INST 2403 Activity

The Milky Way

In this activity, we want to get a sense for the dimensions and shape of our galaxy, the Milky Way. The dimensions of the Milky Way are as follows. The diameter of the disk is 100,000 ly. The *central bulge* is shaped like a football with long diameter 15,000 ly parallel to the disk, and short diameter 4000 ly. The sun is in the *galactic disk* of thickness 1,000 ly about 26,000 ly from the center. The Milky Way has a *spherical halo* of globular star clusters. The disk contains a lot of gas and dust, whereas the central bulge contains some, and halo doesn't contain any.

1. Use ruler and pencil to draw the Milky Way on a white sheet of paper face on (bird's eye view). The scale should be 2cm = 10,000 ly.

2. Use ruler and pencil to draw the Milky Way including some globular star clusters on a white sheet of paper edge-on (from the side).

3. Draw the position of the sun on both sketches.

4. Indicate in the drawings how galactic latitude is measured.

5. What is the galactic latitude of the sun?

   Zero, it is in the disk.

6. What is the galactic latitude of most stars in the galaxy?

   Zero, see above.

7. What is the galactic latitude of the globular star clusters?

   Large. They can be any where (halo)

8. In which parts of the galaxy (halo, disk, bulge) do stars form at the highest rate? Rank the regions and explain.

   Highest star formation rate in disk, then bulge, the halo. The amount of gas & dust is key, b/c this is the material that stars are forming out of.

9. Bright stars we see in the night sky are very far from Earth - very far compared to the sun, that is. Recall that a lightyear is about 63,000 AU, or 63,000 times the distance to the sun. Stars in a scaled down model can be represented by golf balls which are about 100 miles apart. Is it likely that stars collide?

No, they are too far apart compared to their size (diameters)

10. Stars very far away by that standard are 500 to 1000 ly from the sun. Draw them into the sketch to scale. ✓

11. Objects that are farther than these stars must be very luminous so we can see them. Some of these deep sky objects include M42 (Great Orion Nebula) 1500 ly, M14 (globular star cluster) 30,000 ly. Draw them in to scale. ✓

12. How do we know that these distant objects are still part of the Milky Way?

Their distance to us is less than the diameter of the Milky Way.

13. The Andromeda Galaxy is about the same size as the Milky Way and 2.5 million ly away. Draw it on another piece of paper and put the two pieces of paper it in an appropriate distance to each other.

14. How likely is it that these two galaxies could collide? Compare to the collision probability of stars above.

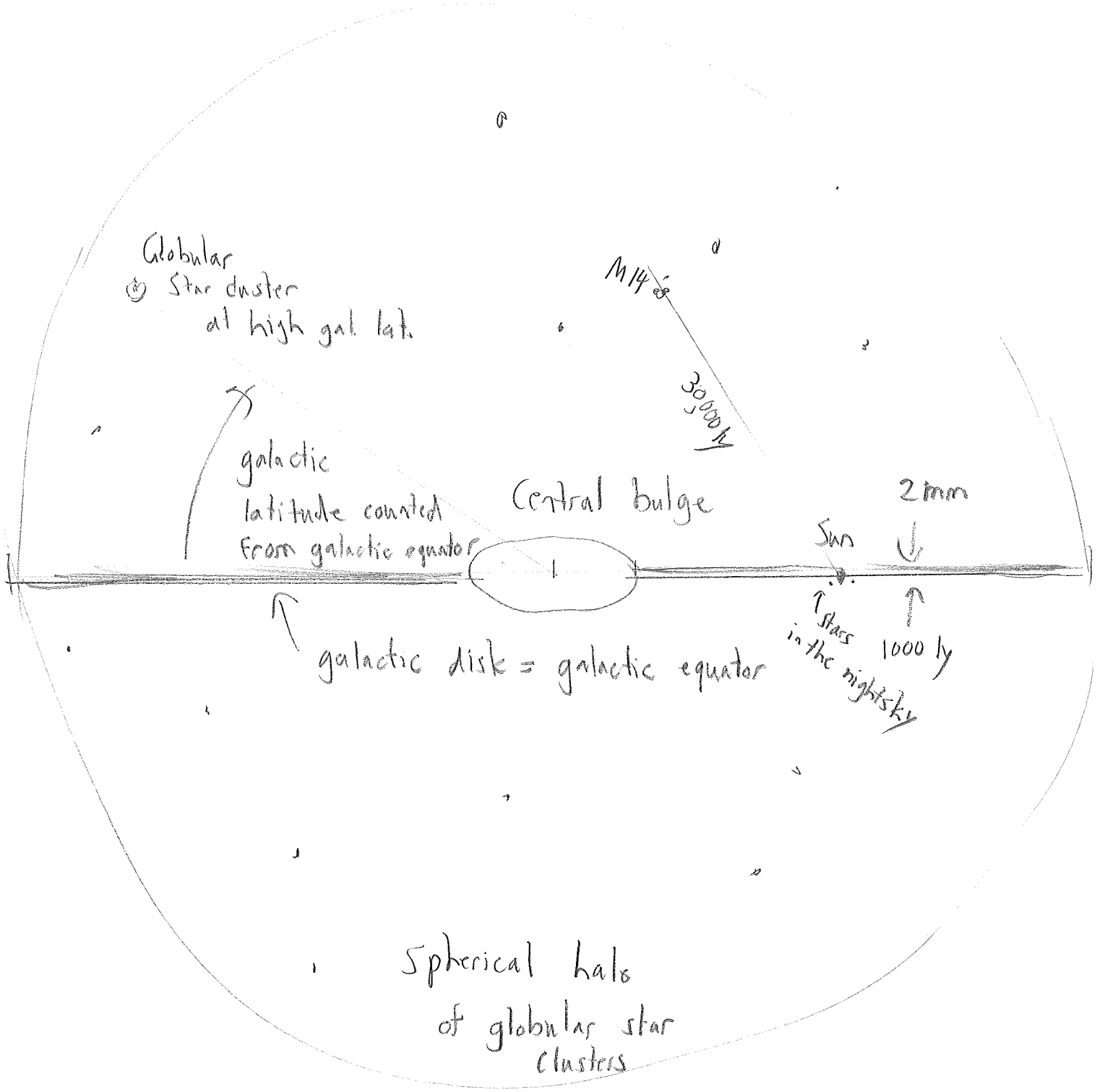
Basically impossible that 2 stars collide (2 golf balls 100 miles away), and comparatively likely that 2 galaxies collide (2 frisbee disks 10 m apart)

20 x MW diameter = 2 mill. ly

Milky Way

Andromeda galaxy

Edge on:


Globular
Star cluster
at high gal. lat.
M14
30,000 ly
galactic
latitude counted
From galactic equator
Central bulge
2mm
Sun
stars
in the nightsky
1000 ly
galactic disk = galactic equator
Spherical halo
of globular star
clusters

Face-on: