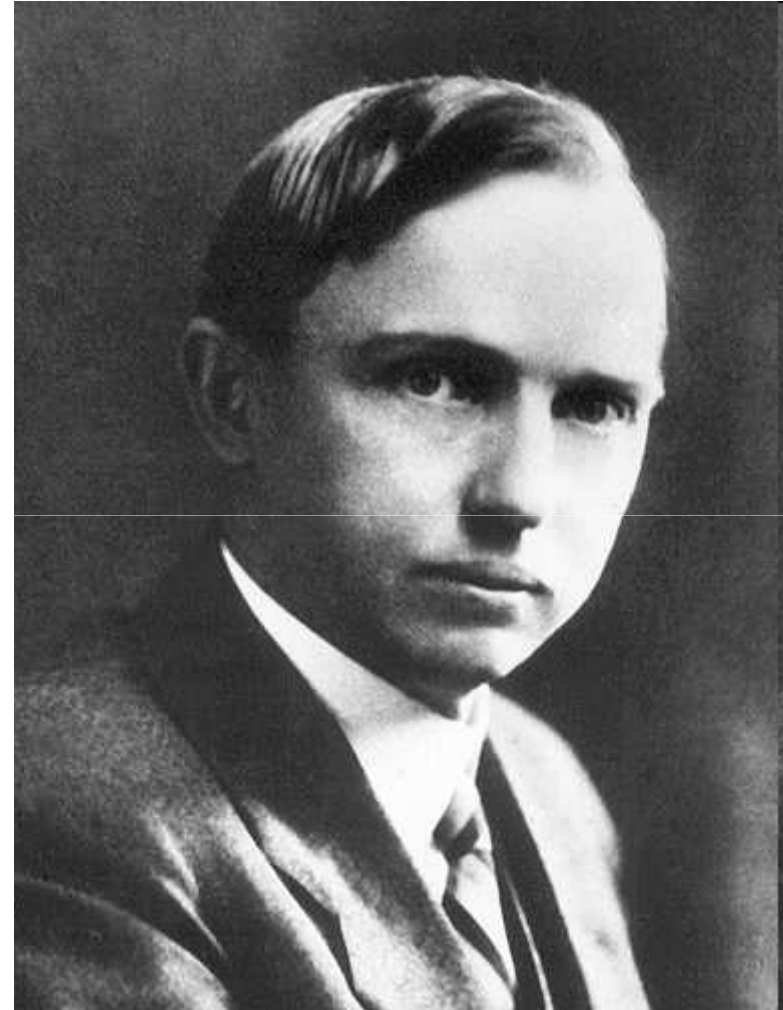


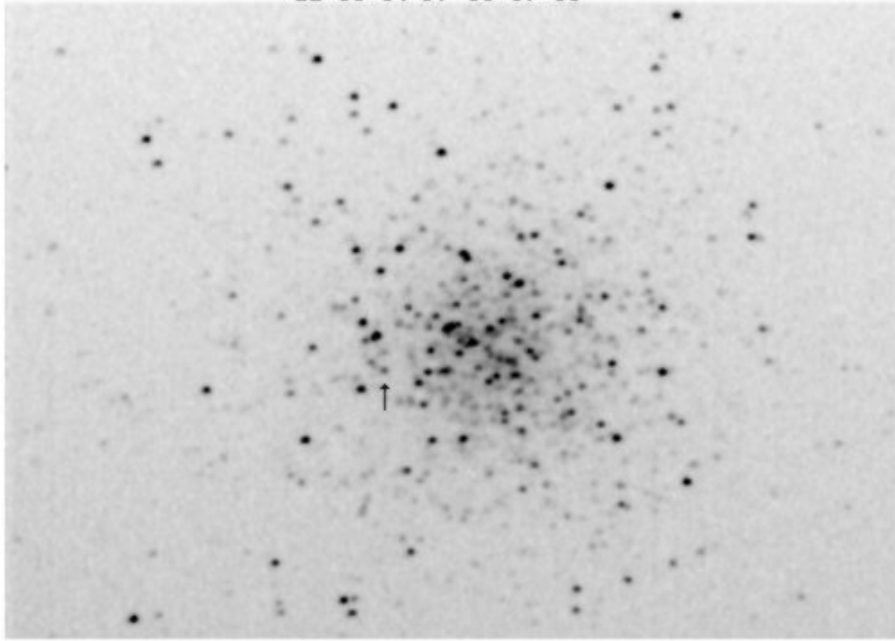
Where are we in the Galaxy?

- How are stars, gas and dust distributed in the Galaxy ?
- Harlow Shapley (1918) : *Globular Clusters and the Structure of the Galactic System (PASP, Vol. 30)*

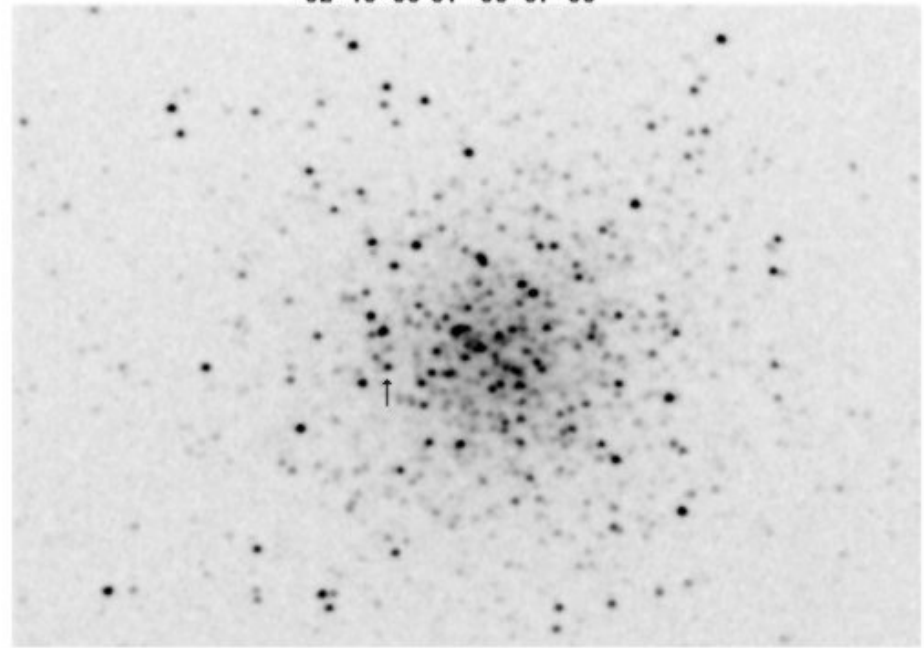


HARLOW SHAPLEY
(1885 – 1972)

22:33:34 UT 13/09/03

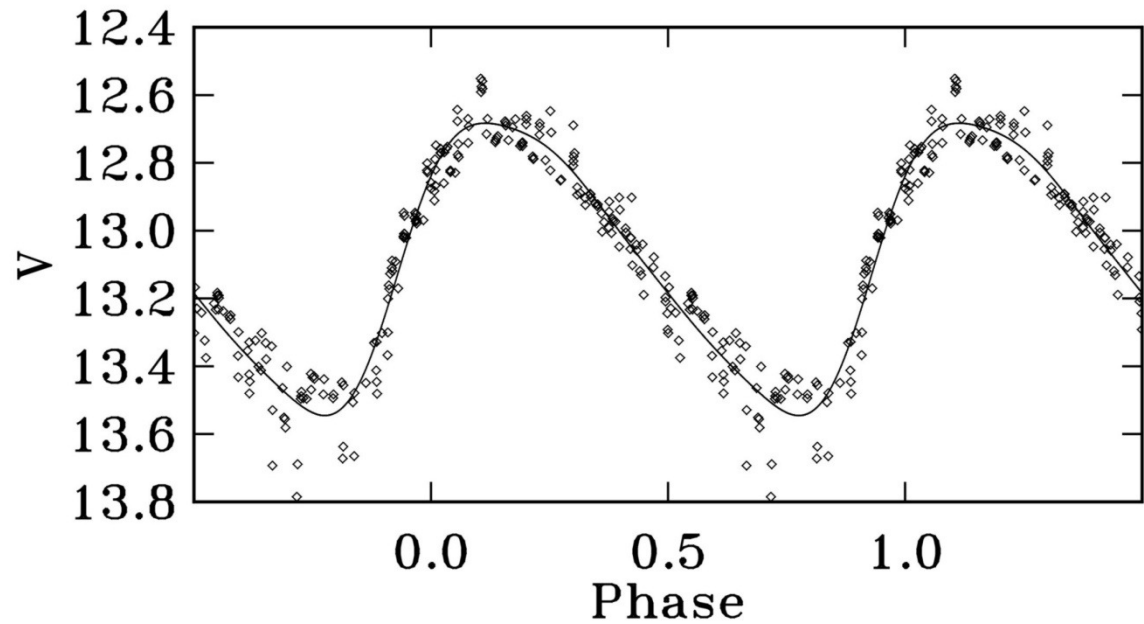


02:43:50 UT 08/07/03



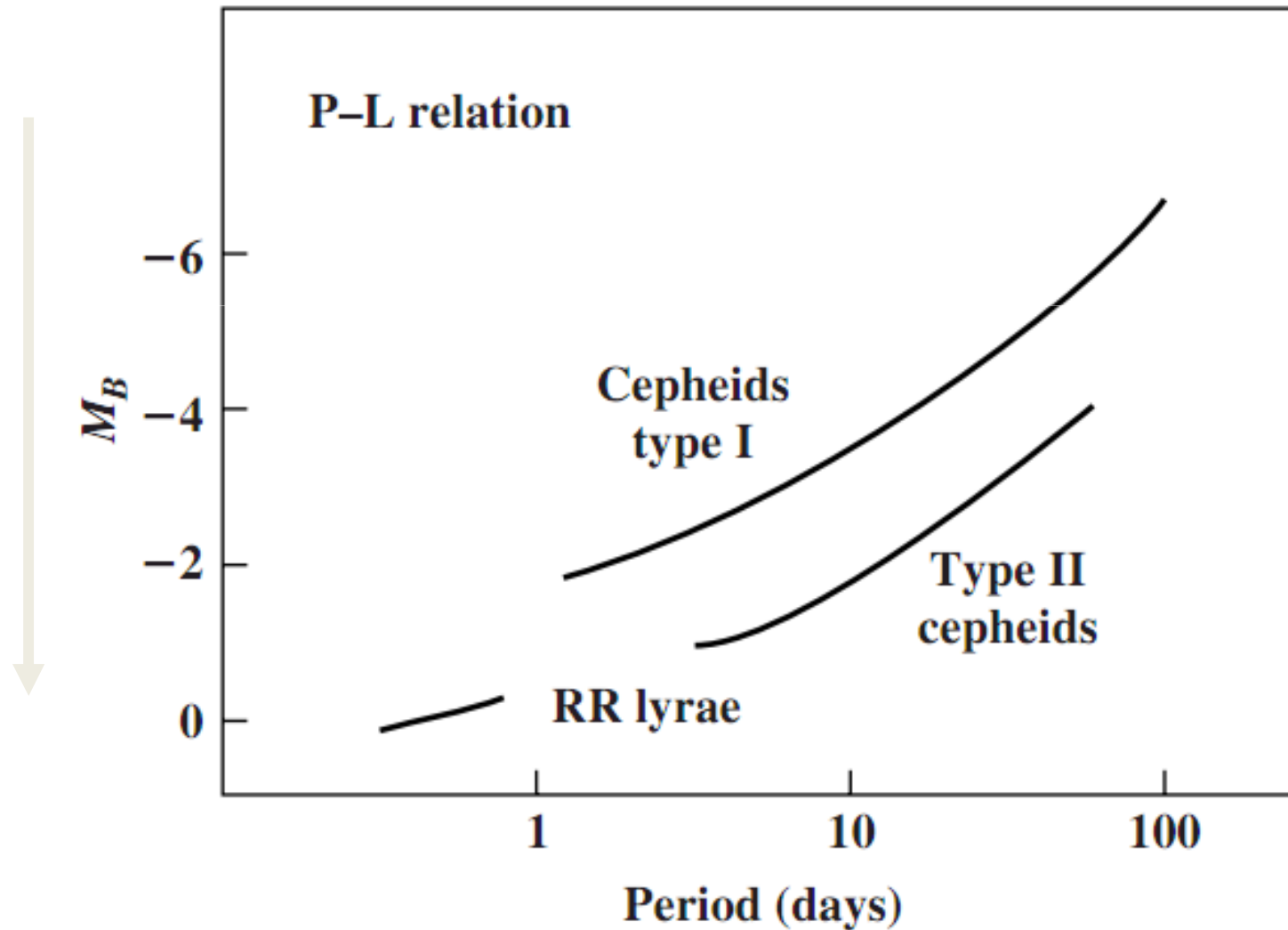
M13 globular cluster. The cepheid V2 is arrowed near its minimum (left) and maximum (right) brightness.

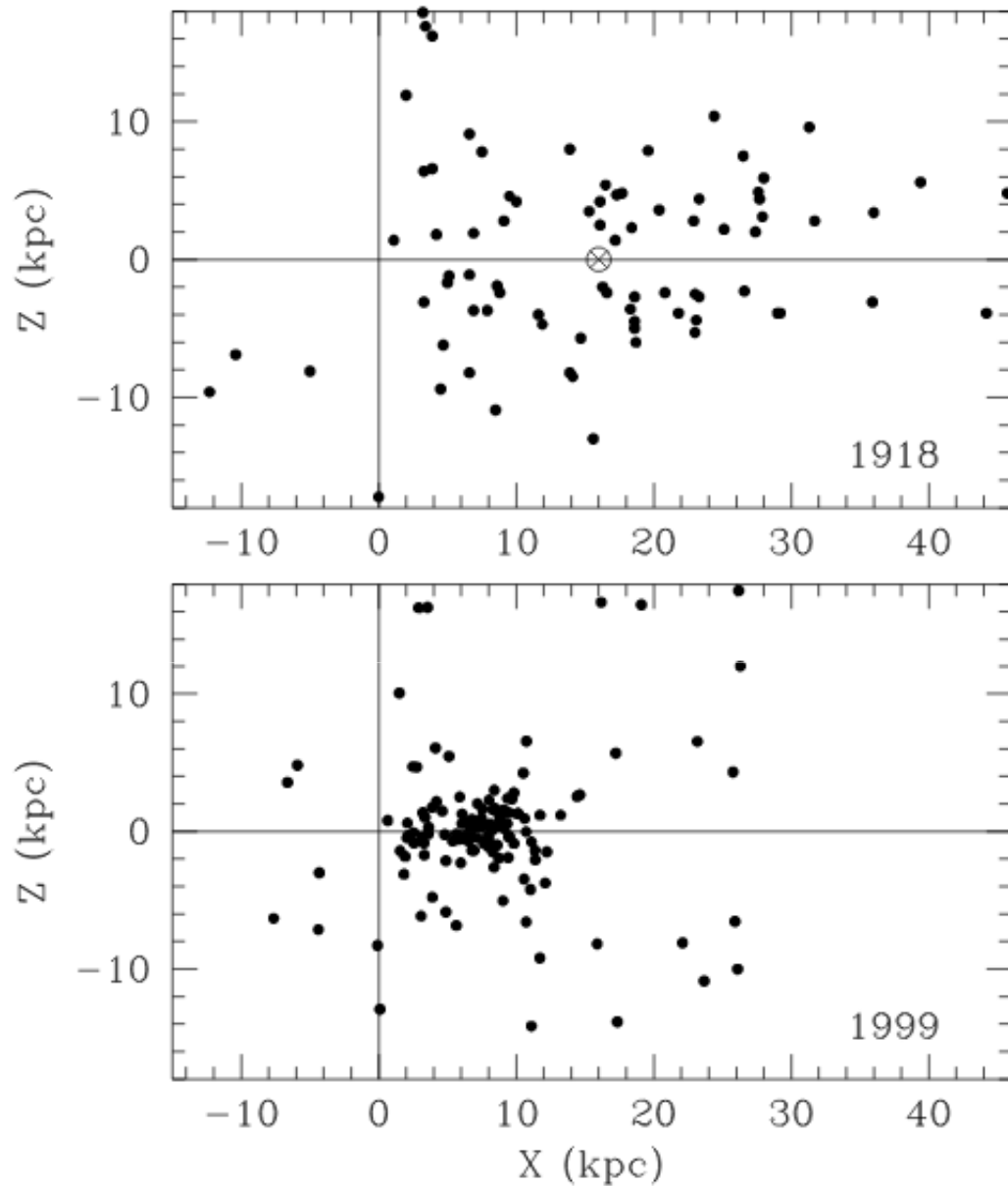
*Light curve of the
star V2*



Stellar Pulsations as Distance Indicators

Period – Luminosity Relationship





The horizontal line at $z = 0$ kpc corresponds to the mid-plane of the Galaxy

Top panel: The spatial distribution of the Milky Way globular clusters as measured by Shapley (1918). The Sun is at (0,0) at this graph, and Shapley's estimated location of the Galactic centre is marked at (16,0).

Lower Panel: The spatial distribution in the same plane according to more recent data available. The tight grouping of the clusters near the Galactic centre (now at 8,0) and the underlying symmetry of the distribution are much more obvious in the graph.

From this, one sees that the GCs form a near spherical distribution. But the center of this spherical distribution is well displaced from the position of the Sun.

Where are we in the Galaxy?

Estimates on the distance to the Galactic center from other groups

Reference	R_o (kpc)	Calibration	Comments
Oort & Plaut 1975	8.7 ± 0.6	$M_{pg}(RR) = 0.7$	
Clube & Dawe 1980	7.0 ± 1.0	$M_v(RR) = 1.0$	
Blanco & Blanco 1985	8.0 ± 0.7	$M_v(RR) = 0.6$	all metallicities
	6.9 ± 0.6	$M_v(RR) \propto [Fe/H]$	mean $M_v = 0.82$
Walker & Mack 1986	8.1 ± 0.4	$M_v(RR) = 0.6$	
Fernley et al 1987	8.0 ± 0.6	$M_v(RR) \approx 0.6$	infrared
Walker & Terndrup 1991	8.2 ± 1.0	$M_v(RR) = 0.85$	$[Fe/H] \approx -1$

Ghez et al. (2008) $R_o = 8.4 \pm 0.4$ kpc

Gillessen et al. (2009) $R_o = 8.33 \pm 0.35$ kpc

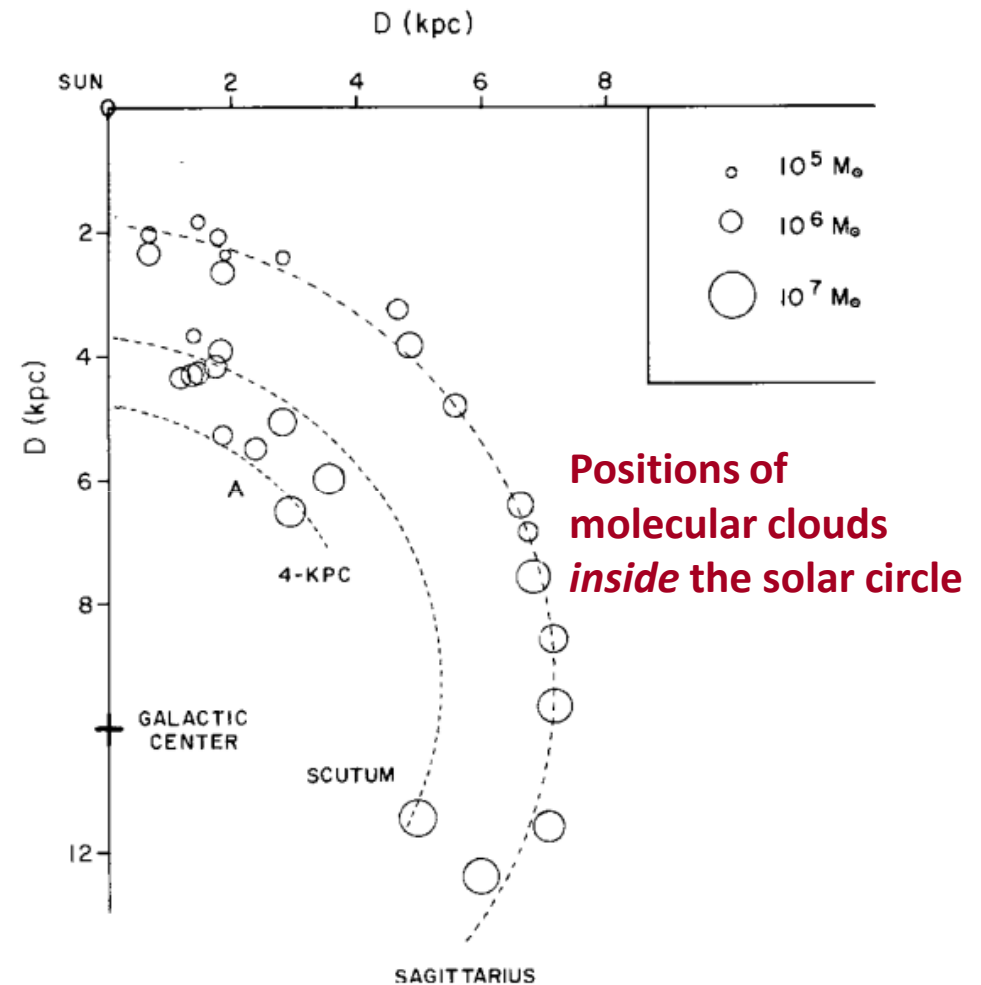
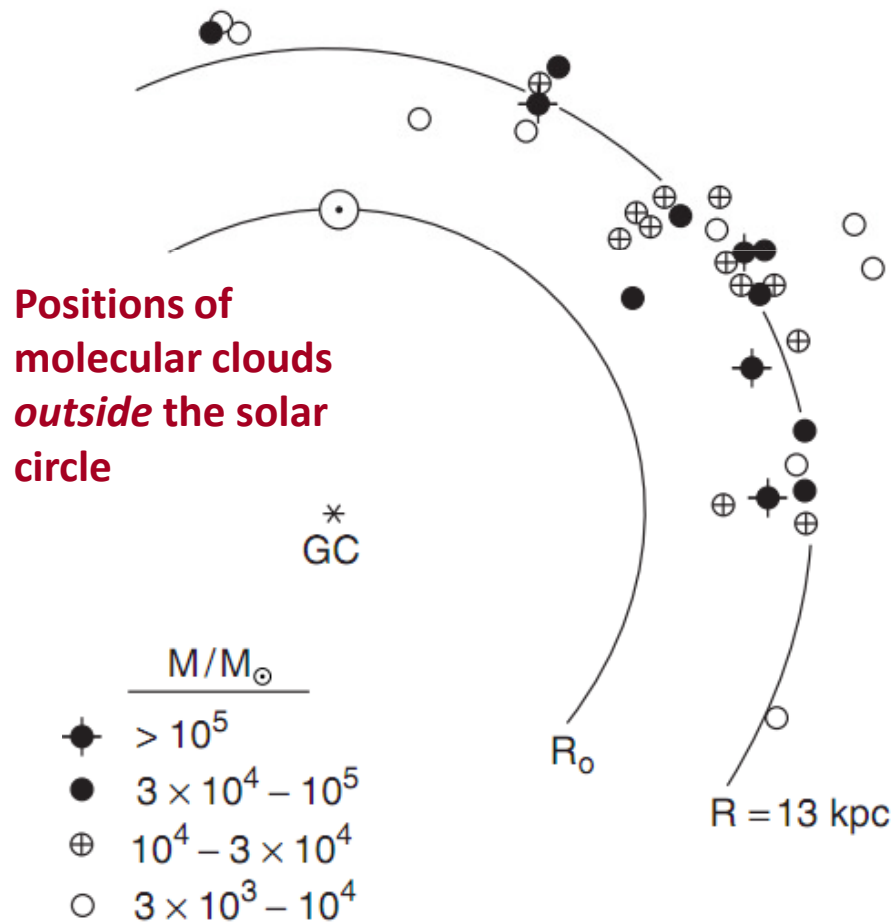
Inferences from mapping the distribution of globular clusters :

- There is a morphological center to the Galaxy
- We are not at the center

$$R_o = 8.2 \pm 1.0 \text{ kpc}$$

Structure Within the Disc

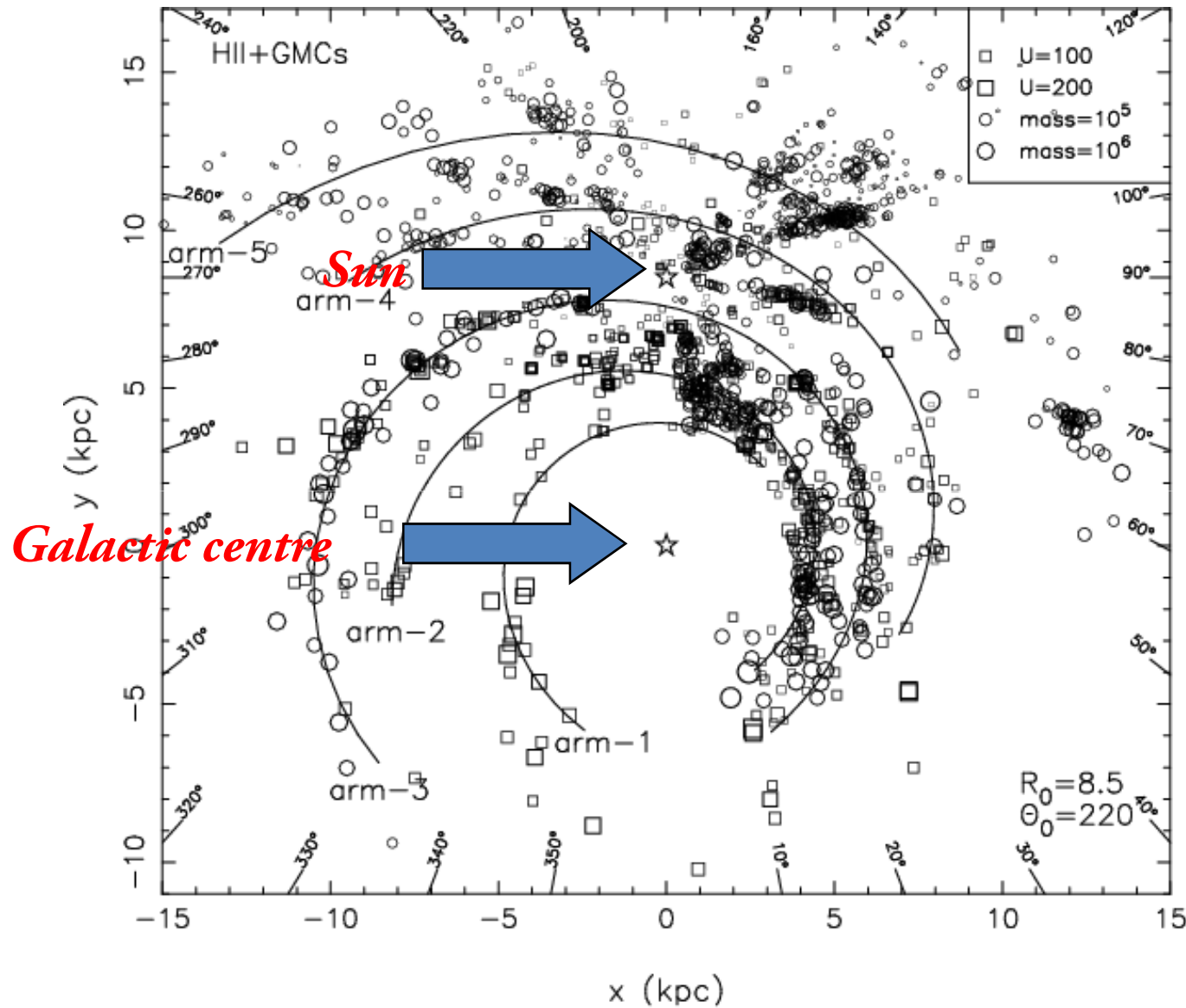
■ Mapping the distances to H I clouds, CO complexes, H II regions, and OB associations



Dame et al. 1986

The figure in the previous slide shows the spiral structure of the Galaxy as determined from giant molecular cloud complexes inside the solar circle. The sizes of the circles indicate the masses of the complexes, as indicated in the upper right. The 4 kpc and Scutum arms are drawn from the 21 cm maps. The Sagittarius arm is drawn as it would best fit the CO data. [*Thomas Dame, CFA/Dame, T.M. et al., Astrophys.J., 305, 892, 1986, Fig. 9*]

Structure Within the Disc



The distribution of H II regions and GMCs with arm models fitted to the distribution.

Galactic longitude is shown around the inside perimeter

Structure Within the Disc

