Although this Astrophotography Guide relates to a specific telescope, the Siberia 150, much of it is relevant to any telescope fitted with an equatorial mount and clock drive. Again, while written for film photography, much of it is relevant for DSLR imaging.

A Guide To Basic Astrophotography With The Siberia 150 Telescope Written by Bill

With it's motorised German equatorial mount, the Siberia 150 Newtonian reflector telescope is an ideal instrument for serious amateur astrophotography.

It is prepared for prime focus photography and can be adapted to high power eyepiece projection and guided piggyback work using accessories available from SCS Astro.

As an existing user of the Siberia 150, I was very pleased when SCS Astro approached me to write this photography guide. It has allowed me to pass on many of my own tips and suggestions, which should enable you to get the most from this excellent telescope.

I hope you find this guide helpful and enjoy using the Siberia 150 as much as I have.

Choosing Photographic Equipment and Accessories

I may be stating the obvious, but you must have a camera which is suitable for astrophotography and the only real choice for serious amateur work is a 35mm SLR (single lens reflex) model.

Ideally, your 35mm SLR camera should have a mechanical shutter which can work without relying on battery power. This could be an important consideration if you want to make lengthy guided exposures or decide to work in very cold conditions.

Your camera should be equipped with a standard lens which has a focal length of around 50-58mm and a maximum aperture of at least f/2.

This will be a good choice for guided astronomical subjects and it will be useful in many non-telescopic situations.

You may be tempted to consider using a standard zoom lens such as a 28mm-70mm f/3.5- f/4.5. These lenses are very convenient for everyday use, but they normally have less light gathering power than a fixed focal length lens and must be used at a reduced aperture to provide good performance. Being complex optical designs, they are also prone to flare and ghosting.

You will also need a few minor accessories before you start making astronomical photographs.

These include a short cable release of the self locking variety, (unless your camera has a T setting) an ultra violet filter to protect the front element of your camera lens from damage, a fold back rubber lens hood and the SCS Astro camera mounting attachment for this telescope, which will allow guided piggyback work.

The telescope is equipped with a very useful camera coupling ring which is built into the focuser. This takes the form of a male M42 screw thread ring, which allows many 35mm SLR cameras such as the Zenith models, or older Pentax and Prakticas to be securely attached to the telescope for prime focus work.

However, these days, virtually all 35mm SLR cameras use a bayonet lens mount, so you may need a simple adapter ring which will couple most makes of 35mm SLR camera to the M42 thread. (Including a few auto focus models!)

If you decide to purchase additional lenses for your 35mm SLR camera, with the intention of using them for piggyback work and terrestrial subjects, you should choose fixed focal length lenses rather than zooms, for the reasons I have already mentioned.

A good affordable combination would be a 28mm wide angle lens and a 135mm telephoto lens. These additional lenses will allow you to photograph most guided and unguided astronomical subjects.

Finally, you may want to consider buying an eyepiece tele-extender, which will make high magnification photography possible and a high quality eyepiece.

My own preference for use with this telescope, is a device called a variable tele-extender which allows you a choice of magnifications and a Japanese 12.5mm multicoated eyepiece.

Guided Piggyback Photography

The term piggyback is fairly self explanatory and refers to the method of mounting a camera alongside a telescope and taking advantage of its equatorial mount for guided photography.

You will need the SCS camera attachment bracket which has been specifically designed for this telescope.

It clamps onto the mounting platform in a couple of minutes and you can then leave it in position permanently.

It is possible to attach a camera directly to this bracket with a standard 1/4" accessory screw, but I would strongly recommend the use of a small ball & socket head, which will make it relatively easy to frame your subject matter.

The camera attachment bracket can be fitted to either side of the mounting platform, which allows you to choose whichever position you feel most comfortable using.

Make sure that both bolts on the camera bracket are tight, but don't overdo it!

Balancing the Telescope

Before attempting any form of guided photography, you must fully balance your telescope, with and without accessories fitted.

Start by removing the protective caps from the optical tube and insert an eyepiece into the focuser. If you are using the SCS piggyback camera bracket, this should be fitted and can be left permanently in position.
Carefully slacken the main bolt which allows adjustment of the polar inclination and slowly release the second bolt which holds the support strut. You now want to move the whole mount until the polar altitude scale shows 0º
Position yourself behind the rear plate of the motor housing and swing the declination shaft until it is roughly horizontal. You should have the counterweight on one side and the tube assembly on the other.
The next task is to slacken off the screws which hold the clutch plate to the main gear wheel inside the motor housing. This adjustment is not as difficult as it might sound and the screws can be accessed via a cover in the rear of the motor housing.
However, I feel that the best way to tackle this job, is by removing the entire motor cover panel, which is secured by five small screws.
This takes about a minute to carry out and it does give you easy access to the main gear wheel.
When you have removed the motor cover panel, put the five screws somewhere safe where they wont get lost!
The three spring tensioned screws which provide friction for the clutch plate will be visible just beyond the motor and you can reach them very easily. (See the Russian Guide, Fig 8, No 12)
As you use your screwdriver to adjust these screws, take care to avoid damaging any internal components, paying particular attention to the electrical connections and wires on the right.
To adjust all the screws, it will be necessary to tilt the declination shaft slightly in one direction or the other. Do not remove these spring tensioned screws entirely, just slacken them off sufficiently to make the whole assembly reasonably loose.
You should now be able to swing the declination shaft up and down with an absolute minimum of effort and any lack of balance will become immediately apparent.
Adjusting the telescope's balance is very easy and all you have to do is release the locking collar which holds the counterweight in position and carefully alter its position on the declination shaft.
Once you are satisfied with the overall balance, take a ruler and establish the exact distance between the end of the declination shaft and the counterweight.
Make a note of this measurement in the rear of your manual or in a notebook and this will allow you to quickly set the balance whenever you add or remove an accessory.
Now repeat the process with your camera body and standard lens mounted on the Piggyback attachment.
If you intend to use a wide angle or telephoto lens, you must fit it to the camera body and repeat the balancing procedure, making further notes. You may find there is little difference in weight between several short focal length lenses, but it's a good idea to check.
Lenses with focal lengths greater than 135mm can be used for guided piggyback photography with the Siberia 150, although a lightweight 300mm lens is the longest focal length I would recommend.
Once you have balanced all your various equipment combinations for the polar axis, the three spring tensioned screws on the gear wheel clutch plate can be equally re-tightened.
Don't overdo this, just make sure the clutch action is firm rather than really tight and see that the declination shaft moves smoothly, before re-fitting the cover plate on the back of the motor housing.
It's also necessary to check the balance along the declination axis, which is a very easy operation.
With the polar altitude scale reading 0º and declination shaft horizontal, slacken off the brake screw (Russian Guide, Fig 4, No 12) and observe which way the optical tube swings.

*** CAUTION ***

If camera equipment is attached to the telescope, you must take care to prevent it from becoming detached or impacting on part of the mount or pedestal. Make sure your hands are in position to prevent this from happening and take your time!
The ring clamps which hold the optical tube in place must be slackened just enough to allow you to slide the tube into a new position. Once this has been established, they can be re-tightened.
You will find it a good idea to place small self adhesive stickers on the tube to indicate the normal and adjusted positions. This is particularly useful if you normally store the optical tube in its wooden case.

Selecting The Right Film for Astrophotography

There are three choices of film open to you. These are black & white film, colour print film and transparency film.
Black and white film is ideal for the photographer who has access to a darkroom. It is relatively easy to use and fairly economic to buy.
A number of different B&W films are suitable for astronomical work, although the best B&W film for virtually every telescopic application is Kodak Technical-Pan. This fine grained film has a significantly enhanced red sensitivity and works particularly well with a Wratten #25 filter.
It has very flexible exposure indexing and can be developed in a wide range of B&W developers. In addition, Technical-Pan film works very well in hypersensitized form. (More on hypering in a later section!)
The next choice is colour negative film for prints and the main drawback with this material, comes at the processing stage.

Many astrophotographers have been less than satisfied by the results from their local high street processing company, but it's not really fair to blame these companies for the difficulty. Minilabs are geared up to produce pictures of holidays and weddings and not specialised astronomical work, so don't expect too much!

However, there are the occasional exceptions to this rule, or you may feel its worth paying extra for the services of a professional lab.

Alternatively, you might even have access to a darkroom with colour processing equipment and the skill to make use of it.

Whatever means of processing you decide on, I am going to suggest the best choice of colour negative film for piggyback, prime focus or eyepiece projection photography is an ISO 400 type.

For a lunar eclipse, detailed close ups of the lunar surface or planetary work, it may be worth switching to an ISO 1000 film.

You may also find it worth experimenting with a really fast colour negative film like Konica SR 3200. This is a very grainy film, but it will allow you to record good telescopic images of subjects like the Orion Nebula, using relatively short exposure times.

The third option is colour transparency film for slides and the advantage of using this material is the fact that nothing is altered during processing, so the finished result will be a good reflection of your photography.

High quality prints can be made from transparencies and because you are using this film, a lot of unnecessary printing is eliminated.

Again, I would recommend an ISO 400 film produced by one of the major manufacturers for piggyback, prime focus and eyepiece projection work.

However, there are some situations where a slower ISO 100 film will be more suitable, such as low magnification prime focus pictures of the Moon.

You can also use very fast colour slide films for guided work and a film with a rating of perhaps ISO 1600, will reduce the exposure time considerably.

At the present time Kodak Panther 1600X is the best high speed colour slide film on the market, although it is quite expensive.

Problems With Long Exposures

When you start making lengthy time exposures of the night sky, it will soon become apparent that something is wrong with the film you are using.

Although you will have worked out the exposure carefully, the results may look underexposed and the colours may have altered dramatically.

Unfortunately, this is perfectly normal for any film which has been exposed outside its design parameters.

Film is manufactured to produce consistent results within a predetermined exposure band, which is necessary for consistent results under everyday conditions.

Once you move outside this band and start making lengthy time exposures, a problem arises, which is called reciprocity failure.

Reciprocity failure is sometimes described as a loss of film speed which occurs with long exposure times. In fact, the film continues to work correctly but there is an insufficient intensity of light to produce an acceptable image during a correctly calculated period of exposure time.

Another way of looking at this, is to say that insufficient numbers of photons reach the film's silver atoms in a short enough period of time to create a lasting impression.

In the case of colour films, these have three separate emulsion layers and each layer has its own reciprocity characteristics.

This is why some colour films produce noticeable red casts and others shift to green when long exposures are made.

Coming to grips with the Problem

The best technique for dealing with reciprocity failure is gas hypersensitization, (or hypering) which works by baking the film in a forming gas which usually comprises of 92% nitrogen and 8% hydrogen.

This process removes moisture from the film's emulsion, which inhibits the silver atoms sensitivity to lower numbers of photons.

Hypersensitization can be undertaken by the photographer, but quite honestly, it is not a practical proposition for the occasional user.

However, several specialist companies will either supply hypered film or hyper customer's film on a mail order basis and the cost is usually quite reasonable.

Problems will arise, if you plan to store the film once it has been hypered and ideally, you should use hypered film as soon as possible. However, hypered film can be stored in refrigerated conditions for a short period of time, providing it remains in a sealed container.

Taking Guided Piggyback Photographs

I'm going to start by assuming you have chosen a clear dark night to take photographs and you have paid particular attention to accurate polar alignment. I'm also going to assume your camera is fitted to the attachment bracket and you have the telescope's motor running.

First, you will need to roughly aim your telescope in the direction of a suitably bright star which should be as close as possible to the celestial equator. This may require you to slacken the rings which hold the telescope's optical tube to the mounting platform and rotate the focusing tube into a comfortable position.

Take the 15mm Kellner eyepiece, carefully prise out the field stop and replace it with the cross-hair graticule. Now attach this to the
x4 Barlow lens and insert it into the drawtube.

Find your bright guide star in the eyepiece and position it in the centre of the cross hairs, then rack the image out of focus.

If you find this degree of magnification is stretching your eyesight to the limits, remove the Barlow lens and just use the 15mm Kellner eyepiece with the reticule fitted. If you have been careful with your polar alignment, this is usually adequate for use with short focal length camera lenses.

Before you start making pictures, it's not a bad idea to let the telescope's motor run for a few minutes. As well as giving the motor a chance to settle down, it will allow you to observe your guide star and make sure the tracking is accurate.

Providing the polar alignment has been properly set up, the guide star should remain centred in the cross-hairs for several minutes.

However, all telescope drives suffer from what is called periodic error and this means that the guide star will eventually begin to drift out of position.

You will need to bear this in mind while you are making exposures and carry out small corrections by turning one of the large knobs located on either side of the motor housing.

To begin with guided piggyback photography will seem rather like a juggling act, with various parts of the telescope and camera needing attention at the same time. However, once you've established a working routine it will become very easy.

Before you think about making your first exposure, check that the camera lens's focus is set to infinity and the aperture control is set
to the position you require.

Normally, this will be the widest lens opening, such as f/2 or f/2.8.

Next, make sure the shutter dial of the camera is turned to the B setting. (In some cases the T setting)

A short cable release is necessary to open the camera's shutter and
this should be of the self locking variety.

Have the cable release's locking ring ready to hold the camera shutter open when you press the plunger in. If you are new to photography, familiarise yourself with the way this works before tying to take guided pictures.

Now you can advance the film in the camera, so the shutter is ready to open, the moment you are ready.

*** IMPORTANT ***

Starting and finishing your guided exposure by simply using the cable release to open and close the shutter is not recommended, because it may generate unwanted camera shake.

The most satisfactory way to carry out this operation, is by carefully holding a black piece of card in front of the camera lens and then opening the shutter.

Next, check that your de-focused guide star is exactly in the middle of the crosshairs, then very carefully, lift the black card away from the front of the lens and this will start the exposure.

You can now start your watch or timer. Keep checking on the guide star to make sure it is centred, but be very careful not to jar the telescope in any way.

The de-focused guide star in your finder will eventually start to drift, so you will need to make occasional tiny corrections to keep it in place.

Once the exposure is completed, you must carefully re-position the black card in front of the lens and then close the shutter.

I would strongly recommend the use of a rubber lenshood during this procedure.

Incidentally, if you are working away from a power source and do not have the optional 12v DC supply, it is possible to manually guide your telescope without the motor running. Naturally, you will have to make continual adjustments.

Prime Focus Photography with the Siberia 150

The Siberia 150 telescope is specifically designed to allow the attachment of a camera body to the focuser via a built in coupling ring.

First you must unscrew the eyepiece holder and this uncovers a threaded male M42 camera coupling ring.

Because of the position of the finderscope on some versions of the Siberia 150, it may be necessary to remove it before proceeding. Undo one of the small retaining screws and slide the finderscope away from the retaining plate. Take great care not to lose the small screw!

The M42 screw thread has been widely used in the past for attaching lens to 35mm SLR cameras and it is still used on the Russian made Zenith models. This means that any camera body with an M42 mount can be fitted directly to the telescope without any difficulties.

Most 35mm SLR cameras now use a variety of different bayonet lens mounting systems, but the majority of these mounts can be coupled to the M42 ring by means of a simple adapter.

For example, if you have a Olympus OM-1 or a Pentax K1000 camera, it
is possible to attach the camera body directly to the Siberia 150 with a suitable adapter ring in just a few seconds.

Adapters for popular lens mounts are readily available in the U.K, but if you own a camera body with a very unusual fitting, it may be possible to have a custom adapter made up.

When your camera body is attached to the telescope, you will be able to obtain sharp focus in exactly the same way you would for an eyepiece by adjusting the telescope's focuser.

There is a useful provision to increase tension on this movement, which will be helpful if you are using a heavy professional camera.

The Moon

The Siberia 150 telescope's focal length is 1200mm, which produces an image of the full Moon on your film of 10.9mm in diameter.

This means you will be able to record detailed images of the entire Moon during all its phases and I would recommend that you experiment with a sharp fine grained film for this subject.

A lunar eclipse is a fine target for prime focus photography with the Siberia 150 and you will be able to make a detailed record of the Moon as it gradually darkens.

When the Moon is within the Umbra, (Earth's shadow) it will still be possible to record good images without too much difficulty. Having said that, lunar eclipses are very unpredictable, so it may require an exposure lasting for 10 seconds or more with a very fast film.

Exposures must be kept as short as possible, because the Moon crosses the sky at what is called the Lunar Rate. This constantly varies, but it is about 98% of the normal sidereal rate.

Nevertheless, the telescope's motor drive should hold the Moon in position long enough for you to secure some good exposures during totality.

Deep Sky Objects

With subjects like the Andromeda Galaxy or Orion Nebula, it should be possible to keep these objects framed for long enough to make a photographic record.

The main problem, is being able to check how accurately the telescope is tracking while you take pictures. Obviously, this is rather difficult when a camera is occupying the eyepiece position.

There are very sophisticated methods of overcoming this particular problem, such as secondary guidescopes and special off-axis guiders, but they can be rather expensive.

So the simplest solution may be to use a high speed film and carefully establish the limits of what is permissible before drifting becomes evident.

Higher Magnification

The next option is known as eyepiece projection photography and it allows very high image magnification.

This technique uses a tube shaped adapter which positions a normal eyepiece between the telescope's optics. These devices are widely available and couple to most 35mm SLR camera bodies by means of a T-2 adapter ring.

*** IMPORTANT NOTE ***

The Russian made eyepieces are fractionally larger than the 1.25" models produced in the Far East. This may make it difficult to fit them into every photographic adapter on the market. You should check compatibility before making a purchase.

An eyepiece projection adapter, also called a tele-extender, will provide you with a really big increase in focal length and allow you to take detailed close ups of the lunar surface or capture the brighter planets.

The first thing we need to know, is the f-ratio and the focal length in use. The formula is as follows:

Eyepiece Projection f-ratio = Telescope's f-ratio X (D-F) / F

The telescopes f-ratio is that found at prime focus. D is the distance from the focal plane of the eyepiece to the film plane inside the camera and F is the focal length of the eyepiece.

The Siberia 150 reflector telescope has an f-ratio of f/8, so let's say the separation between the eyepiece and the film plane is measured at 165mm. (It can be varied)

If we are using a 25mm eyepiece, then this part of the calculation
shows the extra magnification involved.

$$(165-25) / 25 = 5.6$$

We finish off the formula by multiplying this magnification figure of 5.6 by the f-ratio of the telescope, which is f/8 and we see that the new overall f-ratio is f/45.

To calculate the EFL (effective focal length) of the telescope, we multiply the revised f-ratio by the telescope's aperture.

EFL = Revised f-ratio X Telescope's aperture (millimetres)

If the revised f-ratio of the telescope is f/45 and we multiply this number by the telescope's aperture which is 150mm, the telescope is seen to have an effective focal length of 6750mm.

Suppose we substitute the 25mm eyepiece for a 15mm eyepiece. This combination will alter the f-ratio and produces a greater degree of magnification. It means we now have an f-ratio of f/80 and a focal length of 12,000mm.

By using a film which is rated at ISO 400, the exposure can be kept quite short for most subjects, even at f/80. Nevertheless, you must pay considerable attention to dampening vibration and obtaining sharp focus.

If you have a camera body with a mirror lock, it will be worth using it before you start your exposure. Alternatively, if your shutter is going to be open for more than one second, it is best to hold a black card in front of the telescope to start and finish the exposure.

Carefully check the focus between each exposure and remember that two identically exposed frames can be affected by changes in the atmosphere, which is something you have no control over. The only thing you can do, is to shoot plenty of film!

Afocal Photography with the Siberia 150

The afocal method of photography, allows you take photographs through the optics of the telescope, without the need for any special accessories other than a camera tripod.

Basically, what you are doing, is lining up the optical system of your camera with the optics of the telescope and using both to produce a single long focal length.

However, positioning your camera lens so it looks into the eyepiece can be fiddly and it has to be said this method is less satisfactory than prime focus coupling, or eyepiece projection.

Nevertheless, it is possible to obtain high magnification photographs which are acceptably sharp. All you must remember to do, is to set
your camera lens to its widest aperture and make sure there is no extraneous light entering between the front of the lens and the eyepiece.

If you have a rubber lenshood, this may solve the problem, otherwise you can make use of a small piece of black plastic sheet.

Normally, the camera lens will be set to infinity and focus will be adjusted using the telescope's focuser. You must take care to prevent the eyepiece from making contact with the lens's front element and it's a good idea to leave a U/V filter in place.

Before you start thinking of taking pictures, it will be necessary to establish the overall focal length and f-ratio of your set up.

First determine the magnification produced by the eyepiece in use. This can be calculated by dividing the focal length of the telescope by the focal length of the eyepiece.

The Siberia 150 reflector telescope has a focal length of 1200mm and when the 25mm eyepiece is attached, it produces a magnification of x48.

Now we must allow for the focal length of the camera lens in use and multiply this by the magnification of the telescope. Let's suppose we have a 35mm SLR camera which is fitted with a 58mm lens, it will be necessary to make the following calculation:

Focal length of camera lens X Magnification of Telescope
= Revised focal length of telescope. (58 X 48 = 2784)

This tells us that the entire optical system has a new focal length of 2784mm, but we now need to determine the revised focal ratio so the exposure time can be calculated.

To do this, we divide the overall focal length by the telescope's aperture, which is 150mm. (2784 / 150 = 18.5)

This means the telescope has a nominal focal length of 2800mm and a focal ratio of f/18.

If the 42mm eyepiece is fitted to the telescope and the same formula is applied, using the 58mm camera lens, the combination will provide a focal length of 1650mm and a focal ratio of f/11. (You will get better quality results using your camera body at prime focus!)

Switch to the 15mm eyepiece and use this in combination with a 58mm camera lens. It will provide an overall focal length of 4650mm and a focal ratio of f/32.

If the 58mm standard lens is now exchanged for a short telephoto lens of say 90mm, the magnification increases again.

If the 90mm lens is combined with the 15mm eyepiece this gives the telescope an overall focal length of 7200mm and a focal ratio of f/48.

You need to carefully check your focus between each exposure and bear in mind that two identically focused shots can show variation due to vibration through the telescope and changes in atmospheric conditions.

There is little you can do to avoid changes in the atmosphere, but vibration and camera shake can be reduced with care. First, make sure your telescope is standing on a perfectly level surface and try using the camera's built in self timer to release the shutter.

Always have the telescope's motor running, even for short exposures.

With exposures longer than 1 sec, (5-6 sec max) you will need to use a different method to start and finish your exposures.

First, observe the object you are photographing through the camera viewfinder and make sure it is not drifting.

Now cover the front of the telescope's aperture with a piece of black card and open the camera's shutter. Allow the camera two or three seconds to settle down, then remove the card. Stand away from the telescope and begin timing the exposure.

When the exposure has been completed, cover the telescope aperture and close the shutter.

Filters

Filters are often useful for planetary photography and they can enhance detail considerably under certain conditions.

A black & white film like Kodak Technical Pan 2415 is particularly good for planetary work when used in conjunction with filters. Try using a #25 red filter for Mars, which should help to bring out surface detail. With Jupiter and Saturn, try a #15 yellow filter, which should enhance cloud belt detail.

Many specialist filters are manufactured for astrophotography and I would encourage any experienced photographer to investigate these further.

Getting the Right Exposure

Normal everyday photographic subjects are known as extended objects.

The list of extended objects also includes such things as the Moon, planets and nebula.

Exposure values for extended objects increase by the square of the focal ratio and normal f-numbers found on camera lenses are used to establish the correct value. (Don't worry about this too much!)

However, in terms of exposure assessment, stars behave quite differently, because they are point sources of light and they respond directly to the aperture size of a camera lens, or telescope.

To determine the size of a camera lens's aperture, we divide the f-number into the focal length. This means that a 58mm f/2 lens has a aperture of 29mm.

Used to photograph ordinary extended objects at full aperture, a 28mm f/2 lens will provide exposures which are identical to those made with a 58mm f/2 lens or for that matter a 200mm f/2 telephoto lens.

However, the aperture size of a 28mm f/2 lens is only 14mm, which means it has less ability to record point sources of light than a 50mm f/2 lens during the same exposure period.

This is an important consideration and allowances must be made when you are using different focal length lenses for piggyback guided photography.

Exposure time will depend on the magnitude of stars you want to photograph and as an example, a 58mm f/2 lens will record down to magnitude 10 with a 5 minute exposure if you use ISO 200 film and transparency is good.

Optical performance of any camera lens is another consideration and even the finest lenses give their worst performance at maximum (and minimum) apertures.

Because of this, it is usually possible to improve the performance of a short focal length lens, by closing its aperture down by « to 1 f-stop.

I have provided a guide for Piggyback exposure times with different lenses, for star fields and constellations, but I must stress that these are only suggestions for initial experimentation.

	ISO 200	ISO 400	ISO 1600
50mm Lens			
f/2	4 Min	2 Min	30 Sec
f/2.8	10 Min	5 Min	90 Sec
28mm Lens			
f/2.8	20 Min	8 Min	3 Min
135mm Lens			
f/2.8	8 Min	3 Min	60 Sec

For prime focus, afocal and eyepiece projection work, the following tables may be useful as a starting point. Other values can easily be calculated from these figures.

The Moon

f/	ISO 100	ISO 200	ISO 400

Thin Crescent

8		1/15 sec	1/30 sec	1/60 sec
11		1/8 sec	1/15 sec	1/30 sec
16		1/4 sec	1/8 sec	1/15 sec
22		1/2 sec	1/4 sec	1/8 sec
32	1 sec	1/2 sec	1/4 sec	
45	3 sec	1 sec	1/2 sec	

Wide Crescent

8		1/30 sec	1/60 sec	1/125 sec
11	1/15 sec	1/30 sec	1/60 sec	
16	1/8 sec		1/15 sec	1/30 sec
22	1/4 sec		1/8 sec	1/15 sec
32	1/2 sec		1/4 sec	1/8 sec
45	1 sec	1/2 sec	1/4 sec	

Quarter Phase

8		1/60 sec	1/125 sec	1/250 sec
11	1/30 sec		1/60 sec	1/125 sec
16	1/15 sec		1/30 sec	1/60 sec
22	1/8 sec		1/15 sec	1/30 sec
32	1/4 sec		1/8 sec	1/15 sec
45	1/2 sec		1/4 sec	1/8 sec

Gibbous

8		1/125 sec	1/250 sec	1/500 sec
11	1/60 sec		1/125 sec	1/250 sec
16	1/30 sec		1/60 sec	1/125 sec
22	1/15 sec		1/30 sec	1/60 sec
32	1/8 sec		1/15 sec	1/30 sec
45	1/4 sec		1/8 sec	1/15 sec

Full

8		1/250 sec	1/500 sec	1/1000 sec
11		1/125 sec	1/250 sec	1/500 sec
16	1/60 sec		1/125 sec	1/250 sec
22		1/30 sec	1/60 sec	1/125 sec
32		1/15 sec	1/30 sec	1/60 sec
45	1/8 sec		1/15 sec	1/30 sec

Lunar Eclipse at Totality

f/	ISO 200	ISO 400	ISO 1000
8	10 sec	6 sec	2 sec

*** Please Note ***

Effects of pollution in the Earth's atmosphere make exposure predictions for a lunar eclipse very difficult. A dark eclipse could require significantly longer exposure periods, so you will need to make an on-the-spot assessment and bracket as widely as possible.

For planetary photography, these suggestions may be helpful.

	f/	ISO 100	ISO 200	ISO 400	ISO 1000
Mars					
	45	1/4 sec	1/8 sec	1/15 sec	1/30 sec
	64	1 sec	1/2 sec	1/4 sec	1/8 sec
	90	3 sec	2 sec	1 sec	1/4 sec
	120	6 sec	4 sec	2 sec	1 sec
Venus					
	16	1/60 sec	1/125 sec	1/250 sec	1/500 sec 22
		1/30 sec	1/60 sec	1/125 sec	1/250 sec 32
		1/15 sec	1/30 sec	1/60 sec	1/125 sec
	45	1/8 sec	1/15 sec	1/30 sec	1/60 sec
	64	1/4 sec	1/8 sec	1/15 sec	1/30 sec

	90	1/2 sec	1/4 sec	1/8 sec	1/15 sec
Jupiter					
	45	1/4 sec	1/8 sec	1/15 sec	1/30 sec
	64	1 sec	1/2 sec	1/4 sec	1/8 sec
	90	5 sec	2 sec	1 sec	1/4 sec
	120	10 sec	5 sec	2 sec	1 sec
Saturn					
	45	4 sec	2 sec	1 sec	1/2 sec
	64	9 sec	5 sec	2 sec	1 sec
	90	25 sec	12 sec	6 sec	3 sec
	120	55 sec	30 sec	15 sec	10 sec

Photographing the Sun

*** WARNING ***

NEVER look at the Sun directly through any optical instrument. Even the briefest exposure WILL destroy your eyesight.

Ensure that any solar filter you use has been specifically designed for the purpose you intend using it for. Make sure any solar filter you use is in good condition before fitting it to your telescope.

Never use a solar filter designed for an eyepiece. The glass used for these can suddenly crack with disastrous results.

Remember the Siberia 150 is fitted with a x8 finderscope which is capable of projecting an intense beam of light behind it. Make sure the finderscope is covered before using the telescope for solar work. Better still, remove the finderscope altogether.

The Sun produces the same image size as the Moon and it can be photographed directly through the telescope just so long as an over-the-aperture Mylar or metal on glass filter is used.

You will still need to align your telescope to the celestial pole and if you are working away from your usual observing site, it may be practical to use a compass for rough positioning.

Fit the aperture stop over the front of the telescope and attach your filter to the outside of it so the aperture is completely covered.

If you have a square solar filter, it should be possible to devise a simple method of holding it in position.

Large solar filters are available which can be fitted over the entire front of the telescope, although cost will be proportional to size.

Aluminized Mylar filters tend to render the Sun pale blue on colour film and this can be improved by the addition of a #21 orange or #23 light red filter. Metal on glass filters provide a more pleasing yellowish look. To take photographs, you can attach your camera body to the M42 ring built in to the telescope's focuser.

It may be possible to use your camera's TTL metering system for exposure evaluation if you have a spot metering facility. On the other hand, you may be able to use a normal centre weighted TTL meter if the subject matter is large enough. This would arise if you were using a teleconverter or eyepiece projection. However bracketing is still recommended.

It is difficult to be specific about exposure times, although a typical aluminized Mylar filter will allow you to use a shutter speed of about 1/125 sec at f/8 with an ISO 100 film. Check the suggestions made by the manufacturer of the filter.

Solar Eclipses

There are two types of solar eclipse. The first is known as an annular eclipse, which occurs when the Moon is at apogee and its size appears to be marginally smaller than the Sun. As a result, we see a bright ring of fire surrounding the Moon's dark disc. This type of eclipse may only be observed and photographed by the projection method or by using one of the specialised filters already mentioned.

The second more spectacular form of solar eclipse is when the light of the sun is completely blocked by the Moon and we are left with just the corona. During totality, it is quite safe to look directly at the Sun and take photographs without eyesight protection.

If you are using your Siberia 150 to photograph a total eclipse and have a camera attached for prime focus photography, remember to cover the aperture or replace the filter immediately the Sun moves out of totality. Use a slow film and choose colour. This spectacular subject really is wasted on B&W film.

Exposure Suggestions for a Total Eclipse of the Sun

NO FILTER, ISO 50 FILM

	f8	f/11	f/16	f/22	f/32	f/45

Diamond Ring	1/500		1/250	1/125	1/60	1/30	1/15	
Prominences		1/250		1/125	1/60	1/30	1/15	1/8
Inner Corona		1/60		1/30	1/15	1/8	1/4	1/2
Outer Corona	1/4		1/2	1*	2*	4*	8*	

NO FILTER, ISO 100 FILM

Diamond Ring	1/1000	1/500	1/250	1/125	1/60	1/30		
Prominences		1/500		1/125	1/60	1/30	1/15	1/8
Inner Corona		1/125		1/60	1/30	1/15	1/8	1/4
Outer Corona	1/8		1/4	1/2	1*	2*	4*	

* Accurate guiding is essential to prevent blur.

Looking After Your Camera

Use paper tissue and proper lens cleaning fluid for your filters and lenses. Blow away loose particles with a blower brush or an air spray.

Do not over-clean lenses or filters. Never touch or attempt to clean an SLR camera's mirror.

If you have a mechanical SLR, it is usually better to leave the shutter un-tensioned while the camera is not in use.

Remove the batteries if you plan to store the camera for a period of time.