

# *Globular Clusters*

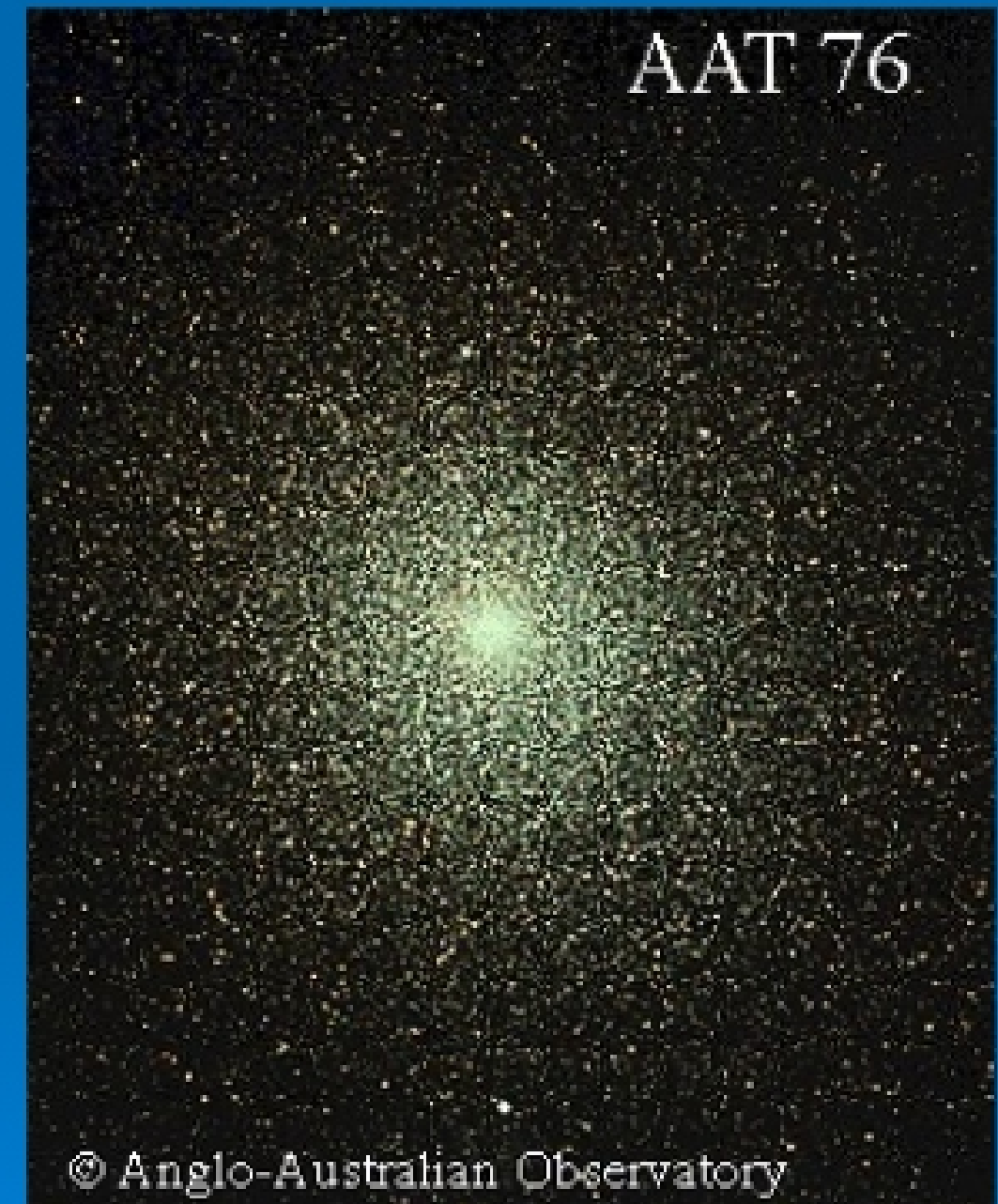
Globular clusters are clusters of stars which contain stars of various stages in their evolution. An H-R diagram for a globular cluster can give a snapshot of the evolution of stars.

# Globular Clusters

Globular clusters are systems of between 0.1-1 million stars, gravitationally-bound into a single structure about 100 light-years across. This is a picture of a typical globular cluster (GC), NGC 104. Notice the strongly peaked distribution of stars and spherical symmetry - both indicating a stable gravitationally-bound system. The typical separation of stars in a globular cluster is around 1 light year (thus star-star collisions are rare, although the high stellar density will effect the dynamics of binary-star systems), so the brightest stars in the sky seen from a point within the GC would have similar brightnesses to those seen in the sky from Earth. The one significant difference about the view within the GC would be the brightness of the night sky itself, where the diffuse background of faint stars in the cluster would make the sky relatively bright compared to that seen from the Earth.

The astrophysical study of globular clusters forms an important and major part of modern astronomy, providing information on some of the most fundamental problems in astronomy. Globular clusters are important for a number of reasons:

- \* The homogeneity of the stars in these clusters (note the similar colours of all the stars in the image of NGC104 above) indicates that they have similar chemical compositions and similar ages. This makes them the simplest systems to use to test theoretical models of star formation and evolution.
- \* Furthermore, globular clusters are some of the oldest stellar systems known and thus estimates of their ages can be used to constrain the age of the Universe as a whole.
- \* Finally, the distribution of their ages, and correlations between cluster ages and metal abundances makes these systems an invaluable probe into the processes of galaxy formation.



# Globular Clusters

To date about 160 globular clusters have been discovered in our Galaxy, and large numbers are seen around other galaxies in the local Universe. The figure shows the distribution of 132 globular clusters, plotted in Galactocentric coordinates. The centre of the Galaxy is at the centre of the plot and the plane of the disk lies across the middle of the figure. You can see that the distribution of globular clusters does not follow that of the disk of the Galaxy, rather the globular clusters are distributed in a spherical halo around the Galactic centre. This is because these clusters of stars formed early on in the history of the Galaxy, before the majority of the proto-galactic material had settled into a disk. The apparent absence of globular clusters in the plane of the disk of our Galaxy arises from a combination of two effects. Firstly, the high obscuration from dust in the disk of the galaxy makes GC's hard to find in directions close to the disk. Secondly, any globular clusters on orbits close to the plane of the disk may be tidally stripped and destroyed through interactions with the disk of the galaxy.

