Deep Sky Objects

by Ken Graun

The Next Step

Generally, those interested in amateur astronomy begin by purchasing a telescope to get acquainted with the night sky. Usually, the first objects to view are the Moon and planets. But, what comes after that? Most amateurs take the next step in finding and viewing some fuzzy-type objects that require a little more effort because most of these objects are not visible to the naked eyes. These objects have been named Deep Sky Objects (DSOs), a term that started to be used in the mid 1900s.

What are DSOs, Deep Sky Objects?

Basically, they are far away and fainter extended objects that are not single or double stars, or any object in our solar system.

The following six objects are considered Deep Sky Objects:

1. Open Clusters (of stars)
2. Globular Clusters (of stars)
3. Nebulae
4. Planetary Nebulae
5. Supernovae
6. Galaxies

What is not considered a DSO?

1. Any object in our Solar System. This includes the planets, comets and asteroids.
2. Individual stars.
3. Double stars, or any multiple star system.

History of DSOs

Before the telescope, that is, before 1609, individuals who observed the night sky knew of the hazy Milky Way Band and also some additional fuzzy/hazy spots but they did not know what they represented.

Galileo kicked off modern day astronomy by using the newly invented telescope to explore the night sky but the initial focus was on the Moon, planets and Sun. It took several years before a few scientists of the day started to indicate in their notes faint and fuzzy objects but these observations were not published.

Charles Messier, a Frenchman, working in Paris, became the leading observational astronomer in the mid to late 1700s. He was the first to publish three catalogues of Deep Sky Objects from 1771 to 1781 each additive and finally totaling 103 objects. The list consisted mainly of his own observations but also including those observed by others.

Messier had a passion for comets and discovered 20. And, he became famous for these

Charles Messier.

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Messier published the very first catalogue of 103 Deep Sky Objects because there was no other catalogue like it. He thought it might be a useful addition to the astronomical community. He DID NOT publish it as a list of objects that could be confused with comets —a misnomer that keeps getting perpetuated.

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discoveries. However, he had over 100 articles published on the gamut of astronomical phenomenon. Now, I want to make one thing very clear about Messier's catalogues of Deep Sky Objects. He published them because there were no catalogue of DSOs in existence and he correctly thought it would be useful for the field of astronomy, and it was!

William Herschel, in England, received a copy of Messier's last catalogue in 1781 and promptly started his own survey cataloguing 1,000 DSOs by 1785 and 2,500 by 1802.

But Messier's catalogue has remained famous because it represents the biggest and brightest objects visible from the northern hemisphere. It has become an amateur's delight because it is a great starter in the viewing of DSOs. Oh, Messier's catalogue today totals 110 objects because historical records indicate 7 more objects that Messier found but did not add to his catalogue.

A little later, Dreyer, from Ireland, in 1888 published the New General Catalogue (NGC) of 7,840 DSOs that he compiled from observations of astronomers around the world. He then published two addendums called the Index Catalogue (IC) by 1908 of 5,386 additional objects. This adds up to over 13,000 objects in the NGC/IC catalogue!

Deep Sky Objects Described

Except for galaxies, all Deep Sky Objects are part of our Milky Way Galaxy. Yes, other galaxies do have their own DSOs but these are way too small to see in most scopes. Here is a description of the six types of DSOs:

1. Open Cluster (of Stars). The Pleiades is a visible-to-the-eyes example but most are much smaller and fainter needing a telescope. All stars are born in clusters from nebulae and most clusters eventually disperse. Generally, open clusters contain up to a few hundred stars. Groups with thousands of stars are Globular Clusters. Open clusters appear as a concentration of stars but they can be loose or tight in their formation and irregular in shape.

2. Globular Clusters. 10,000 or so stars packed in a ball, gravitationally bound. About 200 of these are associated with out galaxy. In small telescopes, these look like faint cottonballs. In larger scopes around 15 inches plus, they are beautiful because you see many of the individual stars. M13 in Hercules is a favorite and is easy to locate. Although globular clusters are part of our galaxy, many are located outside the galaxy's plane—mostly in and around our galaxy's core.

3. Nebulae. Giant clouds of hydrogen gas. Many of these clouds, but not all, are where stars are actually being born like in M42, Orion's nebula which is a favorite and is easy to find and very bright. Some nebulae are dark and some are lit up by their stars. Many look like faint fuzzy smudges appearing whitish.

4. Planetary Nebulae. These have *nothing* to due with planets, except that many are *roundish*. When some stars die, they shed their outer "atmosphere" which expands outward to create beautiful nebulous shells. The Ring Nebula, M57, in Lyra is a favorite. Our Sun will most likely create a planetary nebula but don't wait around for it to happen. Many look like faint round fuzzy smudges appearing whitish.

5. Supernovae. Nebulae that are the remnants of large stars that explode at the end of their lives. The Crab Nebula, M1, in Taurus is the only supernovae in Messier's catalogue. Appearance in the telescope vary but they are akin to looking like nebulae & appear whitish.

6. Galaxies. These are the farthest and largest observable objects, although most are "small" in the telescope. "Islands" of multimillions to billions of stars, just like our Milky Way Galaxy. The Andromeda Galaxy, M31, in Andromeda is just visible to the naked eyes as a faint glow. There are two basic shapes with many variations. Many look like faint, whitish, roundish fuzzy smudges—some with star-like centers—some pencil like.

NGC & IC Catalogues

These two catalogues list over 13,000 DSOs covering the entire Celestial Sphere. What is different about these objects compared to Messier's? Although there are exceptions, for the most part, the NGC/IC objects are usually smaller and fainter than Messier's.

Now, in the deeper southern hemisphere, there are many very bright DSOs that are NGC/IC objects because Messier could not observe that far south.

And, on average, IC objects are smaller and/or fainter than NGC objects but there are exceptions here, too. There are a few big and relatively bright IC objects that are easily seen by us amateurs using small telescopes. When you are compiling a list of 13,000+ objects, there is bound to be some misplaced "items" but Dreyer did a whopping job with his catalogues!

DSOs Designations

Almost all DSOs are designated by a number that is *preceeded* by a letter or letters indicating the catalogue. M/NGC/IC are the most prevalent. There are many specialized DSO catalogues. The format of designations does vary a little. Examples:

M25, M32 for Messier. Note: Messier did not put an M in front of his catalogue numbers—that is a modern practice.

NGC 25, NGC 1526 for Dreyer's New General Catalogue by Dreyer

IC 86, IC 254 for Dreyer's Index Catalogue

Cr 25, Cr 138 for Collinder's catalogue of 471 Open Clusters

Tr 10, Tr 24 for Trumpler's catalogue of 37 Open Clusters

How to find DSOs

Manually. Point & Move. If your mount is manual, the way you find DSOs is to point your telescope using your finder at the spot in the sky where an object is located, then slowly move the telescope around that spot until you see it. Of course, you need to be familar with the constellations and positions of objects—use stars charts. Start with a lower magnification of about 50x to give you a wider field of view. If you do this and can't find the object, reposition the telescope again and move it slowly to see if you spot it—it is easy to move the telescope far from your mark. With some practice, you will get the hang of it. On nights when you can't seem to find anything, give up and observe another night to avoid fustration.

Star Hopping requires a fairly detailed celestial atlas. You start with a fairly bright star in the telescope—a star easy to see and find in, then you match stars in the eyepiece to an atlas and slowly but surely "walk' your way across a set of stars, using the atlas, to the object. Star hopping works but it is tedious. You use a lower magnification og 50x or so and hop a little less than one field-of-view at a time

GOTO. This is the easiest method to find DSOs! Once your telescope/mount is set up to "Go" after the alignment process, all you have to do is press some buttons on the hand controller to move to any object you choose. Remember, if the object is too faint for your telescope size or the condition of your night sky, you may not be able to see the object. Even with GOTO, start with a lower magnification be make sure your object will be in the field of view—none of these systems are perfect.

Dark Adapation and Red-light flashlights a must!

Night vision from dark adapated eyes is essential for visually observing DSOs! And, keeping your eyes dark adapted is important, so don't go in and out of a bright house while observing them! It takes 5 to 10 minutes to reach an inital dark adaptation and longer for a deeper one.

Using a red-light flashlight for reading reference material will help to keep your night vision. CAUTION: There are many red-light flashlights that are TOO BRIGHT to use for astronomy—they will cause you to lose or interfer with your night vision. Look for a red-light flashlight that has variable brightness.

Recognizing & Observing DSOs

It does take some orientation/practice/experience to **recognize** the various DSOs, but not a lot. So, when you start, the question is, "What exactly should I see?" Observing the Messier objects is a good training ground for learning what DSOs look like because the NGC objects are usually smaller and fainter.

Observing. Except for a few DSOs, almost all of them need to be observed in relatively dark skies and with dark adapted eyes.

Here are some tips.

1. You need relatively dark skies. Big city skies won't do. Some people have to leave their cities to observe any DSO. But, give your skies a try to test its limits.
2. Avoid nights when the Moon is Full or bright —this whitewashes the sky and makes it difficult, if not impossible to see DSOs.
3. Your eyes must be dark adapted. It takes a good 10 minutes to get them initially dark adapted and more minutes for a deeper dark adaptation. Use a red-light flashlight to read charts and atlases to keep them that way—see above topic.
4. Avoid nearby bright or glaring lights because this interferes with dark adapted eyes. Don't stare into car headlights.
5. Sometimes, you may need to use averted vision with your observing eye to glimpse fainter DSOs—see separate topic.
6. DSOs can be observed easier in larger diameter telescopes, so the bigger the scope, the brighter DSOs will appear and bigger scopes will allow you to see fainter ones, too.
7. Around 50x is good for locating DSOs.

Your eyes must be dark adapted to see DSOs and it takes some practice to recognize the various objects.

Our Eyes, the Blind Spot & Averted Vision

Our eyes are not conducive for seeing objects in the dark—they work best in daylight. And, we actually have a blind stop near the centers of our vision—it is where the bundle of "wires" that carry images to the brain is located—the wires have no image receptors.

So, in the dark, if you look directly at a *very faint* object centered in your field-of-vision, you will not see it! Obviously, this will occur when you are looking at very faint DSOs.

So, the solution to possibly see very faint DSOs is to use averted vision (you can use direct vision when viewing brighter DSOs, which applies to most Messier objects), which is looking at or viewing something from the side of your vision. The area around the edge of the retina has many more rod receptors which are more sensitive to low levels of white light. The rods are not sensitive to color. Yes, viewing using averted visions does put some strain on the eye but it allows us to see some faint DSOs that may allude us. Now, if you view DSO's with really large telescopes, you will infrequently have to use averted vision.

DSOs visible to the Naked Eyes

Most DSOs require the use of a telescope in relatively dark skies. However, here is a list of some DSOs that can be seen or glimpsed from the Northern Hemispheres as fuzzy patches with the naked eyes but you will need relatively dark skies to see them.

- ✓Pleiades, M45, in Taurus is the only DSO that you can plainly see the individual starts with your eyes. It's an open cluster.
- ✓Andromeda Galaxy, M31
- ✓Double Cluster in Perseus, NGC 884 & 869
- ✓Omega Centauri, NGC 5139, a BIG globular
- ✓M6 & M7 Open Clusters in Scorpius
- ✓Beehive Cluster, M44 in Cancer. Historically, the nose of Leo.
- ✓Coma Cluster, Cr 256, Historically, the tail of Leo.

DSOs of the Southern Hemisphere

There are no Messier objects in the "deep" Southern Hemisphere because Messier conducted all of his observations from Paris—he could not see all the way down to the bottom of the sky.

So, almost all of the DSOs that are visible from the Southern Hemisphere have NGC and IC designations.

The area around the constellation Crux and Carina is rich with DSOs. One reason for this is that this area is emmeshed in the Milky Way Band where there is alway an abundance of open clusters, nebulae and globular clusters.