Inbound- Task I

Shakunaveti Sai Sri Ram Varun

June 28 2024

1 Equatorial co-ordinate system

Equatorial co-ordinate system is commonly used system to find and place stars, galaxies and celestial objects. Earth is considered to be the origin of this system, since we are the observer (Reference frame considering observer at rest).

By convention, the origin is fixed to be the orientation of Earth as of January 1st 2000 12:00 TT. In this reference frame x-axis is equinox, z-axis is Earth's axis of rotation and y-axis is perpendicular axis to both the axes. Earth's axis shifts over time due to precession, but this is very slow and we update our reference frame every 50 years.

Elliptic plane is an imaginary plane across which the Earth rotates around the Sun. Therefore the Celestial North pole is tilted at an angle of 23.5° to the Elliptic North pole. Similar to Latitudes and Longitudes in geographic co-ordinate system we use Right Ascension and Declination in Equatorial Co-ordinate system.

Declination is angular distance if an object w.r.t North or South of the y-axis (celestial equator).
Right Ascension is the angular distance measured from vernal Equinox towards East. Vernal Equinox is the point where sun crosses the Celestial equator. Vernal Equinox generally happens around March 20th. Right Ascension is measured in Hours Minutes and Seconds. Right Ascension is the relative time difference when the star and sun arise across the Vernal Equinox. Since, every month Earth revolves 30°around the sun, The RA of the respective star decrease 2hrs every month from march.

2 Task

From the given task, I plotted DEC vs RA in a linear scale through the written python code.

```
import numpy as np
import matplotlib.pyplot as plt
data = np.loadtxt("data.txt",usecols=(0,1,2,3), skiprows=1)
```

```
HIP = data[:,0]

Vmag = data[:,1] #require vmag to make size of stars not to show them identical;

RA= data[:,2] #RA values are given in degrees; will convert them to hours and make in 24 hou
RA = RA*24/360

DEC = data[:,3] #declination is given in degrees as required


fig, ax = plt.subplots()

fig.set_facecolor('black')  # Set the figure background color to black
ax.set_facecolor('black')  # Set the axis background color to black

ax.scatter(RA,DEC, color='white', marker='o',s=80*(np.power(10,Vmag/-2.5)))

#ax.grid(color='white', linestyle='--', linewidth=0.5)
ax.tick_params(colors='white')  # Set tick labels color to white
for spine in ax.spines.values():
    spine.set_color('white')  # Set spines color to white


ax.set_xlabel('Right Ascension')
ax.set_ylabel('Declination')

ax.grid(False)
ax.set_xlim(0,24)
ax.set_ylim(-90,90)


plt.show()
```

From this I have obtained the figure: Since I did not want to show all the stars with same size, I have given them relative sizes from a formula I have seen in this article.

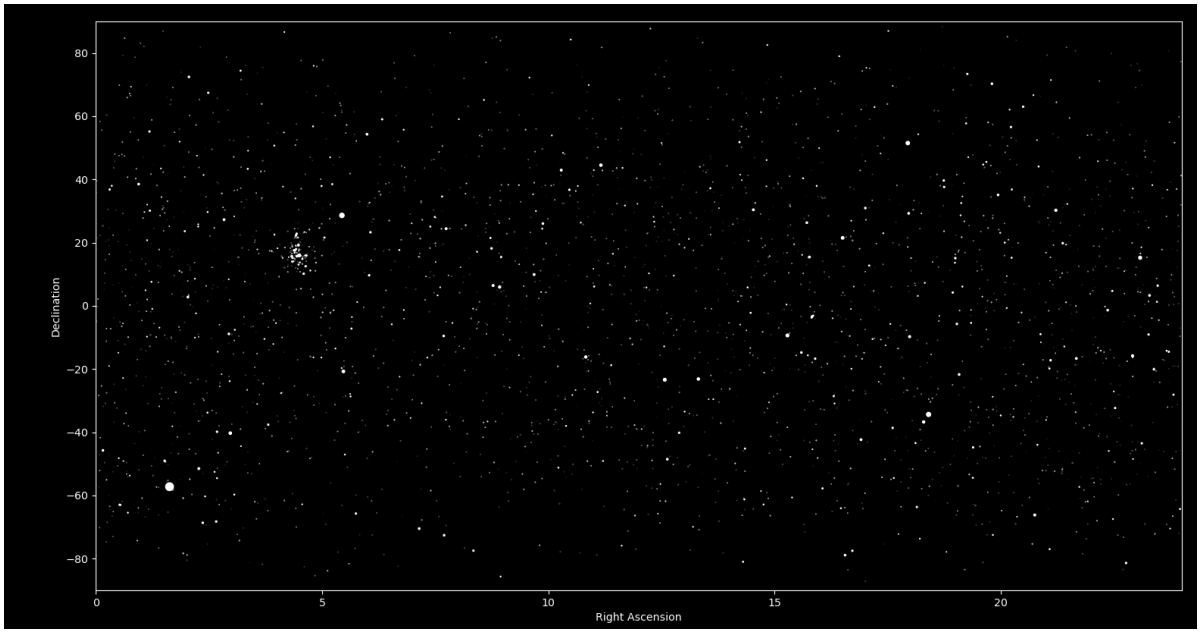

Figure 1: Stars- normalized