The moon during an eclipse

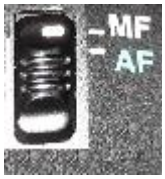
Stars – Star-trails – and the Milky Way

The topic of 'Stars – Star Trails and the Milky Way' come up from time to time amongst all keen photographers, and while many have tried it previously, there is always some new starters. These notes are designed to assist them.

Most images of the sky are wide-angle images taken with whatever lens you have that has a short focal length. With a dSLR, this could be your 18-55mm 'standard' lens, or a specific wide-angle lens anywhere from 10mm to 20mm. With a fixed-lens superzoom / bridge camera, it will be whatever focal length is "1x zoom". Smart-fone users also can do 'astro' photography via an App called ProCamera from the Apple Store. [see more below]

Let's start with some basic settings …

1. **<u>Focussing</u>** … if your lens has a manual focus control, then set the focus to infinity eg: 

2. **<u>Electronic focusing in the dark</u>** can become a bit of a problem, so you need to set **Manual Focus [MF]** on your lens or camera body; The location of the button varies between cameras eg:  

   To achieve electronic focus in the dark, you have several methods available …
   a) before full dark, do a normal Auto-Focus on something far away, then flick from AF to MF and do not touch the lens afterwards! -or-
   b) point the camera towards a street light or house light and focus onto that bright light, then again flick from AF to MF.

   Note-1; If your camera has Focus-Peaking, then as you gently rotate the focus ring you will notice the shimmering effect that denotes exact focus has been achieved.

   Note-2; I will often use some masking tape onto the focus ring to prevent accidental movement while adjusting other camera settings.

   Note-3: By industry definition, Infinity insofar as a camera lens goes, is 1000 times the focal length of the lens. Therefore, infinity for a 50mm lens is 50 metres away.

3. **<u>ISO settings</u>** … you are shooting at night and it is very dark – so you will need the highest ISO / sensitivity setting that your camera can use while still maintaining good image quality. Each camera has its factory-enabled ISO capabilities – and the choices are displayed when you press the ISO / Menu button eg: 

4. For best results, choose an ISO setting one or two options less than maximum … often the maximum is more of a 'wish-list' rather than a quality setting.

5. **<u>Lens Aperture settings</u>** … always use the maximum available from the lens in use. For most of us, this will be in the range of F2,0 – F2,8 – F4,0 – with some options between these settings.

6. **<u>Exposure time / Shutter time</u>** … the constant movement of the Earth means that the camera is capable of recording that movement in relation to the stars and the moon. There are several formulas often quoted to minimise that movement if it is <u>*not*</u> wanted. For our purposes, if you keep the exposure time to 30 seconds or less, then stars will continue to look like stars, not streaky lines.

7. **Tripod behaviour** … tripods are notorious for wobbling when you do not want them to wobble or shake! The adjustable legs, the centre-column that moves up and down all contribute to allowing the tripod to vibrate ever-so-slightly when in use. Therefore you need to use ***-either-*** a remote control device ***-or-*** the self-timer built into the camera and stand well back once it is activated.

   If you need to purchase a tripod, do not skimp on quality and weight ~ the cheaper and lightweight ones will give you more trouble than they are worth.

8. **And don't forget** … your small torch to illuminate all your camera settings!

   With our eyes retaining traces of bright-light vision whenever we swap from a bright scene to a darker scene, for us to get the best from deep-sky / dark-sky viewing, we need to give our eyes a 10- to 20 minute 'brightness-rest' before we can detect more than just the brightest of the stars. Keep torch light away from your eyes and others around you, and if the torch has a brightness control, it is suggested that it be set to the lowest brightness level while you are star gazing.

Smart-Fone information-

The Apple store has an App called 'ProCamera' [cost unknown] which allows the user to take extra-long photos in low light by taking many photos and stacking them together to create a brighter result. The App has many additional features as well, making it closely similar to many traditional cameras.

> ***Note-4: Most smart-fone camera lenses have a maximum aperture of about F2 and a longest shutter time of only 3 or 4 seconds. Therefore they take many short exposures and 'glue' them together to make a long exposure. In daylight, the fone-camera uses both fast shutter speeds &/or a Neutral Density filter to control bright sunlight.***

Milky Way images-

In recent years as cameras and their sensors have become better and better, we are seeing increasing numbers of very nice Milky Way images.

courtesy of Shutterstock image library.

For best results we need to be some distance away from a town or large light source – when we're close to town the glow from street lights will be reflected in the airborne dust and cause the quality of our images to be lowered.

Technique:-

1. locate the Milky Way in the overhead sky … its location and position above the horizon does alter with the seasons;

2. set focus to infinity, set ISO to your camera's best high-value, set self-timer if not using a remote control, angle tripod towards your target zone in the sky, set aperture to maximum and a suitable shutter speed, and take your first test image;

3. examine the test image – refine focus or ISO or shutter speed as needed … sit back for 10 to 15 minutes and try another photo to make sure of your result. It may be that you can experiment with people or items in the foreground, those items being shown as a silhouette against the sky.

In the Southern Skies …

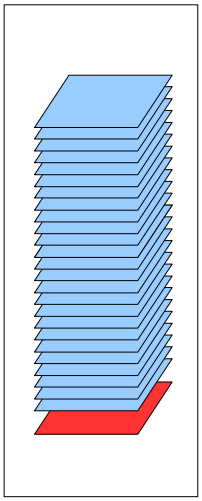
The Milky Way is easily seen overhead on most nights – and the darker the area via absence of street & building lights reflecting off the airborne dust in the sky, the better we can see all the stars. Generally speaking, the well-known centreline of the Milky Way rises in the south-west and during the night moves across the overhead sky towards the north-east and disappears from view with the dawn.

Star Trails-

follow the traditional film-camera 'long exposure – record movement' style of photo, except that with digital cameras and processing, today we take large numbers of short-exposure time images and “stack” them via software.

This image is constructed from 320 camera images of 20 seconds each with the camera lens at 1x zoom NB: To see a “circle” the camera must be pointing at the north or south celestial pole. [see next page]

How is it done? … how can you create 1 hour to 3 hour long exposures?



This has led to digital photographers searching for other methods for taking star-trails.

One enterprising astro-photographer and computer programmer in Germany [Mr Achim Schaller whose web site is “startrails.de”] has developed a program for doing just this, and he has made this program freely & publicly available. It is called “startrails.exe”; it is released as a zip file so that you can download it easily and activate it via a couple of mouse clicks. The program is pretty smart and a delight to use. It ”stacks” lots of images on top of each other, and in doing so, it makes each image (called a layer) to become transparent so that the bright star movement now becomes visible over the dark background of the original image loaded at the bottom of the stack.

In my star-trails photos, I have combined from 50 camera-images to 1000 camera-images … depending upon the exposure times. (shorter exposure times means more camera-images over the total exposure time itself). On my pretty-ordinary laptop computer, stacking of 350 exposures takes around 10 minutes.

Technique:-

1. locate the Southern Cross in the overhead sky … its location and position above the horizon alters with the seasons and the time of night;
2. angle tripod towards the Southern Cross and its pointers, set ISO to your camera's best high-value, set self-timer if not using a remote control, set shutter to desired time, **cancel** long-exposure Noise Reduction “NR” via your camera's menu, set focus to infinity, then set aperture to maximum, and take your first test image;
3. examine the test image – refine focus or ISO or shutter speed as needed … sit back a minute or so and try another photo to make sure of your result.
4. Once you are happy that the camera is producing a 'good' image, *set continuous exposure mode to 'on'* and use the remote control to lock the shutter in the open position. Listen for a minute or so for the 'click-clunk' change-over from first image to the second and the second to the third, and when you're confident that all's well, go somewhere warm for the next half-hour or so. :)

Suggested 'best' time for Star Trails …

[in most of Australia] if you commence your photography 15 to 30 minutes after sunset, there is still enough light in the sky to provide a pleasant backdrop for the resulting star trails. If there is too much light in your early images, just remove them from the collection before you stack them later via software.

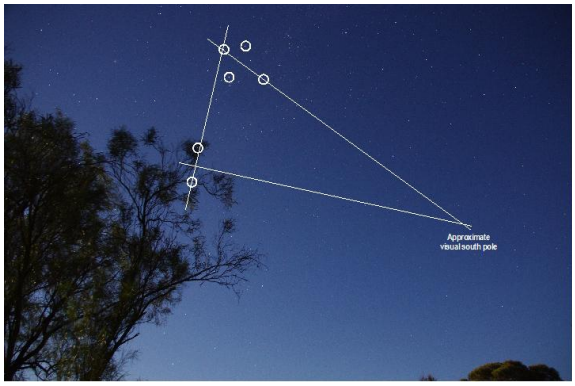
Creating a 'full-circle' when doing star trails ...

"South" as we know it is the south Magnetic pole within Antarctica. The "South Celestial Pole" is an imaginary dot in the sky around which the earth rotates, causing the stars to become circles when that imaginary spot is included within the photo frame.

Find the Southern Cross

Just about all Aussies know how to find the Southern Cross ~ we all know what it looks like as it's on the National Flag – however as the 12-month-long year progresses and the earth rotates, the location of the Southern Cross does vary slightly in its inclination [height] above the horizon. Adjacent to the Southern Cross are two very bright stars known as 'the Pointers'.

We also use these to locate the South Celestial Pole. Some times of the year, the Pointers are below the Cross, and at other times they are above the Cross. [An astronomer will be able to explain more ~ I will not try to in these notes]



Once you have located the Southern Cross & the Pointers, start to draw some imaginary lines in the sky. [see the sketch]

- draw a line from the top of the Cross down through the pointers;
- draw another line down through the cross towards the horizon, and finally
- draw a connector line at right-angles through the Pointers towards the [above] centre-line through the Cross.
- Where they meet is the South-Celestial-Pole.

Although it all sounds difficult, from the sketch above you'll see how easy it is and once you have found it, it's easy to do it again and again.

Some samples …

550 images of 8-seconds

100 images of 30 seconds

200 images of 30 seconds