



Deep Sky Astrophotography in Bright Skies: Dealing with the Moon and Light Pollution

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The Moon is full about every four weeks. That's a given, like snow in winter where I live. Within about a week either side of full, the Moon floods the night sky with reflected sunlight. This can be, among other things, beautiful, romantic, eerie, tranquil or even photogenic in its own right. But it creates real challenges for deep sky imaging. Even when there's no Moon in the sky, skies near even small cities may also be plagued by light pollution. For example, I image from Bortle Class 5 suburban skies, and my southern sky is bathed in the glow of an auto mall less than 5 km away.

What's a deep sky imager to do? Take a deep breath. Think things through. Then make the best of the situation.



The Moon was just a few hours past full when this image was taken.

Much like man-made light pollution, the Moon's light washes out faint objects. Since I'm not willing to surrender two weeks of deep sky imaging to the Moon every month, and light pollution is all around me, I've developed a few strategies to keep the shutter open even under less-than-ideal conditions.

Location, Location, Location

When the Moon is 3-7 days on either side of full, I can usually find some pretty dark areas of sky in the north, especially on very transparent nights when there are fewer particles in the air to scatter moonlight. The moon follows a lower altitude path in the summer than winter, so is further away from my northern target area in summer than in winter (but the nights are so short!). By shooting on transparent nights and shooting only objects when they are near the meridian (say 2 hours on either side), the effects of light pollution are minimized.

Choose Star Clusters

Open clusters and globular clusters are my targets of choice in bright skies, especially if I want to acquire a whole colour image data set in one session (I use a mono camera with filters). Since they are often overlooked by imagers, compared to galaxies and nebulae, this gives me a chance to give open and globular clusters their due in my image collection.



Colour data for this image of the Little Dumbbell Nebula was captured under moonlight. Luminance data was acquired near new moon. Effects of light pollution were minimized by shooting this object when it was highest in the sky.

Take Many Short Exposures

Many short exposures can give a better result than fewer long exposures, especially when the skies are bright from moonlight or light pollution. One reason is that shorter images have fewer (or no) saturated pixels in the bright areas. Another reason is that stacking more images does a better job of removing artifacts in individual frames, like hot or cold pixels. Finally, a lower background brightness in the image gives more dynamic range between the darkest and brightest pixels in the image.

Shoot Through Narrow Band Filters in Bright Skies

My colour pictures are made up of four or five channels, each taken through a different filter (red, green, blue, Hydrogen-alpha and Oxygen III). H-alpha and Oxygen III data can usually be collected in spite of light pollution or moonlight — even on the night of full Moon — because of the narrow range of light wavelengths that passes through these filters. These filters can be used with one-shot colour cameras too.

I usually wait for a moonless night to shoot my broadband red, green and blue data, and image objects when they are highest in the sky, near the meridian. I no longer use a clear (luminance) filter, preferring to synthesize a luminance channel from my other data. I've found that the luminance filter is more severely affected by light pollution and moonlight than R,G, B, Hydrogen-alpha or Oxygen III.



Moonlight gradients were easily dealt with by PixInsight's Dynamic Background Extraction process in this image of NGC2419.

Remove Light Gradients During Processing

Even on moonless nights most of us will capture unwanted light pollution in our images along with the precious photons we're really after. Most image processing software comes with tools that can reduce the impact of unwanted light gradients in images. I use PixInsight's DynamicBackgroundExtraction tool as one of the first steps in my deep-sky image processing workflow. GradientXterminator is an effective and easy-to-use plug-in for Photoshop.

Tune-up Time

Telescopes, cameras and mounts need a lot of regular TLC to keep working at their best. The period around full Moon each month is when I tend to do these things. Even though I have a "permanent" setup, I change optics, camera orientation, and guiding parameters regularly. My reflector's collimation and my mount's polar alignment and pointing models need to be periodically updated. New software configurations for imaging and mount control need testing. When the moon is out I sometimes take test shots to see how to best frame objects in future imaging sessions. Other nights that are no good for imaging – thin cloud, haze, too windy, patchy cloud – are also good for this essential part of astrophotography.

Overcome

Most amateur astroimagers know that there's a sort of "Drake equation" for the probability of getting a good night's imaging. And the news isn't good. For most of us imaging time is very limited due to light pollution, clouds, wind, heat, cold, work, family commitments, other hobbies (really??), equipment malfunctions and short summer nights. With a few carefully chosen strategies, you can stop the Moon from robbing half of your imaging time every month, and mitigate the impact of light pollution on your results. Use the brightest nights – whether from moonlight or light pollution – to make sure you're equipment is ship-shape for those clear, transparent, steady, moonless nights that deep sky imagers crave. And on those finest of clear nights, target objects that can punch through your local light pollution. It also helps to become proficient at using software tools to manage uneven field illumination cause by light pollution or moonlight.

And don't forget to look at the Moon with any size telescope or the naked eye. It is beautiful. It's also a great first target for imaging with any kind of camera.