Imaging Spring's Galaxies

The brightest stars, clusters, and nebulas are all part of the winter sky, the swath of Milky Way that rides high overhead during the early evening in the coldest of seasons. The opposite side of the sky is home to the summer Milky Way and the largest concentration of bright deep-sky objects such as star clusters and nebulas. In between, in the spring and fall, the night side of Earth points out away from our own galaxy into the extragalactic void. The great empty reaches of space between galaxies holds virtually no clusters or nebulas. Instead we see only other galaxies, island universes of billions of stars, but so remote they can be difficult to see even in a telescope. But point a camera to these objects and the detail you can capture is incredible. The faint fuzzies of the spring sky come to life through the camera.

M100 imaged with a 12.5" f/8 Hyperion telescope. Total exposure time 3 hours.

The Challenge

Galaxies provide an imaging challenge. Why? Because they are so far away! Unlike clusters and nebulas—objects in our own galaxy—other galaxies are so distant as to appear quite small. Most of spring's best galaxies are around 10 arcminutes in extent, or about one-third the diameter of the full moon. Compare this to the 30-60 arcminute size of most nebulas and star clusters.

Not only are galaxies small, they are generally quite faint. Spring's brightest galaxies are about magnitude 7, while most are in the magnitude 9-10 range. A typical 9th magnitude galaxy is over 200 times fainter than the Orion Nebula, a common winter imaging target.

Visually, most galaxies are unimpressive in a moderate-sized telescope. It takes about a 16" or larger telescope to start showing considerable detail in the

eyepiece. But even a small telescope can take impressive astrophotos. Because the camera collects so many more photons than your eye, an 8" telescope can beat the visual performance of even the largest amateur telescope!

The Targets

The spring sky is home to the Coma Berenices/Virgo galaxy cluster. Composed of literally thousands of galaxies, this clusters is a monstrous grouping of galactic targets. The Virgo cluster is located approximately 60 million lights-years away, and packs nearly 2000 galaxies into a volume 15 million light-years wide. The cluster covers an area of sky in the constellations Virgo and Coma Berenices.

All types of galaxies are available within the Virgo cluster: face-on spirals, edge-on spirals, irregular and elliptical, interacting groups. Many more galaxies are located north of the Virgo cluster in Ursa Major, while Leo—west of Virgo—is home to a variety of galaxies as well.

By far the most impressive targets will be spiral galaxies and interacting groups of galaxies which show disrupted components and tidal tails. The easiest to image will be the brightest and largest, but some of the most impressive are smaller and fainter. While fainter galaxies just require more exposure time, getting the most detail from small targets will be easiest with a larger telescope.

Equipment

While any telescope can get a decent picture of a galaxy, spring's smaller targets mean this is the time when a longer focal length telescope is ideal. But this doesn't mean you should lose hope if you only own a smaller telescope. Don't pack up and wait for the summer sky to arrive. Wide-field systems such as a small refractor or HyperStar setup are perfect for capturing large groups of galaxies such as the heart of the Virgo cluster (the region around M84 and M86) or pairings such as M81 and M82 in Ursa Major.

Still, the ideal system for most galaxies will be a scope with a relatively long focal length, greater than about 1200mm. The greater the focal length, the greater the image scale or magnification. The larger the aperture, the faster the system will be at a given focal length. For example, a 10" SCT has a 2500mm focal length at f/10, while a 14" SCT has approximately the same focal length at f/7, requiring half the exposure time. Alternatively, a larger scope gives a greater focal length at a given focal ratio. A 14" scope at f/10 has a 3500mm focal length, providing 40% more image scale than the 10" f/10 scope.

Exposure

A longer exposure is better, up to a point. At some exposure time, the general glow of the sky background (even from a dark site) limits how much detail you can get. Continuing to exposure past this point does not gain much in terms of faint detail. At that point it is better to just take *more* exposures rather than longer exposures. The more images you take, the more you can stack, and the more images that get stacked, the less noise will appear in the image. This means you can extract more faint detail from the galaxy.

The ideal exposure time depends on the location, the camera, and the telescope. You can use the Ideal Exposure Calculator on the Guide to CCD Imaging on starizona.com: http://starizona.com/acb/ccd/calc_ideal.aspx. This requires a test image, and you can read all the details at the link above.

A typical exposure time for a long focal length telescope, running at a typical focal ratio of f/6 to f/8 is going to be 5 to 10 minutes. Plan on stacking as many 10-minute exposures as you can stand taking. More is always better.

Planning

When taking such long exposures (several hours total), planning is important. German equatorial mounts will not allow tracking through the meridian (or at least not much). This means if the target is in the east, you must start imaging it soon enough that you can finish the exposure when the target reaches the meridian. However, you do not want to start imaging when the object is too low in the sky, as you will get the most detail when looking through the least amount of atmosphere. Ideally, wait until the object is at least 30 degrees above the horizon. Some objects may not get this high in the sky, but objects in the Virgo Cluster and Ursa Major will get pretty high if you live in the northern hemisphere. Fork-mounted telescope users do not need to worry about any issues with the telescope crossing the meridian, but it is still best to plan so the target will be highest in the sky during the exposure.

Favorites

Below is a list of some of the best springtime galaxies, including bright Messier objects and fainter, challenging, lesser-known targets.

M51
The famous Whirlpool Galaxy in Ursa Major. One of the most photographed galaxies. Try to capture the faint loops and tidal tail extending off the companion galaxy.

M65 & M66
Along with NGC3628, these galaxies comprise the Leo Trio, a beautiful grouping. Each galaxy alone is a great target, but if you have a wide enough field of view, try to get all three.

M100
A gorgeous, textbook face-on spiral in Virgo. There are a number of nearby fainter galaxies as well.

M101
A large, pinwheel-like spiral galaxy in Ursa Major. While relatively bright and quite large, there is a great deal of faint detail available in the outer spiral arms that can be challenging to capture.

NGC4051
A lesser-known target in Ursa Major. A slightly irregular, tilted spiral galaxy with nice structure in the arms.

NGC4565
A perfect edge-on galaxy in Coma Berenices. There is quite a bit of detail in and around the dust lane that bisects the galaxy if you have enough image scale, but this is a beautiful target even in a small scope.

NGC4631
The Whale Galaxy in Coma Berenices. An irregular galaxy with lots of structure. With a wide enough field of view you can also capture neighboring NGC4656, known as the Integral Sign due to its highly irregular shape.

NGC4725
A stunning galaxy in Coma Berenices. This is not photographed as much as it should be given its beauty. NGC4725 is a barred spiral with an unusual property: it only has one spiral arm, which wraps almost twice around the galaxy.

M101 imaged with a 12.5" f/8 Hyperion telescope. Total exposure time 4 hours.