

## GLOBULAR CLUSTERS\*

Globular clusters are some of the oldest structures in the galaxy. They are very large, gravitationally bound groups of stars that have the reddish tint of an aging stellar population. Each is on an orbit about the center of the galaxy independent of the motions of other clusters or the disk of stars. Their positions and orbits thus give us information about the center of our home galaxy, the Milky Way.

Plot the positions of some globular clusters relative to the Sun (the motion of the Earth through the seasons must be removed from all astronomical measurements of cosmic bodies, so we consider their positions to be relative to the Sun). Below is a selection of clusters, their galactic latitudes and distances. Plot these on the polar grid on the following page. Number 2, NGC 1851 is plotted for you.

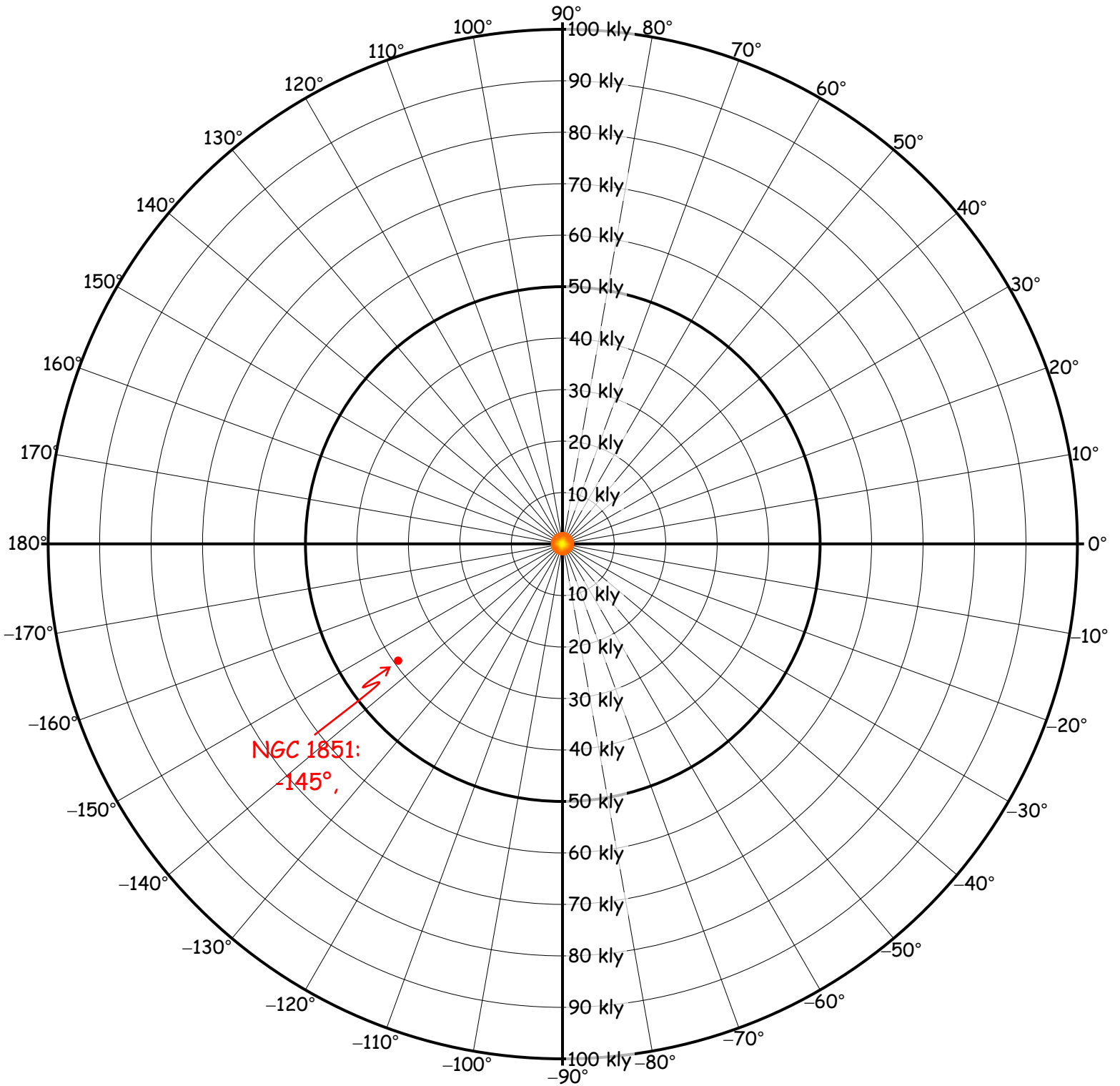
Number	Name	Latitude	Distance
		degrees	light years
1	NGC 288	-90.6	29000
2	NGC 1851	-145	39000
3	NGC 1904	-150.6	42000
4	NGC 2298	-164	35000
5	NGC 4147	102.8	63000
6	NGC 5634	49.3	82000
7	NGC 5897	46	24000
8	NGC 5904	4	24000
9	NGC 6121	16	7000
10	NGC 6144	16	33000
11	NGC 6171	23	20000
12	NGC 6218	26.3	16000
13	NGC 6229	40.3	99000
14	NGC 6284	10	47000
15	NGC 6284	9.9	50000
16	NGC 6316	6	35000
17	NGC 6333	11	26000
18	NGC 6356	10.2	50000
19	NGC 6426	16.2	68000
20	NGC 6453	-4	36000
21	NGC 6535	10.4	22000
22	NGC 6652	-11	31000
23	NGC 6681	-13	6000
24	NGC 6715	-14.1	87000
25	NGC 6723	-17	8000
26	NGC 6809	-23	17000
27	NGC 6864	-26	61000
28	NGC 6864	-25.8	68000
29	NGC 6934	-18.9	51000
30	NGC 7099	30	41000

Plotted as an example.

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\* Adapted from Desch & Terndrup (2012), *Starry Night Workbook with Starry Night College Software for Understanding Our Universe*, (W. W. Norton & Company, Inc.:New York).

Plot the globular cluster positions on the plot below, centered on the Sun. After finishing, mark the position you see as the center of the galaxy (the centroid of the globular cluster distribution) along the 0° line<sup>31</sup>.



Distance to Galactic Center \_\_\_\_\_ kly<sup>2</sup>. Compare to the current average value of 26 kly<sup>2</sup>.