

Beginners Guide to Back Yard Astronomy

Tips for Students and Novices:

There are a lot of different telescopes available to the amateur astronomer these days. Newtonians, Refractors or Catadioptrics. Please see our "**telescope types**" page for more details. As a general rule bigger is better but not always practical or possible, but when starting out, as a minimum we would recommend a good quality 60mm Refractor, a good quality 114mm Reflector or if money permits a good quality 100mm Maksutov Cassegrain. Galileo only had a 30mm Refractor while Newton's first Reflector was only about 50mm. So in comparison the size and quality of the telescopes we have available to us these days is absolutely superb.

Try and make sure the telescope has good quality 1.25" eyepieces and has a solid mount. A good finderscope is also desirable. Please see our "**how to choose a telescope**" page for more details which can help you in selecting a suitable telescope.

Getting the most out of your Telescope

So you have a telescope, but how do you get the most from it?

Before you point your telescope to the night sky bring it out during the day and practice using it on various objects (**Warning NEVER look directly at the sun without proper sun filter protection**).

Mount: Familiarise yourself with knobs, levers and buttons, try different eyepieces. If possible set up your telescope on a solid level surface and keep the tripod/mount as low as practical while maintaining a comfortable viewing position. View a object at medium to high power, see how long it takes for the vibrations to stop after you have bumped the telescope, the quicker the vibrations stop the better. You can try and improve the vibration test by making sure all bolts, knobs and levers are tightened (caution do not over-tighten as you may strip threads). You may also want to try placing or supporting a weight to the centre of the tripod. If your telescope uses counter weights make sure it is balanced correctly. These steps will help to ensure your mount will be more stable.

Finderscope: This is also a great opportunity to align the finderscope. Finderscopes on most telescopes are pretty cumbersome and difficult to get right so adjusting it during the day will save you a lot of stress at night. Select a small object and centre it in the field of view of your telescope, make sure all levers are

locked so that the telescope does not easily move. Now centre the same object as in the telescope, in the cross hairs of the finderscope by turning the finderscope adjustment screws. Check both the telescope and finderscope alternatively to make sure the telescope is not moving while you are making the adjustment. This procedure may take a few attempts, as it is rather fiddly. Once you are happy with the alignment, be careful not to bump the finderscope again, as most finder scopes are easy to put out of alignment.

Night Acclimatisation and Dark Adaptation

Now that you are familiar with your telescope you are ready to explore our magnificent universe. To try and get the most out of your observing session here are a few pointers which will give you the best opportunities to see more detail, colour and fainter objects. Take your telescope outside at least half an hour before you plan to observe, this should allow most telescopes enough time to adjust to the outside air temperature. When your telescope is in the process of stabilising its temperature the glass or mirrors may slightly distort in shape, causing the image to be fuzzy, also heat haze dissipating from a mirror may also cause the image to suffer. Try and set up your telescope in the darkest possible place, away from stray light, and wind that will cause the telescope to vibrate.

Just as your telescope needs time to adapt so do your eyes. Generally your eyes take about 20 minutes to fully adapt to the dark but only a split second of bright light to lose it. So avoid exposure to bright lights during your observing session, even a distant street light or a dull house light can be annoying. When using star charts make sure you are using a dull " red light torch ", this will help keep your eyes dark-adapted. If there is stray light around try shielding yourself and your telescope from it. You can create a crude shield by rolling up some cardboard and extending the tube of your telescope, this will reduce the amount of stray light that enters from the side of your telescope striking the objective lens or secondary mirror. This can also act as a dew shield. If there are any other areas in which stray light can enter, an open primary mirror for example, try shielding it also. Please remember to balance your telescope again if any of the extensions have any significant weight. You may also want to try covering your head with a dark cloth, which hangs past the eyepiece, when you are observing, just like the way photographers used cover their heads to take photos in the early days of photography. All the above pointers do indeed sound like a lot of trouble to go to, but they do help in trying to get the best out of your observing session but are by no means essential.

Viewing, Eyepieces and Magnification

The viewing or seeing conditions is a big factor on how well an object will appear in your optical instrument. One night you may be able to see exquisite detail at high magnification and on another night every thing may seem blurry and you must use low magnification, so it is important to try and pick a good night to observe. The best time to view is early in the morning before sunrise. This is because the earth has given off a lot of stored heat and the air is generally calm, but don't despair if you are not an early bird, as excellent views are still available at more civilised hours. Avoid looking at objects where your telescope has to point over nearby roof tops as these roof tops will be radiating built up heat collected during the day and will cause the object you are observing to be fuzzy. Your best views will come from objects that are high in the sky, this is because we are looking through less atmosphere. Objects that are low in the sky towards the horizon will show less clarity and detail as we are also looking through variables such as heat and pollutants trapped in our lower atmosphere as well as a longer layer of atmospheric belts due to the curvature of the earth. This is why you may notice that stars that are lower in the sky twinkle more than stars that are directly above. From this you can see that a quick method of determining the viewing conditions is to see how much the stars are twinkling. The less twinkling the better the viewing conditions should be. You will soon learn how to pick the good nights after a bit of experience.

When you have your sights (finderscope) set on an object it is best to use the lowest magnification eyepiece on your telescope to start with. This is the eyepiece that has the longest focal length (largest mm) marking on it, (K25mm) for example. These low magnification eyepieces give the widest field of view, which will give you a better chance of making sure your selected object will be in the field of view when you look into the eyepiece. Apart from that low power, wide field eyepieces give you the brightest images making the object more visible. Once you have centred the object in the field of view you can try increasing the magnification by changing eyepiece to a shorter focal length (smaller mm) or by using a barlow lens. Calculating the magnification your particular eyepiece will give, is quite simple, and you can find out how on our "**eyepiece types**" page.

Where to start looking

The best place to start would be to observe the brighter objects like the moon and planets, then later when you feel more confident move onto the fainter objects such as nebula and galaxies.

The best time to observe the moon is when it is just over half phase or less, you will be able to see more detail as there is more contrast and shadow.

The most interesting and also the easiest planets to observe are Venus with its changing moon like phases. Unfortunately Venus is a planet covered in thick gas

clouds which does not show any great detail apart from its changing phases in modest size telescopes. Mars can reveal some beautiful detail especially with larger telescopes. You can see the polar ice cap and lots of surface colour variations. If you have a smaller telescope the best views will come when it close to our Earth approximately every two years. Jupiter however, can be seen well in even the smallest telescopes, you will be able to see some of the major cloud belts as well as four of its moons which if you observe long enough will reveal their rotation around the planet. Majestic Saturn is a fantastic sight. Small telescopes will be able to show you the famous rings. Larger instruments will show detail in the rings as well as the planets cloud belts.

The easiest way for the eager amateur astronomer who can't wait to look at nebulae, galaxies and other deep sky objects, is to go out on a clear night and look for faint fuzzy spots in the night sky. You can use either the unaided eye or a pair of binoculars, (binoculars themselves are a great observing tool) and then turn your telescope to your discovered fuzzy spot. This will most probably be a nebula, galaxy or star cluster. However the best way for the beginners, is to use star charts or maps to identify objects you want to look at, this way you will learn more about the night sky. A book like the Australian Astronomy 2004 is ideal.

The best way to view these objects is to start with a low power, wide field eyepiece. This will give you a clearer brighter image. Once you have centred the object in the field of view you can start to try higher magnifications to see if you can see more detail. This will require some experimentation on your behalf as the image quality can vary greatly from one power to the next. Also as previously discussed the seeing conditions can also be different from night to night. You would have already noticed that your object drifts out of your field of view due to the rotation of the earth. The best way to maximise your observation is to position the object at the other extreme of the field of view, this will let the object stay in your field of view longer, before it drifts out again. This also gives the telescope time to stop vibrating after you have let go of the controls, thus giving you a steady image. The other way around this is to install a clock drive or motor drive on your telescope. This motor drive compensates for the rotation of the earth, thus leaving the object centred in your field of view. Telescopes with motor drives require alignment to the south celestial pole in order for the tracking to work accurately. For fainter objects, (even for brighter ones if you like) you can try using a technique called Averted Vision. This is where you do not look directly at the object but rather look away from the centre of the object towards the sides of the field of view, only just far enough from the centre of the object so that you get the best view. You will be using a more sensitive part of your eye to get the light from the object, which will give you a brighter view. It sounds strange and will feel strange and take some concentration and patience, but it works, and with practice it will work for you also. So this all means that getting the most detail from the objects you observe is an acquired art. It takes time practice and patience

Do's and Dont's

The following list contains some important recommendations which you should know about that will enable you to get the most enjoyment out of your telescope or binoculars.

Never use telescopes, Binoculars or your un aided eye to look at the sun without using proper "SOLAR FILTER" protection. Only use certified full aperture filters, or solar projection method. Do not under any circumstances use solar filters that screw into the eyepieces as the heat from the magnified solar energy can crack the eyepiece/filter and permanently blind you. This also applies to your finderscope.

Never Leave your telescope or binoculars outside unattended where children may accidentally look at the sun through it. Children must always be supervised when using optical equipment.

Never Leave eyepieces or lenses lying around exposed the sun as the suns rays may be magnified and start a fire.

Always observe Electrical safety recommendations which come with the telescopes and never exceed the maximum safe working voltages.

Never clean the large internal mirrors on a telescope unless you are competent of doing it properly, this is best left for an experienced service centre. The mirrors are best left alone and very rarely (Years) require that degree of cleaning. A layer of fine dust on the mirror is not really a major problem.

Before cleaning any lenses or eyepieces always blow off any small solid materials off the glass surfaces to avoid the risk of scratching.

Never use any harsh solvents to clean your eyepieces or lenses as these fluids can permanently damage the special coatings which are applied to the glass surfaces. Only use recommended cleaning materials.

Do not expose your telescope or binoculars to impacts or shock as this can put them out of alignment or in severe cases can damage the glass or mechanics.

After using your telescope or binoculars do not wipe off any condensation which

may have formed on the lenses, mirrors or eyepieces, it is best to leave them uncovered and allowed to dry naturally.

Always store your telescope in a dry environment and if practical have mirrors, lenses or eyepieces facing down or covered well to try and avoid dust settling on the surfaces.

Never over tighten screws or bolts as this may result in damage to the threads or components attached to them.

Never use force on any optical or mechanical components on your telescope as you may permanently damage them. The telescope is a precision apparatus and should always be treated with great care. If something does not want to screw on or move correctly, just pause and gently try again.

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Cleaning Telescope Optics

It is recommended that before cleaning any optics you check with the instruction manual or manufacturer to see if they have any preferred cleaning techniques. If you are unable to check then the following process will be able to provide you with a reliable cleaning method.

It is very important that you do not clean your optics out in the field as you risk damaging them by exposing them to dirt and dust etc. You should always clean your optics in a clean environment. Make sure you are in a bright natural or white light environment.

But as the old saying goes "prevention is better than cure" so please try and take care of your optics and avoid unnecessary exposure to dust, in other words always cover your optics well when not in use.

Cleaning Eyepieces and Lenses

1. Prepare your materials and your work environment. Make sure you have the following materials available.

A clean work area such as a clean kitchen bench, place a clean lint free towel down on the bench where you are going to work.

A quantity of De-ionised or distilled water.

A blower bulb or other pressure duster. (not compressed propellents)

An extremely soft camels hair brush.

Some Cotton Buds, Cotton Wool balls, lens or facial tissue. Do not use any tissues with oils or perfumes like lavender. (Preferably sterile)

Store your cleaning materials in a clean sealed plastic zip bag and do not touch the ends of cotton buds with your fingers. (There is no use in using materials that have been contaminated before you even start to use them).

Pure alcohol or alcohol containing only water as the other ingredient. If you use other types they may contain oils or perfumes which will leave streaks on your optics. Do not use nail polish remover.

2. Use the blower bulb to blow off any deposits of solid material on the lens surface such as dirt and dust. Do not use your breath as water droplets can get on the lens, causing spots. If the lens has particles that cannot be blown off you can try to remove them by gently flicking the camel brush in an upward motion away from the lens surface do not brush the lens while the particle is still there, or moisten (do not soak) a tissue or cotton bud with distilled water and gently dab the surface, without rubbing. Once dry use the air bulb again to blow off any more dust if necessary.

3. Moisten (do not soak) a cotton bud or tissue with an alcohol mix of 75% alcohol and 25% distilled water and gently wipe from the centre to the outer edge using a circular motion. Move your cotton bud or tissue slowly enough to allow the cleaning fluid to leave an evaporating trail just behind the cotton bud or tissue. You may need to do this several times in order to clean properly. Remember to use a clean tissue each time, this will reduce the chance of putting contaminants back on your lens and possibly scratching it. Make sure you now do not touch the glass surface with your fingers as you will cause smudges. An important note is to not use too much liquid at the edge of your lenses as capillary action could drag the liquid inside. The liquid alcohol mix itself is not a problem but as it makes its way inside it can bring in dissolved oils from the eyepiece or lens and leave this oil residue behind after the alcohol mix has evaporated.

4. Check your work by fogging the lens surface with your breath, you will be able to see how clean the lens is by the way the fog evaporates from the surface. This is also a good way to finally clean any small water spots that may be left, simply fog the spot up and wipe with a cotton bud or tissue. Some tissues may themselves leave dust, so after you have finished you can do a final dust blow off with the air bulb. Repeat the process if required.

5. Once you have finished, store your eyepieces back in their sealed canisters. It is

a good idea to even give your eyepiece canisters a clean once in a while.

IMPORTANT NOTE: Acetone can damage plastic and painted surface use alcohol only. This is especially the case with binoculars and cameras.

Cleaning Primary Mirrors: at your own risk.

1. Prepare your materials and your work environment. Make sure you have the following materials available.

A clean work area such as a clean kitchen bench, place a clean lint free towel down on the bench where you are going to work.

A quantity of De-ionised or distilled water.

A blower bulb or other pressure duster. (not compressed propellents)

A clean vessel or pan large enough to hold your mirror. Make sure the vessel drains the water away. (a clean kitchen sink can be used)

Sodium Lauryl Sulphate Soap (mild soap) (Palmolive).

Some Cotton Buds, Cotton Wool balls, lens or facial tissue. Do not use any tissues with oils or perfumes like lavender. (Preferably sterile)

Store your cleaning materials in a clean sealed plastic zip bag and do not touch the ends of cotton buds with your fingers. (There is no use in using materials that have been contaminated before you even start to use them).

Please make sure you have a firm grip on the mirror in all phases of the cleaning process. It will also be worth while removing any jewelry you have on your hands or wrists.

2. Use the blower brush to blow off any deposits of solid material on the mirrors surface.

3. Place a clean lint free towel in the bottom of your vessel or container, this will help protect the mirror from damage by softening any impacts against the vessel. Place your mirror in the vessel or container and raise it on an angle so that water can run off it. Make a solution of luke warm soapy water (not too much soap) in a jug and pour it over the mirror, rinse the vessel and towel. Repeat this process until you are happy you have removed any contaminants which may scratch the mirror surface during contact cleaning.

4. Leaving the mirror inclined in the vessel use the cotton wool balls to very gently wash the mirror surface with a clean solution of luke warm soap and water, be sure not to let the solution dry on the surface as a stain may result and you will have to repeat the cleaning process by gently rubbing the stained area as well as the rest of the mirror surface. Use a very gentle swirling motion while rubbing.

5. Use the clean distilled water to rinse off the mirror in order to remove the soapy solution from the surface.

6. Remove the mirror from the vessel and allow the mirror to stand securely on its side so that excess water will run off.

7. Inspect the mirror for stains. If there are any then repeat steps 3 to 6.

8. Dry the edges of the mirror using a tissue to avoid staining the mirror from any excessive water run off.

IMPORTANT NOTE: Primary mirrors should be cleaned as less often as possible. Usually year(s). A layer of fine dust will not compromise the optical performance of your telescope, so do not go cleaning your primary mirror unless you absolutely feel you have to. Also the cleaning procedure can be tedious and unless you feel confident in doing the job properly you are best to leave it for an experienced service center.