What Kind of Star Group Is That?

By Brad Young, Astronomy Club of Tulsa

> "*It's funny. All you have to do is say something nobody understands, and they'll do practically anything you want them to.*" -J.D. Salinger, *Catcher in the Rye*

Many of the stars we see at night appear in groups. The type of group depends on the number of stars involved and how they physically relate to each other. I've noticed questions at outreach events asking us to explain the workings of different star groups. Sometimes, it is difficult to explain this beautiful, but complicated type of object to an audience with a general knowledge of astronomy. The idea for this question came to me from my wife; Harriet asked me to explain the difference between open and globular clusters and thinking of that response led to this article.

Let's look first at multiple stars, i.e., star systems with two or more members as we see it. This is an important point; multiple stars may not be near each other in space but look like they are. Study of their motion will determine if all the stars are gravitationally bound (attracted to each other by gravity) or not. Many stars that seem multiple are in fact chance alignments. The opposite situation exists; all but two of the stars of the Big Dipper move together in space and indicate an old cluster that has slowly dispersed. True multiple stars that are bound can be considered a small open cluster, and in fact, the boundary between a multiple star and a cluster is not rigid.

Another confusing type of star group is an asterism. Many are small and contain many stars, but are not clusters, whereas others are large and are a cluster. The Pleiades and Beehive are a true cluster, but the Head of Hydra is just a chance alignment. The way to determine if what appears to be cluster is to study it in a professional setting and determine how it was formed.

Open Clusters

> *"Can you bind the chains of the Pleiades? Can you loosen Orion's belt?"*, Job 38:31

Open clusters are all thought to form approximately the same way. It is highly unlikely that several stars would come together and coagulate so to speak into a star cluster. It is much more likely that a existing dust cloud that is disturbed will collapse into a cluster of young stars. The famous Pillars of Creation in the Eagle Nebula are a good example of this stage of star formation. Once most of the cloud has collapsed into stars, the cluster will begin to look like the normal version of one. There may still be significant wisps of dust and extra material surrounding the stars but for the most part that has been used or has dispersed. We begin to see now the stars formed in the process. The Pleiades and the Hyades near it in Taurus are great examples of open star clusters. The Pleiades are younger and therefore remain close to each other relatively in space. The Hyades have had more time to disperse and have moved away from their origin point.

This is typical behavior of an open star cluster - it begins small, concentrated and with some dust or other nebulosity still detectable - and slowly but surely it begins to move apart look to be entirely stars. One of the determining factors in assigning a group as an Open Cluster, in fact, is that the stars involved formed near each other in space originally, and at about the same time. Another clue is its location in its host galaxy, with open clusters primarily forming in the main body where dust and nebulosity is more prevalent, i.e. there is more material to build stars with at hand.

Classification of Open Clusters

Robert Julius Trumpler (1886-1956) was a Swiss born, American astronomer. He introduced term Galactic Clusters in 1925, in the work leading to his classification system, which is the most used means of identifying OCs today. He created, in 1930, a table of 37 Open Clusters that are now known as the Trumpler Catalog, providing examples of his system.

The Trumpler system requires the observer to specify three features of the open cluster:

- degree of concentration
- the range of brightness (magnitude) of the stars in the cluster
- number of stars in the cluster.

Degree of Concentration

I. Detached clusters with strong central concentration
II. Detached clusters with little central concentration
III. Detached cluster with no noticeable concentration
IV. Clusters not well detached, but have a strong field concentration

Range of Brightness

1. Most of the cluster stars have nearly the same apparent brightness
2. A medium range of brightness between the stars in the cluster
3. Cluster is composed of bright and faint stars

Number of Stars in the Cluster

P Poor clusters with less than 50 stars
M Medium rich cluster with 50-100 stars
R Rich clusters with over 100 stars

The Trumpler system denotes open clusters with any type of nebulosity (including light and dark nebula) with an "n" at the end of the classification. For example, a nebula surrounds the open cluster NGC 3293; therefore, the Trumpler classification for NGC 3293 is I3rn.

Globular Star Clusters

> *"Every passing hour brings the Solar System forty-three thousand miles closer to Globular Cluster M13 in Hercules — and still there are some misfits who*

insist that there is no such thing as progress.", Kurt Vonnegut, *The Sirens of Titan*.

The formation of globular star clusters is not perfectly known but it is a fact that they tend to form a halo around the center of the Galaxy and are not found only in the main plane or disc of the Galaxy. Originally, astronomers thought that this pointed to a different method of formation, a more ancient one, with the globular clusters forming early in the days of their galaxy, and becoming isolated, with old stars, and little interaction with the main galaxy, other than to orbit it over millions of years.

However, globulars have been found to contain stars formed at many different times. They also have some characteristics of dwarf spheroidal galaxies and may have been captured by their host. All known types of galaxies have globulars. Interacting galaxies have stripped away some of the globulars in the smaller one, creating intragalactic globulars that reside between galaxies in deep space. We have much to learn about these fascinating objects.

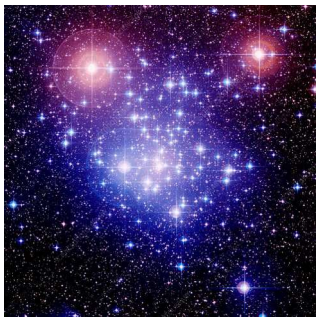
Classification of Globular Clusters

A globular cluster is a spherical collection of stars that orbits a galactic core much like a satellite. In a globular cluster, gravity tightly binds the stars together, which gives the cluster its spherical shape and relatively high stellar density toward the centers. From 1927 through 1929, Harlow Shapley and Helen Sawyer began categorizing clusters according to the degree of stellar density or concentration the system exhibits and established the Shapley-Sawyer Globular Cluster Concentration classification system. The basic scheme is the following:

Class	Description
I	High concentration toward the center
II	Dense central condensation
III	Strong inner core of stars
IV	Intermediate rich concentrations
V-VII	Intermediate concentrations
VIII	Rather loosely concentrated towards the center
IX	Loose towards the center
X	Loose
XI	Very loose towards the center
XII	Almost no concentration towards the center

Determining Which You See

Most of the time, it is easy to differentiate between open and globular clusters. Their appearances are usually quite different, with open clusters containing fewer stars, located close to or within the Milky Way, and a looser shape. It gets complicated at the edges of the classifications. For instance, determine whether these are an open or globular cluster.



Answers at end of article...

More Cluster Fun

The Astronomical League has observing program for both types of clusters, and even has programs for observing asterisms, constellations, constellations of other cultures, and three programs dedicated to multiple stars. Most have an imaging version, also. If you have any questions about this article or the observing programs, let me know in person or via hafsnt1@gmail.com

Sources:

J. Ruprecht, "Classification of Open Star Clusters", Astronomical Institute of the Czechoslovak Academy of Sciences, Praha. Aug 25, 1965.

Harlow Shapley, 1930. "Star Clusters". Harvard Observatory Monographs, No. 2. New York, 1930. Ch. II.5, pp. 11-14.

Jeff Burton, "Shapley–Sawyer Globular Cluster Concentration Class". Archive.org retrieved 6/19/2026

Edward Dugan III, "What is the difference between a globular star cluster and an open star cluster?" Astronomy, June 2019

Mike A. Hotka, *Guide to the Globular Cluster Observing Club*, Astronomical League, 2004.

Bejamin Jones, *Open Star Clusters: A Selection of 125 Open Star Clusters*, Astronomical League, 2005.

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Answer to cluster quiz:

NGC 5466 on left is a globular cluster. NGC 2516 on right is an open cluster.