A Map of the Sellar Component of our Galaxy Extragalactic Neighbours Assignment 2

ESA422

(Vivekjyoti Bhowmik)

Galaxies(Structure, Dynamics and Evolution)

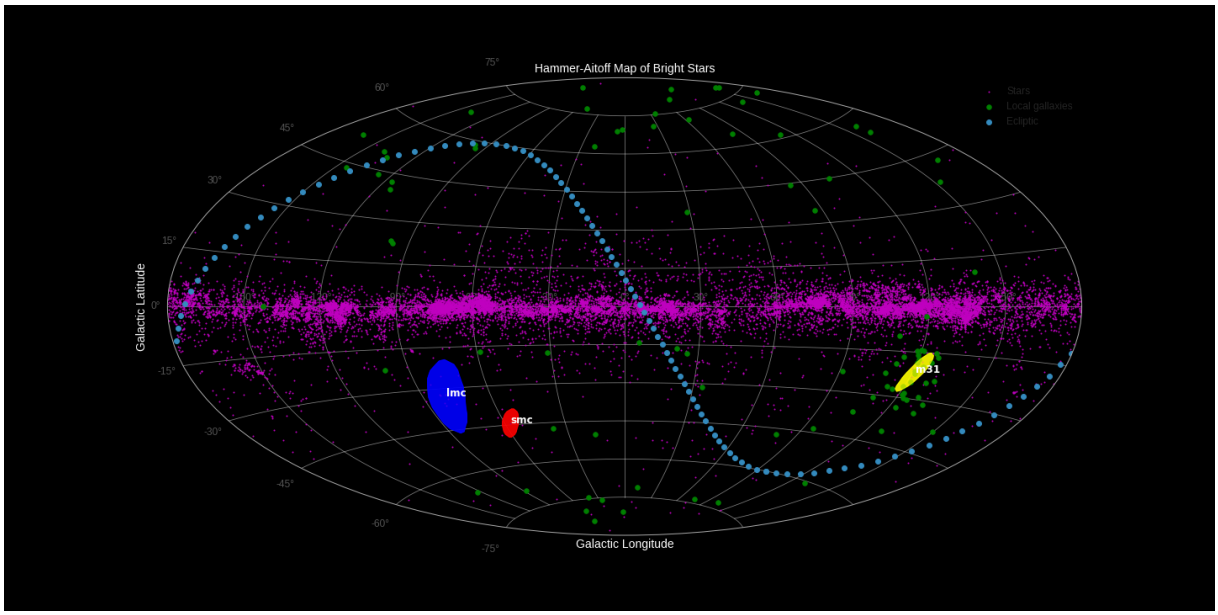
January 29, 2023

A Map of the Sellar Component of our Galaxy Extragalactic Neighbours

Problem 1

a. Generate a Hammer-Aitoff map showing the distribution of bright stars (mostly O, and B) from the catalogue of Reed et al. (2003, 2005). The map should be in Galactic coordinates with Galactic longitude of 0 degree occupying the centre of the map. b.Plot in that same map the locations of the Large Magellanic Cloud, Small Magellanic Cloud, Andromeda Galaxy using slightly bigger filled ellipses of a different colour. You can get the coordinates of LMC and SMC, and Andromeda from NED (NASA Extragalactic Database) : https://ned.ipac.caltech.edu/ c. Also plot in that map the locations of all the other dwarf satellite galaxies identified as part of the Local Group of galaxies. The Milky Way and Andromeda are the two most massive, most luminous members of the Local Group. The coordinates of the Local Group galaxies can be found in McConnachie, A.W., 2012, AJ, 144, 4, and on Alan McConnachie's page: https://www.cadc-ccda.hia-iha.nrc-cnrc.gc.ca/en/community/nearby/ The Local Group dwarf galaxies should be plotted using filled ellipses of a different colour. All external galaxies should be labelled in the plot. Additional Challenge: Try to plot the ecliptic on this map, as a moderately thick line. This may involve converting RA, Dec of the Sun for an entire year into Galactic coordinates. The conversion formula is in the lecture slides.

Solution. Deduced plot:



1 code

```

import pandas as pd
from astropy.coordinates import SkyCoord
from astropy.visualization import astropy_mpl_style
import matplotlib.pyplot as plt
from matplotlib.patches import Ellipse
import numpy as np
import matplotlib as mpl

#reading the stars data file with pandas
df = pd.read_csv("obcat1.txt", delimiter= "\t", comment = "#", header = 0)
galactic_longitude= df.iloc[:,5]
galactic_latitude= df.iloc[:,6]

#reading the local gallaxy data file with pandas
data =pd.read_csv("Table1.txt",delimiter= "\t", comment = "#", header = 0)
galo = data.iloc[:,1]
gala = data.iloc[:,2]

#coordinte conversion to galactic coordinate
coord1 = SkyCoord(galactic_longitude, galactic_latitude, frame='galactic', unit='deg')
coord2 = SkyCoord(galo, gala , frame='galactic', unit='deg')
coord3 = SkyCoord(302.796913,-44.299213,frame='galactic', unit='deg' )
coord4 = SkyCoord(280.465303, -32.888347,frame='galactic', unit='deg' )
coord5 = SkyCoord(121.174405, -21.572936,frame='galactic', unit='deg' )


# Create the ellipse
smc = Ellipse((coord3.l.wrap_at('180d').radian, coord3.b.radian), width= 0.25, height= 0.10, an
lmc = Ellipse((coord4 .l.wrap_at('180d').radian, coord4 .b.radian), width=0.5, height= 0.25, an
m31 = Ellipse((coord5 .l.wrap_at('180d').radian, coord5.b.radian), width= 0.25, height= 0.1, an

#using astropy to create the aitoff map
plt.style.use(astropy_mpl_style)
fig = plt.figure(figsize=(20,10))
ax = fig.add_subplot(projection="aitoff")
ax.set_facecolor('black')

# Add labels and a caption
plt.style.use('seaborn-darkgrid')
ax.set_xlabel("Galactic Longitude", fontsize=14, color='white')
```

```
ax.set_ylabel("Galactic Latitude", fontsize=14, color='white')
ax.set_title("Hammer-Aitoff Map of Bright Stars", fontsize=14, color='white')

# Add labels to the smc,lmc,m31
ax.text(coord3.l.wrap_at('180d').radian, coord3.b.radian, 'smc', color='white', fontsize=12, al
ax.text(coord4.l.wrap_at('180d').radian, coord4.b.radian, 'lmc', color='white', fontsize=12, al
ax.text(coord5.l.wrap_at('180d').radian, coord5.b.radian, "m31", color='white', fontsize=12, al

# Add the lmc to the plot
ax.add_patch(smc)
ax.add_patch(lmc)
ax.add_patch(m31)
#ploting the ecliptic
ecliptic_longitudes = np.linspace(0, 360, 100)
ecliptic_latitudes = np.zeros(100)
ecl = SkyCoord(ecliptic_longitudes,ecliptic_latitudes,unit= "deg", frame='barycentricmeaneclipt
gal3 = ecl.transform_to('galactic')

# Plotting  data points
ax.scatter(coord1.l.wrap_at('180d').radian,coord1.b.radian, c='m', s=1, label = "Stars")
ax.scatter(coord3.l.wrap_at('180d').radian,coord3.b.radian, c='b', s=1)
ax.scatter(coord2.l.wrap_at('180d').radian,coord2.b.radian, c='g', s=30, label = "Local gallaxi
ax.scatter(gal3.l.wrap_at('180d').radian, gal3.b.radian,label = 'Ecliptic')

# Adding SMC, LMC and andromeda to the plot
ax.add_patch(smc)
ax.add_patch(lmc)
ax.add_patch(m31)
fig.set_facecolor('black')
ax.legend()
plt.savefig("10.5.png")
plt.show()


```