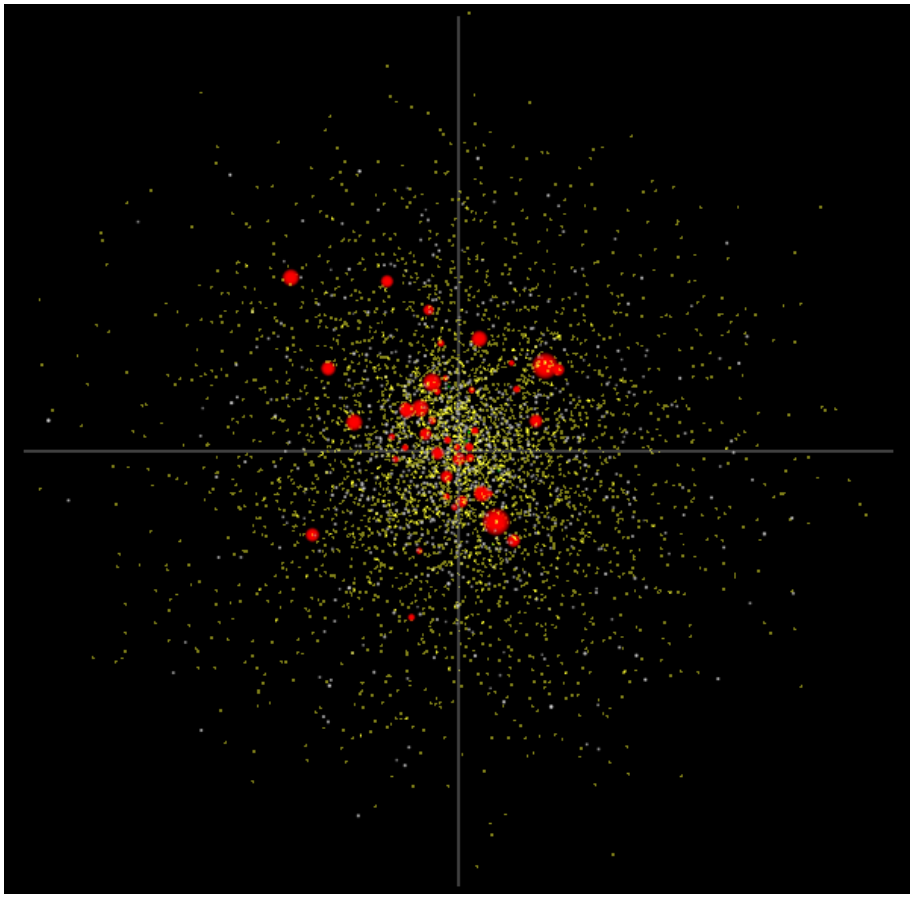
# Star Cluster



Swinburne Astronomy Online 3D PDF

# 1 Description

## 1.1 Star Clusters

Star clusters (SCs) are groups of at least several hundred stars packed closely together, creating an environment that is usually much denser than that of the solar neighbourhood [video]. The most massive SCs - those with 100,000 stars or more - are called globular clusters (GCs). We currently know of only 160 GCs in the Milky Way, while by comparison giant elliptical galaxies can contain up to several thousands GCs. These GCs are generally very old (>10 Gyr) and have had no star formation occurring in them since their birth, which makes them fossil records of the very early days of the Milky Way.

Since all stars in such clusters form in a relatively short time span compared to their age, they age together. Since more massive stars have a shorter Main Sequence lifetime than less massive ones, stars within the SC are at different evolutionary stages and usually fill the entire Herzsprung Russel diagram [video].

## 1.2 The model in this PDF

The 3D model presented in this PDF contains almost 5000 stars from a 3.2 Gyr old open star cluster. In total, approximately 4000 are still on the Main Sequence, while 44 have already evolved off to become Giants, 855 to become white dwarfs, and 5 to become neutron stars.

Main Sequence stars are drawn as points. All other star types are drawn as spheres, with larger sizes indicating a higher luminosity. The axes have a radius of 7 pc.

Star colours are determined by star type:
Main Sequence = yellow,
Giants = red,
White dwarfs = white,
Neutron stars = green.

The model was constructed using the direct N-body code NBODY6 (Aarseth, 2003, CUP) using data provided courtesy of Anna Sippel. The parameters for the set-up (with the exception of the number of stars) are similar to those used in Sippel et al. (2012, MNRAS, 427, 167).

## 1.3 How to use this 3D PDF

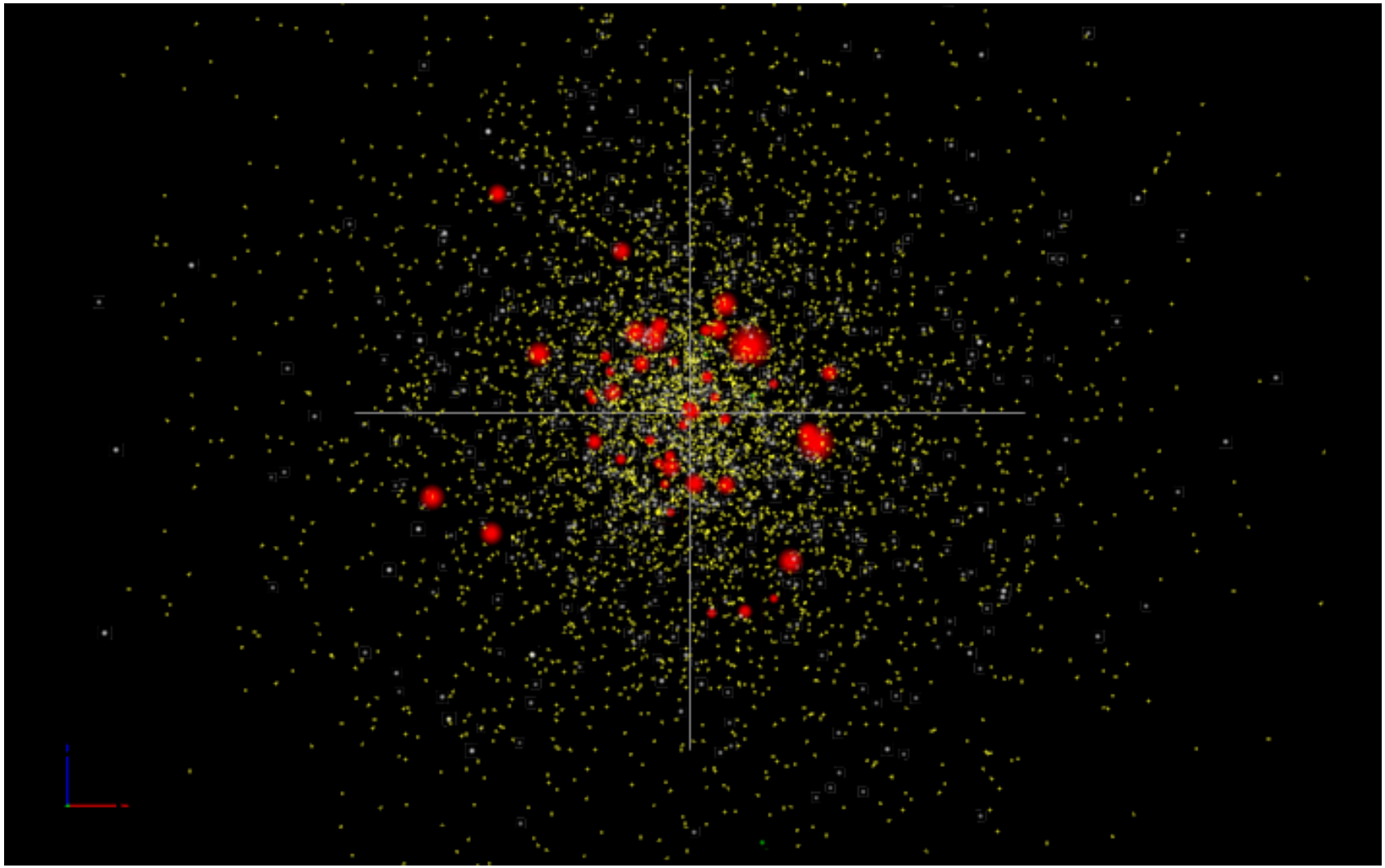
The interactive 3D content appears on the next page of this document. **Given the resource-intensive size of this 3D model, mouse input has been disabled for this PDF. However, you can still make use of the full range of interactions using the keyboard commands below. Note that you must first left mouse click on the 3D figure to utilise these shortcuts.**

| | |
|---|---|
| arrow keys (up, down, left, right) | rotate the object |
| + , - | zoom in or out |
| a | autospin |
| * , / | increase, decrease the autospin speed |
| [ , ] | roll the object clockwise, anti-clockwise |
| h | return to the default view |

Some 3D figures may also allow you to show or hide certain types of objects from view. If available, this option will appear as a text link below the 3D figure, e.g. Click here to....

*Note:* The free Adobe Reader (Version 8 or higher) is required for these 3D PDFs.

## 2 3.2 Gyr old star cluster



Click here to hide/show main sequence stars.
Click here to hide/show white dwarfs.
Click here to hide/show giant branch stars.
Click here to hide/show neutron stars.

# 3 Credits

The data used for this PDF was provided courtesy of Anna Sippel and the simulation was run on the the Swinburne supercomputer using the code NBODY6 (Aarseth, 2003, Cambridge University Press).

The 3D content in this PDF document was prepared with S2PLOT (Barnes et al., 2006, PASA, 23, 82; Barnes & Fluke, 2008, New Astronomy, 13, 599).

Funding for this project was partially supported by Open Universities Australia.

Swinburne Astronomy Online would like to thank Chris Fluke, Sarah Maddison, Artem Bourov and Anna Sippel for their work on this project.