



## Workshop Objectives for Beginning Night Sky Photography by Van Macatee

1. Become familiar with your camera and settings typical in deep sky AP – all in Manual mode.
2. Practice frame and focus techniques.
3. Become familiar with your camera's histogram display.
4. Experiment with exposure durations.
5. Experiment with ISO settings.
6. Understand the effect of exposure duration and ISO on image and noise.
7. Become familiar with the sidereal motion of the sky.
8. Create a wide field image of a constellation with minimal star trails.
9. Create a wide field star trail image.
10. Create an AP landscape scenic image.
11. Develop an image filing system on your computer to store your files.
12. Begin a rudimentary workflow for capturing, archiving and processing your work!

All of these objectives are the foundation of good AP technique and will be used in all future imaging. Mastering these techniques now will position you to take the next step – imaging through a Telescope!

## Image Targets

1. The constellation Cassiopeia
2. Star Trail around Polaris (The North Star)
3. The observing field and sky looking North.

## Equipment List

1. DSLR Camera with fully charged batteries including a spare if you have one.
2. Flash memory card (clear of other 4G or better).
3. Zoom lens that will reach a 50 mm focal length (bring a longer lens if you have one)
4. Sturdy Tripod
5. Remote Release Intervalometer Timer if you have one.
6. A red light – headlamps work well.
7. A battery and 12 volt hairdryer, if you have one, for dew removal.
8. A chair.
9. A printed copy of this document.
10. Note pad and writing utensil to log your image runs/settings.
11. Don't be intimidated! Bring an open mind ready to learn a new a rewarding set of skills!

## When you get home...

1. On your computer, set up a file folder called AP.
2. Inside that folder, create the following sub folders:
  - a. Capture Files
  - b. Master WIPs (work in progress)
  - c. Finished Images
3. Inside the Master WIP folder, create a sub folder for each image target (i.e. Orion).
4. Log into Astrobin.com and create an account – it's free.
5. Download your images from your camera flash card onto the capture files folder.
6. Evaluate the Capture Files, then move the ones you want to process into a new WIP subfolder.
7. Process the files in the WIP folder (use whatever you have – for example, Apple iPhoto has rudimentary processing tools like brightness, contrast, etc.).
8. When satisfied, move the finished image to Finished Images folder and give them a name.
9. Post finished image on Astrobin to your gallery.
10. Post finished image to the CE Facebook page!

**Before the workshop, become familiar with all camera functions listed in the cheat sheet. It is best if you arrive with your camera set up as described below! Remember it will be dark, so know your camera!**

## Cheat Sheet

*This cheat sheet is provided courtesy and with permission of Mr Jerry Lodriguss, from his book 'A Guide to Astrophotography with Digital SLR Cameras' - Available at [astropix.com](http://astropix.com)*

### Planning

- Pick large bright subjects when you are first starting out in deep-sky astrophotography.
- Choose a focal length that will frame the deep-sky object well.
- Decide how you want to frame the object in a planetarium program or star chart before you go out.
- Shoot when the object is high in the sky and transiting the meridian.
- Shoot from the darkest location you can.
- Shoot deep-sky objects on nights of good atmospheric transparency and seeing.
- Make sure batteries are fully charged before going out!

### Camera settings

- Set Program Mode to Manual Exposure.
- Set Drive to Single Shot.
- Set ISO to 400, 800 or 1,600 based on ambient temperature.
- Turn Image Review Off.
- Turn Auto-focus Off.
- Set White Balance to Daylight for non-modified camera
- For a modified camera, use a custom white balance set with a gray card shot in sunshine on a clear day at noon.
- Set File Format to JPEG (in future workshops, we will shoot in RAW format).
- Set Optical Resolution to the highest (native) setting.
- Turn Long-exposure noise reduction Off.
- Turn off in-camera sharpening if you are shooting JPEGs at a high ISO.
- Set contrast and color saturation to normal if shooting JPEGs.
- Set color space to sRGB normally or Adobe RGB if extremely knowledgeable about color spaces.
- Turn off flash.
- Set exposure to Bulb.
- Put Compact Flash Card in camera.
- Use a remote release to open the shutter, or self-timer if you don't have one.
- Mirror lockup is not necessary for long-exposure astrophotography with a decent mount.
- Live-View video is the easiest method of focusing.
- A Bahtinov mask can work well for focusing point sources, but can't be used on extended objects. You can, however, just focus on a star and then move the scope to a planet or the Moon.
- If you don't have a Live View or a computer, just take a test exposure of a star through a Bahtinov mask and examine the image on the LCD on back of camera at high magnification.
- Autofocus can work if the optical system is fast enough and the star is bright enough and located exactly on the autofocus spot.
- Be aware that many auto-focus camera lenses will focus past infinity.
- Knife-edge focusers like the Stiletto and Mitsubishi can be accurate and easy to use if you are familiar with knife-edge focusing.
- If you use a computer next to the scope, examine images of stars in test exposures downloaded to the computer with software metric-assisted focusing such as DSLR Focus or Images Plus.
- At an absolute minimum, use the additional magnification found in a right-angle finder to focus a star, and then double check it by taking an exposure and examining the star at high magnification on the camera's LCD. Tweak the focus a little bit on each side of the best apparent focus to see if you can improve it. Adjust the exposure so the stars are not saturated and over-exposed.
- The worst way to focus is by eye alone through the viewfinder without any additional magnification.

- Once you have achieved focus, lock the focuser down. If it is a lens, tape it down. Be careful that the focus does not change in the process of locking it down.
- Refocus periodically during the night especially if the temperature is changing.

### **Target Acquisition and Framing**

- Locate the object and frame it correctly.
- Move if necessary to find a focus star.
- Focus and lock down the focus.
- Move back to the object if necessary.
- Shoot test exposures to determine the correct exposure and double check the framing.
- Set the camera to single shot mode.
- Turn off autofocus on the lens or camera if using a camera lens.
- Set the exposure mode to bulb on the camera.
- Set the total number of exposures desired on the timer.
- Set the Interval time between exposures to 10 seconds on the timer to give the camera time to download the raw file to the in-camera memory card or to the computer. For older cameras with a USB 1 connection, this time may need to be increased. Set the Exposure time on the timer to desired exposure.
- Start the exposure sequence by pressing START on the timer. To use the mirror lock up, put the camera in self-timer mode and set the mirror lock-up with the camera controls. Then program the remote interval timers as normal but add the length of the camera's self-timer time to the exposure time. The remote interval timer will then signal the camera to start the process and the mirror will lock up, the self timer will count down, and the shutter will open.

### **ISO and Exposure**

- For unguided exposures, expose as long as the mount's tracking allows with no trailing.
- Expose long enough to get the object detail out of the noise that is generated in the camera. A good aim point is for the sky background to be at least 20 to 40 percent of the way from the left side to the right of the histogram. The length of exposure necessary to reach this point will depend on how dark your observing site is.
- At high ambient temperatures, take shorter exposures at higher ISOs. As the temperature drops, you can take longer exposures at lower ISOs. You will need more total short sub-exposures at higher temperatures.
- Take as many sub-exposure frames as you can and average them together in software.

### **Recommended Number of Exposures**

- From an urban or suburban observing site with light pollution, your exposures will be short so you will need to shoot a lot of sub-exposures to get enough signal-to-noise ratio in your images. For bright objects like M27, you may need to shoot 90 sub-exposures at 1 minute each at ISO 800 at f/8.
- For faint deep-sky objects, try for a total exposure time of 1 to 4 hours, depending on how dark your observing site is.
- The total number of sub-exposures needed will be determined by the length of an individual sub exposure and the total desired exposure time. If you can shoot 5 minute exposures (for a given combination of ISO, F/stop and sky brightness), and you want 2 hours of total exposure time, then you will need 24 sub- exposures.
- The longer the total exposure, the more photons the camera records, and the higher the resulting signal-to- noise ratio in the final image.

### **Recommended Methods of Controlling In-Camera Heat**

- Turn off the LCD image display after a shot is taken.
- Use a fast compact flash card or write the files directly to a computer. Do not use a Microdrive.
- Use an external power source instead of the in-camera battery.
- In warm ambient temperatures (above 40F), use a fan to blow air onto the camera during exposures.
- Do not wrap the camera in cold packs to try to lower the internal temperature.
- Do not pause between frames to try to let the camera cool off.
- Shoot continuously and record as many photons as possible.