Astrophotography

Compiled by Greg Dean

Required Tools

1. Attitude – A willingness to:
   -practice, practice, practice.
   -go out at night.
   -experiment / be creative.
   -learn from your photographs (keep records).
   -dance with coyotes.
2. Manual camera or a camera with "manual" function.
   -Bulb "B" time exposure setting.
3. Locking shutter release cable.
4. Sturdy tripod.
5. Extra camera batteries.
6. Small flash light (red filter).
7. Note pad and pencil, or a small tape recorder.

Safety

1. Dress for the weather. It is colder at night and perhaps windy.
2. Visit the site first in daylight to assess safety and receive landowner's permission if applicable.
   -Anticipate potential problems.
      -wild animals.
      -wild humans (groups of partiers in a secluded area).
3. Tell someone where you are going and when to expect your return.
4. Take a cell phone with you.
5. If possible, take a spouse/friend with you.
6. Bring flashlights (red filters).
7. Bring a hot drink or at least some water and a snack.

Lenses

1. 20 mm: wide angle shots.
2. 28 – 70 (80) mm: wide angle shots.
3. 70 – 200 (300) mm: tight shots.

Filters

1. Don't use any.
   -Long exposures may pick up flare.
   -Some filters will reduce light by 1 or more f stops.

Composition

1. It is difficult to compose a picture when it is dark. If possible, compose the shot when you can still see well enough.
2. Be really careful with horizon lines.
3. You can't always see what's at the edges of the camera. (Watch for overhanging branches)
4. Try to have an interesting foreground.

Exposure (bracket, bracket, bracket).

1. Turn off the camera's automatic flash.
2. Remember that TTL metering systems meter for 18% gray.
3. Most shots won't be able to be metered. Meters get confused in the dark.
4. Record exposure details if using a film camera.
   -date, time, lens, film, film speed, aperture, shutter speed.

Auto-focus

-Turn off the auto-focus and use manual focus. Most night time shots can be pre-set to infinity.

General Tips

1. If using film, shoot a daylight shot at the beginning of the roll so lab technicians know where to cut the film.
2. Avoid the moon when using long exposures.
3. Avoid the sun in sunsets unless it is obscured by clouds.
4. Visit potential locations during the day.
5. Avoid invading people's privacy and sensitive locations.
   -Seek permission.

Problems

1. Ambient light: city light pollution, full moon.
2. Headlights.
3. Aeroplane lights blinking across the sky.
4. Wind.
5. Cold.
6. Darkness.
7. Colour cast. Your film will pick up the colours of the lights you are dealing with. Skin tones obviously will not be natural. Long exposures will affect the natural colour, but probably not enough to seriously affect most photos.

Tips for Low Light Astrophotography

1. **Auroras**
   -ISO 400
   -Exposure: Wide open (eg. f3.5)
   -Time: Bracket from 5 to 30 seconds.
      -Shorter time will give crispier auroras.
      -Longer time will give greater colour saturation.

2. **Lightning**
   -ISO 400
   -Exposure: Wide open (eg. f3.5)
   -Time: Anticipate the direction the lightning is moving towards and compose in that direction. Anticipate the time between lightning strikes. Wait until you think a strike is about to happen and then lock your shutter open for about a minute until you get at least one strike. If you are lucky, you may get two or more strikes. Experiment.

3. The Moon

-Size of moon on the negative depends on the size of your lens.

-Size of moon = $\frac{\text{mm}}{100}$ = 50 mm lens = .5 cm moon (This is a tiny moon).
=100 mm lens = 1 cm moon
=300 mm lens with 2X converter = 600 mm or 6 cm moon.

-Recommend faster 400 ISO to reduce the moon's motion.

-Exposure: Spot meter and use TTL metering.

-Perhaps bracket ½ stop.

-or use following Guide

Guide Exposure for Different Lunar Phases		
Moon's Phase	**ISO 400**	**ISO 100**
Crescent	1/125: f8	1/30: f8
Quarter	1/250: f8	1/60: f8
Gibbous	1/500: f8	1/125: f8
Full	1/1000: f8	1/250: f8

-These suggested values can be extrapolated for other focal ratios. Eg. The exposure for photographing the crescent Moon with an f/11 lens at ISO 400 would be 1/60 of a second.

-A wide angle, matrix metered shot will grossly overexpose the moon. Your TTL metering system will try to convert the large amount of dark sky to 18 % gray, thereby creating a lighter image.

-The moon will light the landscape enough to look like daytime. Experiment.

4. Planets

-Photograph one or more planets as a fairly wide angle landscape shot with no star trails.

-ISO 400

-Exposure: Wide open (eg. f3.5)

-Time: 20 seconds or less to avoid trails. Include the moon in the shot only if it is in a crescent stage.

5. Stars

a. Points

-ISO 400

-Exposure: lens wide open (eg. f3.5)

-Time: Less than 20 seconds.

b. Trails

-ISO 100

-Exposure: Depends on light pollution (ambient light).

-Dark: wide open (eg. f3.5).

-Lots of light/bright moon: f8.

-Time: at least 15 minutes for a good star trail effect. Longer the better.

-To emphasize constellations: try about 5 minutes.

-Try shooting out of focus to emphasize star colours.

6. Sunsets

-Avoid shooting at the sun. Can do permanent eye damage.
-Exposure: Use TTL metering and bracket.
    -minus one or two f-stops will increase colour saturation.
-Polarizing Filters: Can do magic if 90 degrees from the sun's direction.
-Watch the horizon lines.

Digital Camera Issues:

Settings:

1. jpg or raw
2. White Balance: Direct sunlight or Automatic
3. ISO: 100 to 800. See above.
4. Long exposure noise reduction: On
5. High ISO noise reduction: Off
6. Metering:
    a. Generally use matrix metering.
    b. Use spot metering for close up of Moon
    -Crescent Moon: spot meter on bright side **or** Earth shine side.

Other:

1. Turn on Manual setting.
2. Turn off auto flash.
3. Turn off auto focus.
4. Plug in locking shutter release cable. Be careful not to lock the locking mechanism on exposures less than 30 seconds.

Advantages:

1. Can see results immediately.

Disadvantages:

1. **Noise** (electronic grain) on long exposures is difficult to get rid of.
   -Increases with higher ISO's.
2. "**Amplifier glow**" is an intrusive glow along one edge or corner of the frame caused by heat from the internal electronics. (Might be able to crop out later)
3. "**Long exposure noise reduction**" doubles the length of each exposure. It immediately takes an additional exposure of equal length with the shutter closed. This "dark frame" records nothing but noise and artifacts such as hot pixels and amplifier glow. The camera then automatically subtracts this frame internally from the deep-sky exposure, in theory leaving an exposure free of such artifacts.
4. "**High ISO noise reduction**" may blur stars. Not recommended for astronomical subjects.
5. "**De-Bayering**" may incorrectly record some stars as vividly coloured green or blue dots, likely a result of an imperfect translation of each pixel's raw monochrome data into a colour image.
6. A bright foreground light can create unexpected and unwanted reflections elsewhere in the photo.

References:

1. http://www.luminous-landscape.com/tutorials/index.shtml. Explore such topics as -Astrophotography; Lunar Eclipse Photography; Meteor Shower & Star Trail Photography; Night Landscape Photography; Solar & Eclipse Photography

2. www.heavens-above.com. Provides lots of information about the night sky: whole sky chart, moon, sun, satellite information.

3. www.spaceweather.com. Information about the possibilities of when auroras may occur.

4. Arnold, H.J.P. *Astrophotography*. Firefly Books. Buffalo, N.Y. 2003. A very thorough introduction to film and digital nighttime photography.

5. Dickinson, Terence and Jack Newton. *Splendors of the Universe*. Firefly Books. Willowdale, Ont. 1997. A practical guide to photographing the night sky. Also describes how to photograph through telescopes.

6. Dickinson, Terence. *NightWatch, A Practical Guide to Viewing the Universe*. Firefly Books. Willowdale, Ont. 1998. A beginners guide to the night sky with one chapter on photographing the night sky.

7. Dyer, Alan. "Cameras in head-to-head showdown." *SkyNews*. May/June 2007. Page 14+. Reviews the effectiveness of three cameras for astrophotography, the Canon Digital Rebel XTi (400D), the Nikon D80, and the Pentax K10D.

"The point being if you go out often enough, you will stumble across everything."