

## **OBSERVING GALAXIES**

For many years deep sky objects that we now know to be galaxies such as our own were considered a form of nebula. When you first start searching the night sky for these distant island universes you will immediately understand why our predecessors came to this conclusion. With a few exceptions galaxies, as seen through the average amateur's telescope, are softly glowing smudges of light that often show few, if any, details. They are not known as 'faint fuzzies' for nothing. But how misleading is this appearance? Faint they may be, but this is due to the often fantastic distances that stretch between our world and those enormous swarms of distant stars. It is worth the effort to study a few galaxies just to contemplate what those smudges mean, what they tell us about the vastness and age of the universe. Everything else this workbook has covered up to this point – planets and moons in the solar system, our own star the Sun, the double stars, nebulae and star clusters – all these lists of objects in the shallow and the deep sky, exist within our own galaxy. They are, for all astronomical purposes, part of our back yard and immediate neighborhood. In this last section devoted to observing objects we direct our attention across space at a very different scale, peering at objects so far away that by comparison with the rest they redefine the concept of 'deep sky.'

As distant as galaxies can be, however, they share in the context of this program something in common with all those nearby planets and relatively near double stars and clusters. They present a challenge when we try to work them into a directed observing program that must deal with an unpredictable assortment of telescopes. To address this we will include in the list of objects only galaxies bright enough to be found with relatively small (approximately 70mm) apertures. As we did in some other cases the list will be much longer than the required number for completion of this particular project. It is hoped that we have cast our net wide enough that everyone can participate. If a galaxy proves too faint for the aperture available to you, try another on the list. Most of the galaxies on the BSIG list are drawn from the Messier list, since these are generally to some degree (at least) accessible to telescopes of 70mm or so in size.

### **First, You Need to Find Them**

Unless you are using a computer driven 'go to' or 'push to' telescope, the ability to read a good star chart and to use star hopping to reach an object will be essential for this project. If you have been hunting down star clusters, nebulae, and double stars successfully, not to worry – you're already qualified to go galaxy hunting! Although there is no rigid requirement to do these observing projects in the order presented, it is recommended that you have some chart reading and star hopping experience behind you before tackling galaxy hunting. It is, of course, your call.

The first step to hopping to a galaxy is to get to know the stars in the vicinity of the galaxy in question. Familiarize yourself with the chart you have available of the sky, then scan the area with binoculars and compare what you see with the stars printed on the chart. This part can be done at home to certain degree. It often helps to do this sort of

backyard reconnaissance ahead of time, rather than struggling to figure out a patch of sky the first time from a dark site. Those hours at a dark site are precious, and anything that leaves you better prepared to make the best possible use of them is worth the time and effort. And you *will* need time at a dark site if you want to get the best possible looks at these (or any) galaxies. (You will also need to be thoroughly dark adapted.)

When the time comes to actually find a galaxy, find a relatively bright (preferably naked eye) star that is within a degree or two of the galaxy's location. Making sure that whatever finder you are using is properly aligned with the telescope, center that star in your lowest power eyepiece (the one that will provide the widest field of view). Take some care to make sure the star is as perfectly focused as possible. Now, using the chart (perhaps with binoculars to assist you) find a star, or better still, small pattern of stars in the direction of the galaxy that will be easily recognized in the finder scope and the eyepiece view. Moving slowly and carefully, slew the telescope so that you can see this star or arrangement of stars in the finder. Keep in mind that in many finder scopes the view you get will be reversed relative to the view in the binoculars – to say nothing of what you see on the chart. When this is done, take a peek through the eyepiece, where depending on the type of telescope you use the view can be inverted or reversed when compared to what you have been seeing. This is why a pattern of stars is especially useful when hopping to galaxies, since you will be able, with practice, to recognize simple shapes that have been re-oriented. Repeat this process in the smallest increments you can manage until the patch of sky in the finder scope matches the view the chart shows around your target. Don't look for a perfect match, since both the finder and the telescope will probably show more faint stars than you see on most standard charts. Go for brighter stars in recognizable patterns. Knowing the field of view of the eyepiece you use will be a big help, since you can measure the distance between hops on the star chart and use that to double check that you are where you think you should be.

Do you see a smudge or patch of faint gray light? If not, first ask yourself if you've been in the dark long enough. It takes at least half an hour for the human eye to adjust in that way, and this is just the useful average. Your mileage, as they say, may vary. Only experience will tell you exactly how long the process takes for *your* eyes, and you can always take in some star clusters or nebulae if you find you need to wait. But let's assume you have been out long enough. Before you decide you've just missed the target, always a possibility of course, try using averted vision – don't look straight into the center of the field of view. Still no luck? Then try tapping the telescope gently; that slight quiver may make the object stand out more clearly if it's in the field of view, since the human eye is better at detecting faint motions than faint objects. If none of these things work the chances are good you missed the target. Try again, and remember to take the smallest steps you can, and to *work slowly*. You will get there. (There are a variety of methods to use for finding objects without a computer. This nutshell account of star hopping is only one of them. The books listed at the end of this section – *Astronomy Hacks* being an especially good example – will provide better overviews for these methods than we can accomplish here.) The use of a unit power finder (Telrad or Rigel Quikfinder) to assist you in these searches is *highly recommended!*

## **Viewing Conditions**

If, no matter how sure you are of your location in the sky (especially if you have reason to believe that your computer controlled telescope is doing its job correctly), you just don't see a galaxy there, double check the viewing conditions. In particular, consider the transparency of the sky. If this condition is on the poor side – a good way to test this is to go to a galaxy you've observed successfully before and see how it looks – it might be a better night for planets or double stars, maybe even star clusters. The less transparent the sky is on a given night, even at a dark site such as TIMPA, the less contrast you will see between a faint object and the sky around it. With some galaxies (and nebulae) it does not take much degradation in conditions to make such a search a hopeless quest. Work toward other goals or revisit old friends in the night sky, and save the galaxies for a time when there is less dust or haze in the air.

The Moon is no friend of the galaxy hunter. Even a relatively slim crescent Moon can brighten the sky enough to rob a galaxy of contrast and detail, or wash it out entirely. Moonless nights or times well before moonrise and after moonset are the times to seek out galaxies.

Hunting for galaxies from a back yard viewing site is often an effort in futility. Unless you have a very large aperture you will not get much detail out of a view, assuming you can find the target galaxies in the first place. (There is a persistent belief that larger apertures are less effective than smaller scopes when light pollution is a problem – this is not true.) Star hopping can be a challenge when the sky is relatively bright. Use back yard viewing time to study the Moon, planets, double stars, and the brighter clusters. Broadband 'light pollution filters' will not help much, while narrowband and line filters will be completely useless. The light from galaxies forms what is called a continuous spectrum, so a filter that passes only one or two wavelengths of light would render a galaxy nearly invisible.

## **Magnitudes of Galaxies**

A word of warning about the magnitudes of galaxies (or any extended 'bright' object) you observe in a telescope: they will often appear much fainter than the magnitude listed in books would lead you to expect. These numbers represent the average brightness, expressed as if the light from the object was seen as a single point of light – in other words, a star. But a galaxy such as M81, with a listed magnitude of 6.8 will not look anywhere near as bright as a star of the same magnitude. M33 is an even better example with a listed magnitude of 5.7, but having such a low 'surface brightness' that observers regularly miss it on a night of merely average conditions.

## **Observing Galaxies**

Using the log sheet format of your choice, observe at least twelve of the listed galaxies. Include the usual day, date, conditions, etc. When you have located a galaxy observe it with as much of a range of magnifications as you have available, until you are satisfied you know what magnification will give the best view. Make a sketch of the object, paying attention to the angle it has in the field of view (especially easy to do with an edge-on galaxy). Mark the positions of north and west on the field of view. Many catalogs list the position angle of galaxies and this can be used to verify that you did, indeed, observe the correct galaxy; if it lines up with north and west on your sketch the way the PA indicates it should, more than likely you're in the right place. The sketch need be nothing more detailed than an outline showing the extent, shape, and orientation of the galaxy, although the use of light shading is easy to do and will represent the galaxy more realistically. Include some stars seen in the field of view for reference.

When making notes, along with whatever other impressions you decide to jot down, think about these things:

1. Is the galaxy uniformly bright, or does it have relatively brighter and dimmer areas?
2. Is there a brighter central core?
3. Is there any structure visible, such as dark marks (lanes) or spiral arms?
4. Is the galaxy well defined along the edges, or does it fade away against the sky?

Galaxies can be subtle objects and unlike star clusters and the brighter nebulae, may not reveal their structural detail quickly. Count on spending some time with each galaxy that you find. Let your eyes and mind become familiar with the object in the eyepiece before you attempt the sketch. A quick glance simply will not do the subject justice. Galaxies, perhaps more than any other category of deep sky object, will teach you patience.

### **\*\*Galactic References\*\***

*Deep Sky Companions: The Messier Objects* Stephan James O'Meara (Cambridge)

*Astronomy Hacks* Robert B. Thompson & Barbara F. Thompson (O'Reilly)

*Deep Sky Wonders* Walter Scott Houston (Sky Publishing)

*The Night Sky Observer's Guide* (two volumes) George R. Kepple & Glen Sanner (Willmann-Bell)

*The Backyard Astronomer's Guide* Terence Dickinson & Alan Dyer (Firefly)

*Burnham's Celestial Handbook* Robert Burnham Jr. (Dover Publication)

*Nightwatch* Terence Dickinson (Firefly Books)

## GALAXY LIST

CONST.	OBJECT	MAG.	R.A.	DEC.	SIZE	TYPE
And	M110	8	00h 40.4m	+41° 41'	17'x10'	EG
And	M31	3.5	00h 42.7m	+41° 16'	178'X63'	SG
And	M32	8.2	00h 42.7m	+40° 52'	8'x6'	DEG
Scl	NGC 247	9	00h 47.0m	-20° 44'	19'x5'	SG
Scl	NGC 253	7.6	00h 47.6m	-25° 17'	30'x7'	SG
Tri	M33	5.7	01h 33.9m	+30° 39'	62'x39'	SG
Cet	M77	8.8	02h 42.7m	-00° 01'	7'x6'	SG
Uma	M81	6.8	09h 55.6m	+69° 04'	26'x14'	SG
Uma	M82	8.4	09h 55.8m	+69° 41'	11'x5'	IG
Leo	M95	9.7	10h 44.0m	+11° 42'	7'x5'	SG
Leo	M96	9.2	10h 46.8m	+11° 49'	7'x5'	SG
Leo	M105	9.3	10h 47.8m	+12° 35'	5'x4'	EG
Uma	M108	10	11h 11.5m	+55° 40'	8'x2'	SG
Leo	M65	9.3	11h 18.9m	+13° 05'	10'x3'	SG
Leo	M66	9.0	11h 20.2m	+12° 59'	9'x4'	SG
Uma	M109	9.8	11h 57.6m	+53° 23'	8'x5'	SG
Cvn	M106	8.3	12h 19.0m	+47° 18'	18'x8'	SG
Vir	M86	9.2	12h 26.2m	+12° 57'	7'x5'	EG
Com	NGC 4565	9.6	12h 36.3m	+25° 59'	14'x2'	SG
Vir	M104	8.3	12h 40.0m	-11° 37'	9'x4'	SG
Vir	M60	8.8	12h 43.7m	+11° 33'	7'x6'	EG
Cvn	M94	8.1	12h 50.9m	+41° 07'	11'x9'	SG
Com	M64	8.5	12h 56.7m	+21° 41'	9'x5'	SG
Cvn	M63	8.6	13h 15.8m	+42° 02'	12'x8'	SG
Cvn	M51	8.1	13h 29.9m	+47° 12'	11'x8'	SG
Hya	M83	8.0	13h 37.0m	-29° 52'	11'x10'	SG
Uma	M101	7.7	14h 03.2m	+54° 21'	27'x26'	SG
Peg	NGC 7331	9.7	22h 37.6m	+34° 25'	10'x3'	SG

SG=spiral galaxy EG=elliptical galaxy IG=irregular galaxy  
 DEG=dwarf elliptical galaxy