

OBSERVING STAR CLUSTERS

We are creatures with a powerful instinct for seeking patterns in nature. This is why our remote ancestors looked up at the night sky and saw what we now call constellations. Those stars, to their eyes and now to ours, appear to form meaningful patterns, as if the stars involved shared some kind of relationship. Far more often than not the apparent patterns are illusions of perspective and do not represent stars influenced by mutual gravitational attraction. This accident of appearance has nonetheless served as a way to remember ancient lore, and in more modern times provides a set of guideposts for navigating the night sky.

When you begin to study the night sky with a telescope or pair of binoculars, however, it soon becomes apparent that stars sometimes do get it together and form real associations. These star clusters are some of the most striking objects you will observe, and are so varied that it is a rare amateur astronomer who grows tired of tracking down and observing them. They include objects so large and easily found they are better viewed with the naked eye or binoculars, and objects so subtle that considerable aperture and skill is required to observe them. The examples chosen for this part of the BSIG program will belong to neither extreme, occupying a middle ground, so to speak. Some will be very easy, some will take a bit of work, but all should be accessible to instruments 70mm and larger in aperture. None will require a trip to the Stewart Observatory.

Star clusters are grouped into a pair of general categories: open (galactic) clusters and globular clusters. Open clusters tend to be relatively young gatherings of stars, born in the same stellar nursery and, as seen by us at this point in time, at various stages of dispersal. Gravity holds them more or less together, but their independent movements through space are gradually loosening those bonds. Globular star clusters, on the other hand, are generally very old aggregates of stars that can number in the hundreds of thousands or even in the millions. These balls of stars are tightly bound by gravity and form systems of their own that orbit the galaxy's core outside the main body of the Milky Way. Although globular clusters tend to be more uniform in appearance than open clusters, as you study the objects on the list you will see that they are, nonetheless, individuals, with no two being exactly alike.

The object list for this section is split into two parts that reflect the two major categories of star clusters. This was done only to emphasize the basic differences between the two classifications and does not in any way reflect on the relative difficulties of observing star clusters. There is no correct order in which to observe these objects. Most of these objects should be visible under clear skies in town, but all of them are best seen at a darker site such as TIMPA. Viewing a given star cluster under both sets of conditions will give a nice idea of how much difference your location can make while observing deep sky objects. (The observation of nebulae and galaxies are even better for this.) If you decide to make such a comparison, feel free to record both observations even though a single observation per cluster meets the project's requirements. Viewing the object from your own backyard prior to a TIMPA night also familiarizes you with the object's location and gives you more time to practice with your equipment, leaving you

better prepared for observing under darker skies. In the end you might well spend less time getting the object in view and more time *observing* it under those darker skies. Wherever you observe, start out with your lowest power eyepiece while finding the object, then increase magnifications until you find the view you think shows the cluster at its best. Some open clusters show their structure best at a relatively low magnification, and it is at such magnifications that sketches are usually easiest to accomplish.

These lists were kept short to make it possible to work through them in a reasonable amount of time. As is the case with all the components of this program the idea is to introduce concepts and skills, not to provide an exhaustively comprehensive catalog of objects. Such projects and programs exist, such as those maintained by the Astronomical League. We hope your experiences with the BSIG program will encourage you to take on some of these observing challenges. In fact, many of the objects we use for this program are also included in various AL observing clubs, most notably the Messier Club. (If you intend to use these observations for both AL and BSIG programs it is recommended that you familiarize yourself with the AL rules, since our requirements do not completely duplicate theirs.) Short as the lists might be, however, an effort was made for open star clusters to provide examples not usually included in 'beginners' catalogs. Charles Messier "missed" a lot of very nice, bright open clusters that are accessible to modest telescopes. The same cannot really be said of globular clusters. Messier seemed to have a knack for catching the best and brightest of these, and so all of our examples are from his catalog.

Finding Star Clusters

Some of the star clusters in the lists at the end of this section are visible from a dark site with eyes alone, and are easily spotted with binoculars or a finder scope. If for some reason you are still having troubles locating a few of them, find them on a star chart and star hop to them. Skip ahead to the section on observing galaxies for a brief account of how to use the technique known as star hopping to find your way to an object.

Making Open Cluster Observations

Using the log sheet format of your choice observe the open clusters on the list, recording the usual information (time, date, location, NELM, seeing, etc.) and making a representative sketch of the object. Start by plotting the brightest stars of all; it sometimes helps to defocus the view enough that only the brighter stars show up clearly, in order mark their positions without distraction. Refocus the view and add the fainter stars in around these brighter lights. For extremely crowded clusters, after plotting the brightest stars use shading to indicate the area of star concentration, rather than making yourself crazy trying to dot hundreds of faint stars into your sketch.

When you take notes for your observation, think about the following and try to put as much relevant information into your notes as possible:

1. Is the cluster loose and sparse, densely compact, or something in between these extremes?
2. Are the stars of the cluster of uniform magnitude, or does the cluster contain a mix of relatively bright and very faint stars?
3. Does the cluster stand out clearly (well defined), or is it difficult to pick out from the background?
4. Are there any colorful stars in the cluster? What colors do you see? (Indicate these stars in the sketch.)
5. Is there anything *non-stellar* associated with the cluster?
6. Roughly how many stars can you see? (With a large or crowded cluster this will be a rough estimate!)

Making Globular Cluster Observations

Using the log sheet format of your choice observe the globular clusters on the list, recording the usual information (time, date, location, NELM, seeing, etc.) and making a representative sketch of the object. When sketching a globular cluster it is a good idea to mark in brighter stars in the field of view first. Use these as landmarks, so to speak, to guide the rest of the sketch. Shading in the area of the cluster is the easiest way to represent the extent of a globular cluster, and is made much easier if you have drawn in a few “field” stars first to tell you how far to go with the pencil. If your telescope resolves stars around the outer edge mark in the brighter ones and then randomly speckle the area around the edge to represent the effect of a loose halo. Bright stars across the face of the cluster should be represented with marks darker than the shading. In a similar way, if the cluster has a distinct core, shade that central region more darkly to make it stand out from the halo.

When you set down your notes regarding these clusters, keep the following questions in mind:

1. Does the outer edge appear well defined, or does the cluster seem to come unraveled or blown apart as you look from center to edge?
2. Is the light of the cluster relatively uniform until the ragged outer edges, or does the cluster have a central region that is distinctly brighter than the outer portion (halo)?
3. Is the body of the cluster a soft, featureless glow? Or can you see sparkles of light scattered across it? (These would be stars in the cluster proper on the edge of resolution.)

Star Clusters and your Field of View

Since by now you should know the true fields of view of your eyepieces you will be able to include an estimate of the extent of the object. Do this by roughly determining the fraction of the field of view filled by the object. If your TFOV for the eyepiece used

is 0.3° and the cluster takes up approximately the middle third of the view, then note in your log that the cluster appeared to extend across approximately 0.1° . You should be as accurate as possible (which is easier, by the way, if you determine your TFOV in arc minutes rather than degrees), but there will be times when you find yourself making a best guess. The idea is not so much to do precise science as to give you a quantifiable means for describing the cluster. Give it your best shot and note the result in your log.

Star clusters are well worth the time it takes to observe and understand them. In addition to being beautiful and fascinating objects they are a class of DSO that lend themselves well to display at public star parties. Some of the brighter examples are very useful for public gatherings. Just consider the sight of the Pleiades in a wide field eyepiece. They can be immediately recognized by a non-astronomer for what they are. You tell them they are about to see a star cluster and when they look, they see a cluster of stars! Star clusters can become addictive, and there are amateurs who specialize in clusters, especially those of the globular kind. Chances are you, too, will be hooked by the time you complete our short list.

****Star Cluster References****

The Next Steps: Finding and Viewing Messier's Objects by Ken Graun (Ken Press)

The Night Sky Observer's Guide by George R. Kepple and Glen W. Sanner (Willmann-Bell)

Nightwatch: A Practical Guide to Viewing the Heavens by Terence Dickinson (Firefly)

Deep-Sky Companions: The Messier Objects by Stephan James O'Meara

STAR CLUSTER LISTS

Open Star Clusters

Catalog/Number	Constellation	Magnitude	R.A.	DEC
NGC 457	Cassiopeia	6.4	01h 19.1m	+58° 20'
NGC 869	Perseus	5.3	02h 19.0m	+57° 9'
NGC 884	Perseus	6.1	02h 22.4m	+57° 7'
M 6	Scorpius	4.2	17h 40.3m	-32°15.5'
M 7	Scorpius	3.3	17h 53.8m	-34°47.1'
M 11	Scutum	5.8	18h 51.1m	-6° 16.2'
NGC 6530 (M8)	Sagittarius	4.6	18h 04.8m	-24° 23'
M 35	Gemini	5.1	06h 09.0m	+24° 21'
M 45	Taurus	2	03h 47.5m	+24° 6.3'
M 37	Auriga	5.6	05h 52.3m	+32°33.2'
M 36	Auriga	6	05h 36.3m	+34° 8.4'
M 38	Auriga	6.4	05h 28.7m	+35°51.3'
M46	Puppis	6.1	07h 41.8m	-14° 49'
M47	Puppis	4.5	07h 36.6m	-14° 29'

Globular Star Clusters

Catalog/Number	Constellation	Magnitude	R.A.	DEC
M 13	Hercules	5.8	16h 41.7m	+35° 27'
M 3	Canes Ven.	6.3	13h 42.2m	+28° 22'
M 30	Sagittarius	6.9	21h 40.4m	-23° 10'
M 12	Ophiuchus	6.1	16h 47.2m	-1° 56'
M 92	Hercules	6.5	17h 17.1m	+43° 8'
M 4	Scorpius	5.4	16h 23.6m	-26° 31'
M 80	Scorpius	7.3	16h 17.0m	-22° 59'
M 53	Coma Ber.	7.7	13h 12.9m	+18° 10'
M 71	Sagitta	8.4	19h 53.8m	+18° 47'
M 22	Sagittarius	5.2	18h 36.4m	-23° 54'