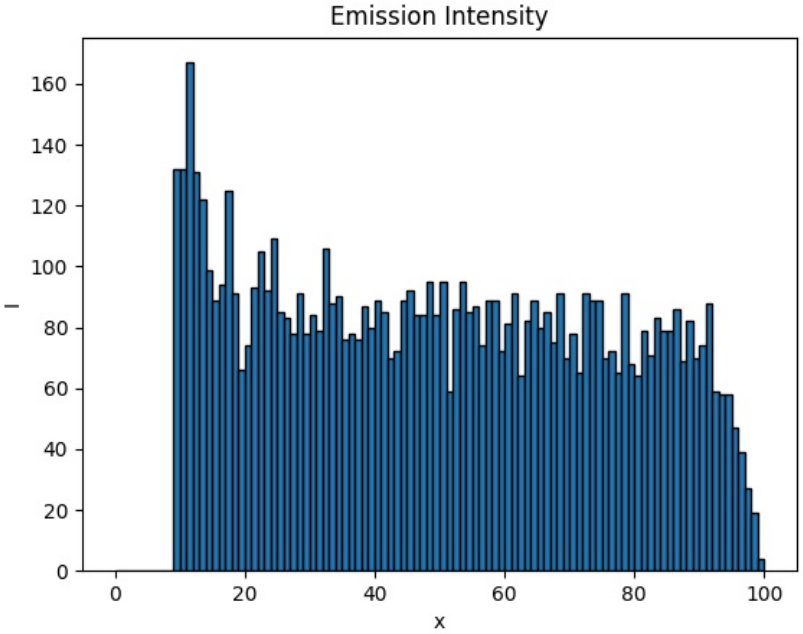

Figure 2: Emission Intensity

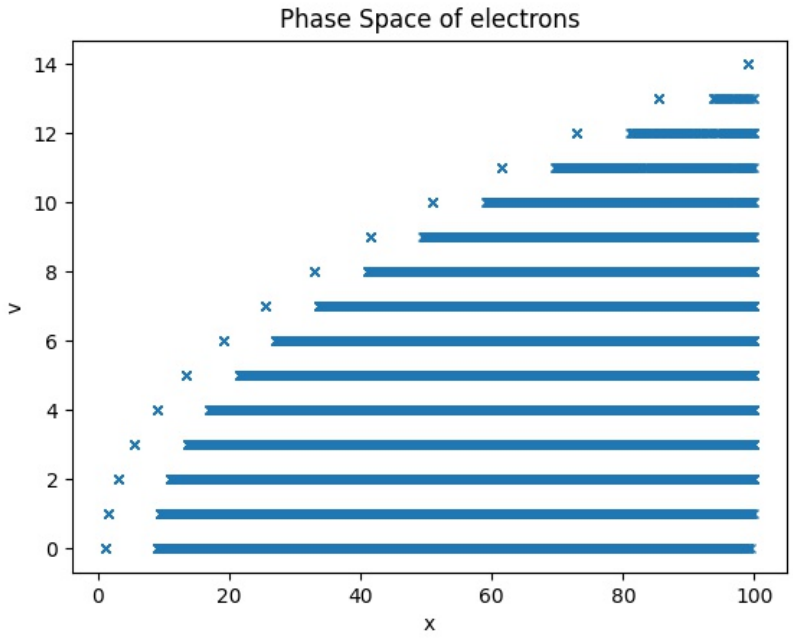

Figure 3: Electron Phase Space

Intensity Data :

xpos	count
0.5	0
1.5	0
2.5	0
3.5	0
4.5	0
5.5	0
6.5	0
7.5	0
8.5	0
9.5	132
10.5	132
11.5	167
12.5	131
13.5	122
14.5	99
15.5	89
16.5	94
17.5	125
18.5	91
19.5	66
20.5	74

Conclusion

We see that a the tubelight, being a fairly complex model can be simulated using a few lines of code in python.