ASSIGNMENT 2

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Hammer-Aitoff maps

Code: -

```python
file = open("obcat.txt",mode='r')
```

```python
galactic_coordinates = []
for f in file:
    line = f.split()
    galactic_coordinates.append([float(line[-2]),float(line[-1])])
```

```python
import astropy.units as u
from astropy.coordinates import SkyCoord
import pandas as pd

gal = SkyCoord(galactic_coordinates, frame='galactic', unit=u.deg)
data = pd.read_csv("Local grp of galaxies.csv")
gal_local_grp = SkyCoord(np.array(data.iloc[:,1:]), frame='galactic', unit=u.deg)
```

```python
import matplotlib.pyplot as plt

plt.subplot(111, projection='aitoff')
plt.grid(True,linewidth=0.8,color='grey')

#OB Stars
plt.scatter(gal.l.wrap_at('180d').radian, gal.b.radian, marker='.',s=3,color='deepskyblue',label="OB Stars")

#Local Group
plt.scatter(gal_local_grp.l.wrap_at('180d').radian, gal_local_grp.b.radian,marker='o',s=5,color='magenta',label="Local Group"

#Sun's path
longitude = np.linspace(0, 360, 1000)
latitude = np.zeros(1000)
```

```
# Transform ecliptic coordinates to galactic:
ecl = SkyCoord(longitude, latitude, unit = u.deg, frame = 'barycentricmeanecliptic')
ecl_gal = ecl.transform_to('galactic')
l_ecl_gal, b_ecl_gal = ecl_gal.l.wrap_at('180d').radian, ecl_gal.b.radian
plt.scatter(l_ecl_gal, b_ecl_gal,marker='o', color = 'yellow' ,s=0.7, label='Eclptic')


#Andromeda
gal_andromeda = SkyCoord([[121.2,-21.6]], frame='galactic', unit=u.deg)


plt.scatter(gal_andromeda.l.wrap_at('180d').radian, gal_andromeda.b.radian,marker='o',s=20,color='white',label="Andromeda")


#LMC & SMC

gal_SMC = SkyCoord([[13.186588,-72.828599]], frame='galactic', unit=u.deg)
gal_LMC = SkyCoord([[280.465303, -32.888347]], frame='galactic', unit=u.deg)


plt.scatter(gal_SMC.l.wrap_at('180d').radian, gal_SMC.b.radian,
            marker='o',s=20,color='lawngreen',label="SMC")
plt.scatter(gal_LMC.l.wrap_at('180d').radian, gal_LMC.b.radian,
            marker='o',s=20,color='orange',label="LMC")

plt.xlabel("Galactic Longitude (l)",labelpad=15)
plt.ylabel("Galactic Latitude (b)")
plt.title("A Map of Our Galaxy & Extragalactic Neighbourhood",pad=30,
          fontweight='bold')
plt.legend(bbox_to_anchor=[0.86,0.16],markerscale=1.4,fontsize=6)
plt.style.use('dark_background')
plt.savefig("Aitoff map.png",orientation='landscape',dpi=300)
```

```
#Since it is very small we can simply put the center, otherwise we
#can sample points from the ellipse of SMC and LMC and then plot them from the code below

SMC = []
n = 2000
delta_ra = np.random.uniform(-0.05,0.05,n)
delta_dec = np.random.uniform(-0.05,0.05,n)

for i in range(n):
    if np.sqrt((delta_ra[i]**2)+(delta_dec[i]**2))<0.05:
        SMC.append([13.186588+delta_ra[i],-72.828599+delta_dec[i]])
```

A Map of Our Galaxy & Extragalactic Neighbourhood