INSTRUCTION MANUAL

Orion® Premium Deep Space Explorer™ 10" & 12.5"

#23013, #23016, #23017, #23019, #23020, #23022

Dobsonian Reflecting Telescope

	2" Low Profile Focuser	1.25" Rack & Pinion Focuser	2" Rack & Pinion Focuser	2" Crayford Focuser
10"DSE	#23013	#23022	#23019	#23016
12.5" DSE	NA	NA	#23020	#23017

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IN 055 Rev B 0199

Congratulations on purchasing an Orion Premium Deep Space Explorer telescope! It is a precision instrument designed exclusively for astronomical observation. With its enhanced Newtonian optical system and its easy-to-use Dobsonian mount, you'll enjoy countless views of fascinating celestial objects.

If you have never used a telescope before, we would like to welcome you to amateur astronomy. Take some time to familiarize yourself with the night sky. Learn to recognize the patterns of stars in the major constellations. With a little practice, a little patience, and a reasonably dark sky away from city lights, you'll find your telescope to be a never-ending source of wonder, exploration, and relaxation.

Table of Contents

1. Important Points About Your Telescope

To get the most out of your new telescope, take the time to read this instruction manual thoroughly. The following suggestions, in particular, should be heeded.

1. Never look directly at the Sun without a proper, professionally made solar filter. Doing so could cause permanent eye damage or even blindness. Never use a dark-glass solar filter that threads into an eyepiece; it may crack under the intense heat that builds up at the focal plane.
2. Like all reflector telescopes, performance is best after the telescope has cooled to the outdoor temperature for at least an hour (longer in colder climates). If possible, store the telescope in a cold place, such as a garage, to minimize the cooling time. It's best to observe with low powers until the telescope has equilibrated.
3. Observe from a dark location, away from street and porch lights. Your eyes take 10 to 30 minutes to adapt to the darkness. Use a red-filtered flashlight to preserve your dark-adapted night vision; a white light can greatly and instantly reduce your low-light sensitivity.
4. Keep your telescope's mirrors in good optical alignment (collimation). The technique for collimation is easily learned (see section 5). Adjustment is required only occasionally, and performance will be noticeably improved.
5. Never lubricate the bearing surfaces of your Dobsonian telescope. Doing so reduces the bearing friction and causes the telescope to move too freely. The inherent friction of the bearing surfaces is an important part of the telescope design.

WARNING: ***Never look directly at the Sun through your telescope or its finder scope—even for an instant—without a professionally made solar filter that completely covers the front of the instrument, or permanent eye damage could result. Young children should use this telescope only with adult supervision.***

2. Terminology

Altitude Bearings The two round hubs on opposite sides of the optical tube, which rest in the cradle of the Dobsonian base. They allow the telescope to be pivoted up or down (altitude).

Altitude Bearing Pads The pads of material on the Dobsonian cradle where the optical tube altitude bearings rest.

Azimuth Pads The white Teflon pads between the two base plates, which allow the telescope to be moved side to side (azimuth).

Azimuth Pivot Bolt The bolt through the center of the two baseplates, which serves as a pivot point for azimuthal rotation.

Collimation Alignment of the optical elements of an instrument. Proper collimation is necessary to achieve peak optical performance.

Ground Baseplate On the Dobsonian base, the round board closest to the ground. It often has "feet" on the underside and three azimuth bearing pads on the perimeter of its upper surface.

Dobsonian Mount A type of simple, cabinet-style altazimuth mount for a Newtonian reflector, invented by John Dobson of the San Francisco Sidewalk Astronomers club.

Ebony Star Pebbly Formica surface on the azimuth axis on which the Teflon pads make contact, providing buttery smooth movement.

Eyepiece A lens-containing barrel that magnifies the image formed by the telescope and allows your eye to focus on it. Eyepieces of different focal lengths will produce different magnification factors.

Finder Scope A highly recommended optional accessory. It is a small, low-power refracting telescope, usually with crosshairs, which mounts on the optical tube of the main telescope to aid in pointing the telescope. Its wide field of view facilitates the location of target objects. When properly aligned with the main telescope, an object centered in the finder scope will also be centered in the main telescope's much narrower field of view.

Focuser A type of mechanical holder for the eyepiece that enables the eyepiece to be moved in and out to achieve sharp focus of the viewed image.

Optical Tube The main body of the telescope, which houses the optics.

Optical Tube Handles Premium Deep Space Explorers come with two handles to assist in lifting the optical tube onto and off of the Dobsonian cradle. The handles are attached to the altitude bearings on opposite sides of the optical tube.

Primary Mirror The large, concave mirror located at the back end of the optical tube. It reflects incoming light to the secondary mirror near the front of the tube.

Primary Mirror Cell The mechanical holder for the primary mirror. It features alignment-adjusting bolts (usually three) that allow exact positioning of the tilt of the primary mirror.

Secondary Mirror The small, elliptically shaped, flat mirror located inside the optical tube beneath the focuser. Its function is to divert the light transmitted from the primary mirror sideways into the focusing tube.

Secondary Mirror Holder The mechanical holder for the secondary mirror; usually a single stalk or an adjustable multivane "spider".

Top Baseplate On the Dobsonian base, the uppermost of the two round boards, which rests atop the ground baseplate. It supports the vertical struts of the telescope tube cradle. The top baseplate rotates on the ground baseplate, allowing the telescope to be moved in the azimuthal direction.

3. Assembly

Unpacking Your New Telescope

The telescope is packaged in three boxes, one containing the telescope tube, another containing the optics, and the other containing the unassembled Dobsonian base and hardware. Exercise care when unpacking the boxes. We recommend keeping the original shipping containers; in the event that the telescope needs to be shipped to another location or returned to Orion for warranty repair, having the proper shipping containers will help ensure that your telescope will survive the journey intact.

Parts List

Qty.	Description
1	Optical Tube
1	Primary Mirror Cell
1	Ground Baseplate
1	Top Baseplate
2	Cradle Sides
1	Cradle Front Brace
8	Wood Screws (socket-head)
4	Black Plastic Screw-head Caps
1	Azimuth Pivot Bolt
1	Cylindrical Nylon Bushing
1	Locking Nut
2	Nylon Washers
3	Wood Feet
3	Self-tapping Wood Screws (Phillips-head)
2	Optical Tube Handles
1	26mm Sirius Plössl Eyepiece (1.25" barrel diameter)
4	Primary Mirror Cell Mounting Bolts (socket-head)
2	Allen Wrenches

Assembly of the Dobsonian Base

Before the telescope can be used, the base must be assembled (refer to Figure 1, page 11). This has to be done only once, unless you disassemble the base for long term storage. The assembly process takes about 15 minutes and requires a Phillips screwdriver, the Allen (hex) wrench provided, and two 1/2" crescent wrenches, or a combination of a common wrench, crescent wrench, or pliers.

Note: When tightening screws, tighten them by hand until firm, but be careful not to strip the holes by overtightening. If you use an electric screwdriver, do final tightening by hand.

1. Screw the wood feet into the underside of the ground baseplate (A) using the self-tapping wood screws provided, with a Phillips screwdriver. Position the feet on the underside of the ground baseplate from the preinstalled Teflon pads, directly beneath them.
2. Loosely attach the front brace (B) of the cradle to the two sides (C) with four of the eight socket-head wood screws in the predrilled holes, using the large Allen wrench provided. Do not completely tighten the screws yet.
3. Attach the two sides (C) to the top baseplate (D) with the remaining four socket-head wood screws in the predrilled holes. Tighten all four screws.
4. Tighten the four side screws installed in step 2, then press on the black plastic screw-head caps.
5. Insert the nylon bushing (E) into the hole in the center of the top baseplate (D). Tap the bushing so it goes all the way into the top baseplate and part way into the ground baseplate (A). The bushing should be flush with the top surface of the top baseplate (D).

6. Place a nylon washer (F) over the long pivot bolt (G), then insert the bolt up through the bottom of the ground baseplate (A) and through the nylon bushing. Now put on the remaining nylon washer (H) and the locking nut (I). Tighten the nut just enough to allow a slight separation of the top baseplate from the ground baseplate when the mount is lifted. The purpose of the nut is only to keep the two pieces from coming apart when moving the telescope.

IMPORTANT! Overtightening the nut will make the mount difficult to rotate in the azimuthal direction.

Installing the Optical Tube Handles

Premium Deep Space Explorers come with convenient handles to help in lifting the optical tube onto and off of the Dobsonian cradle. They also serve as levers for turning the telescope on the azimuthal axis when the scope is pointed near the zenith (straight overhead).

The handles attach to the altitude bearings (disks) on opposite sides of the optical tube (refer to Figure 2). The handles should be mounted in the center position on each of the bearings. Using the provided Allen wrench, remove the bolt that resides in the center hole.

To connect the handles to the altitude bearings, first remove the nut and washer that is on the threaded shaft of each handle. Insert the threaded shaft into the center hole in the altitude bearing. Rotate the handle clockwise until the shaft threads all the way into the hole. Now, re-attach the nut and washer to the end of the threaded shaft from the inside of the telescope. This will require reaching up into the optical tube. This is easiest to do if the telescope is resting on its side. Use a crescent wrench to tighten the nut firmly.

Installing the Primary Mirror

Leave the protective covering on the primary mirror until just prior to installing it in the telescope tube. This is a first-surface mirror and, while tough enough to survive years of use without recoating, it nevertheless must be handled with extreme care. Do not touch the mirror's aluminized surface or allow dirt and dust to build up on it, as this could scratch the coating and compromise the optical performance.

When you're ready to install the mirror in the optical tube, follow these steps:

1. Remove the protective tissue from the primary mirror. Set the mirror cell on the floor in a clean room.
2. Carefully ease the tube over the mirror and mirror cell so that the predrilled holes on the perimeter of the mirror cell line up with the holes at the base of the optical tube.
3. With the socket-head mounting bolts and the large Allen wrench provided, secure the mirror cell into place.
4. You'll adjust the alignment of the primary mirror later, in Section 5.

Placing the Optical Tube on the Dobsonian Base

Lift the optical tube by the handles on the altitude bearings and set the tube down so the bearings rest in the "cradle" of the base, as shown in the front cover picture. For the larger models, we recommend getting a friend to help lift the optical tube. Once in the cradle, the tube should pivot freely up and down with gentle hand pressure. Note that the tube may not be precisely balanced yet, however, since the eyepiece is not in place. Proper balancing may require the use of an optional counterweight system.

4. Using Your Telescope

Your Orion Premium Deep Space Explorer Dobsonian telescope is one of the easiest telescopes there is to use. You will be surprised at the simplicity of operation, ease of manual tracking, and exceptional optical performance. To get the most out of your telescope, read this section carefully.

Use a Finder Scope

An optional finder scope is highly recommended to assist in aiming the telescope. It will help in locating objects and centering them in the main telescope's field of view. An 8x50 finder scope or larger is recommended.

Your Premium DSE comes with two predrilled holes for an Orion 8x50 or 9x60 finder scope bracket. The holes are located a few inches from the focuser. If you purchased an optional finder scope, you will want to install it before using your telescope.

Hardware is not provided for attaching the finder scope since the user could decide to put one of many different finder scopes onto the Premium Deep Space Explorer, each of which might require different nuts and bolts. For the Orion 8x50 or 9x60 finder scopes, we recommend using 10-24 x 1" slotted machine screws and the corresponding nut, accompanied with washers, to fasten the finder to the main telescope. These items are available from any hardware store. To minimize stray reflections, you can mount the finder scope with the screws inserted from the inside of the tube out.

To install other finder scope models, you will need to drill the holes yourself. Choose a position for the finder scope which is directly on top of the telescope tube when the tube is aimed at the horizon, near the focuser. Position the telescope tube so that it is lying horizontally, parallel to the ground. Mark the spots for drilling mounting holes. Drill holes the same size as the bolts being used. Be careful not to let dust or debris fall onto the mirrors. You may want to cover the secondary mirror with a soft tissue or a plastic bag while you are installing the finder scope.

Aligning a Finder Scope

The finder scope and the telescope should be aligned to point to exactly the same spot in the sky. Alignment is easiest to do in daylight hours, before your observing session. Choose a treetop, telephone pole, street sign—anything that is far off in the distance, at least 200 yards away. Put that image in the center of the field of your telescope's eyepiece. Where is it in your finder scope's eyepiece? Hopefully, the image will be in the field of view and some simple adjustments on the alignment screws of the mounting bracket will put the image dead-center in the crosshairs.

By loosening one alignment screw and tightening another, you can change the line of sight of the finder scope. Continue making adjustments to the various alignment screws until the image in both the finder scope the telescope's eyepiece is exactly centered. Check the alignment by moving the scope to another object and fixing the crosshairs on the exact point you want to look at. Then look through the telescope's eyepiece to see if that

point is centered in the field of view. If it is, the job is done. If not, make the necessary adjustments until the two images match up.

Finder scopes often come out of alignment during transportation of the telescope from site to site, so check the alignment before each observing session. One way to help minimize any misalignment is to keep the bolts that attach the finder scope bracket to the main telescope tube very tight.

Transporting the Telescope

The telescope is easy to take wherever you want to do your observing. There are only two pieces to deal with: the optical tube and the base. Don't be afraid to load the telescope into your car for a trip to the hills. Common sense prevails: as long as the telescope doesn't bounce around, it won't get damaged in transit.

Naturally, you should be extra careful not to damage any bearing surface, which could hinder the smooth movement of the telescope.

Carry the telescope tube and the base separately. For the 12.5" model you will need a second person to assist you in lifting and carrying the individual components. Be especially careful when passing through doorways with the optical tube: knocking it against the door frame doesn't do the mirror alignment any good!

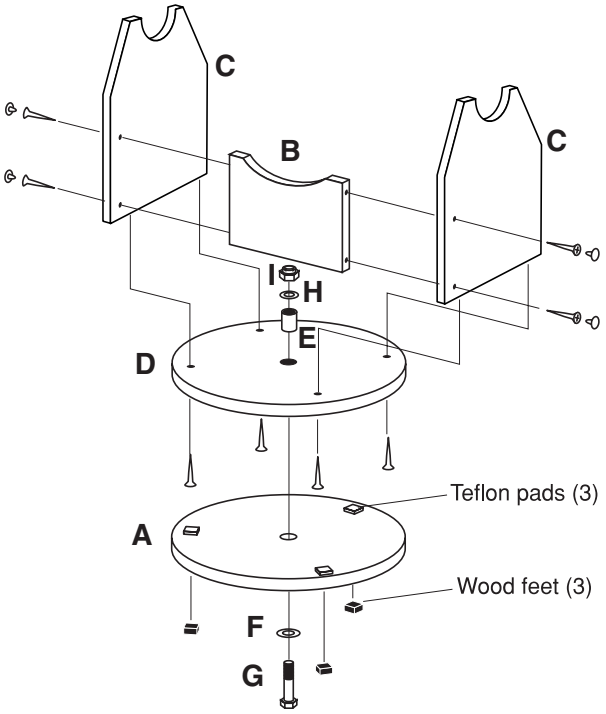

Figure 1. Premium DSE Base Assembly

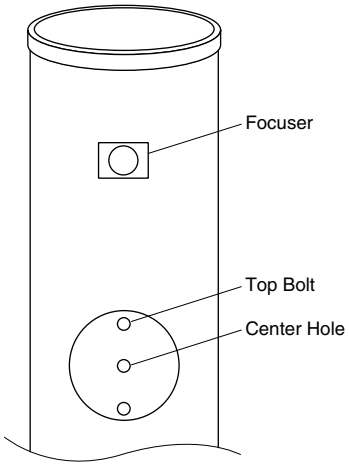

Figure 2. Installation of Tube Handles

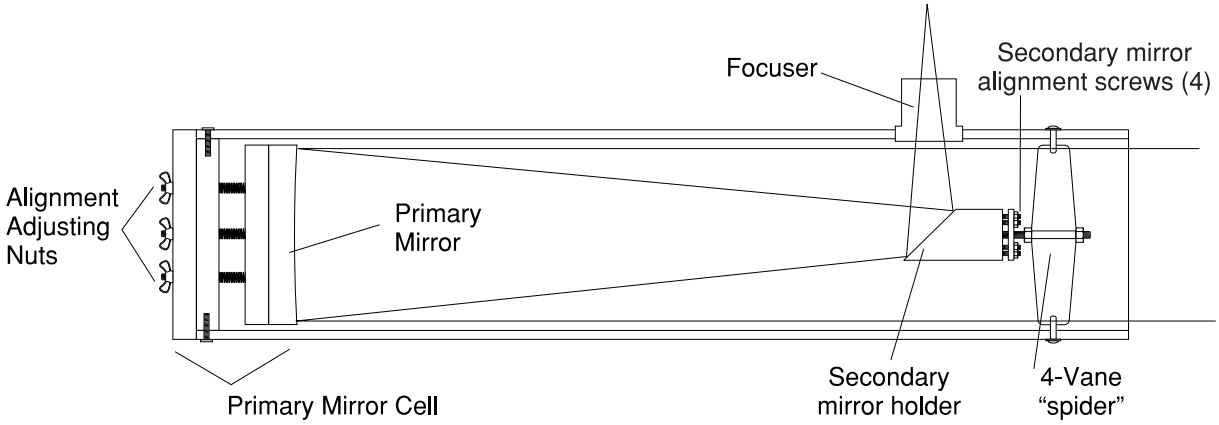

Figure 3. Primary and Secondary Mirror Collimation Points

Set-Up and Field Use

When selecting a location for observing, get as far away as possible from direct artificial light such as streetlights, porch lights, and automobile headlights. The glare from these lights will greatly impair your dark-adapted night vision. The telescope should be set up on a relatively level surface for proper operation of the mount. A grass or dirt surface is preferable to asphalt, because asphalt radiates more heat, which disturbs the air and degrades images.

It's best also to escape the light-polluted city sky in favor of dark country skies. You'll be amazed at how many more stars and faint deep-sky objects are visible in dark sky conditions.

Balancing the Optical Tube

Your telescope was balanced at the factory for the standard 26mm Plössl eyepiece and an optional 8x50 finder scope. Adding a different finder scope or an eyepiece of unusual weight to your telescope may affect its balance. If the scope moves by itself when you let go of the tube, you need to adjust the balance.

One possible source of imbalance is the position of the primary mirror itself. Within limits, the entire primary mirror can be moved up or down in the tube by tightening or loosening all of its alignment screws. This also will have the effect of moving the focal point of the telescope. Be sure you can still focus with all of your eyepieces.

In the event that repositioning the mirror did not cure the imbalance, an additional counterweight should be added to the telescope tube. Any heavy object that will stay on the tube can provide the needed ballast. Large metal washers hanging from a bolt or hook at the base of the optical tube will often do the trick. Or a fishing weight. Your Premium DSE has a 1/4"-20 threaded hole at the base of the tube for adding such a bolt.

There is only so much clearance between the base and the tube, though, so be sure any weight you add will not hinder the movement of the telescope.

A convenient "beanbag"-type counterweight system, designed exclusively for Dobsonian telescopes, is also available from Orion Telescopes & Binoculars.

Focusing the Telescope

Your Premium Deep Space Explorer came with the type of focuser you selected when you placed the order.

Insert an eyepiece into the focuser and secure with the thumbscrew. Look through the eyepiece and get a bright object in the field of view. Now, with your fingers, slowly rotate one of the focusing knobs (on a rack-and-pinion or Crayford focuser) or rotate the focuser drawtube (on a helical focuser) until the object comes into sharp focus. Go a little bit beyond sharp focus until the image just starts to blur again, then reverse the rotation, just to make sure you hit the exact focus point.

If you have trouble focusing, aim the telescope at a bright subject at least a few hundred feet away, such as a bright light. Rotate the focuser fully clockwise so that the drawtube is in as far as it will go. Now look through the eyepiece while slowly rotating the focuser counterclockwise. You should soon see the point at which focus is reached.

Tracking Objects With the Telescope

You will notice that the telescope moves on two axes: azimuth and altitude. The azimuth axis permits left-right motion (parallel to the horizon) via the rotation of the Dobsonian baseplate. The altitude axis allows up-down movement (perpendicular to the horizon) through the pivoting of the two altitude bearings in the cradle.

When viewing near the zenith (straight overhead), the scope can seem a little harder to move, especially in the azimuthal direction, since there's less leverage when the scope is pointed steeply upward. In this case, it may be easier to rotate the base of the scope with one hand, and raise or lower the tube with the other.

The focuser is a very handy point at which to move the telescope with your hand. Applying hand pressure here tends to equalize the force on each axis, and keeps your hands away from the front of the tube. Don't move the telescope around by the finder scope because you might knock it out of alignment.

One of the nice things about your telescope is how easy it is to follow the slow movement of a celestial object across the sky. You never have to release a brake or clamp to the scope, or tighten one once you are on the object. You simply give the telescope tube a gentle nudge or tug with one hand and it will glide on its bearings until you stop applying the pressure.

Celestial objects appear to move because of the rotation of the Earth on its axis. When you observe an object through the eyepiece, you'll see it slowly drift across the field of view. When it gets near the edge of the field, give the tube a slight tug or push to recenter the object. Objects will appear to move faster at higher magnifications, when the field of view is narrower.

Astrophotography

Premium Deep Space Explorers are not suited for astrophotography. A 35mm camera will not come to focus when mounted on the telescope.

5. Collimation of the Optics (Aligning the Mirrors)

Collimation is the process of adjusting the mirrors so that they are perfectly aligned with each other. Accurate alignment is important to insuring the peak performance of your telescope and should be done on a regular basis. Collimation is easy to do and you should become familiar with the procedure, as you will perform it often. Your telescope's optics were aligned at the factory, but may have jiggled out of alignment during shipment or with rough handling.

A simple star test will tell you whether the optics are properly collimated.

Star Testing Your Telescope

Point the telescope at a bright star and slowly rack the image out of focus with the focusing knob. If the telescope is correctly collimated, the expanding disk should be a perfect circle. If it is unsymmetrical, the scope is out of collimation. In reflectors and Schmidt-Cassegrains, the dark shadow cast by the secondary mirror should appear in the very center of the out-of-focus circle, like the hole in a doughnut. If the "hole" appears off-center, the telescope is out of collimation.

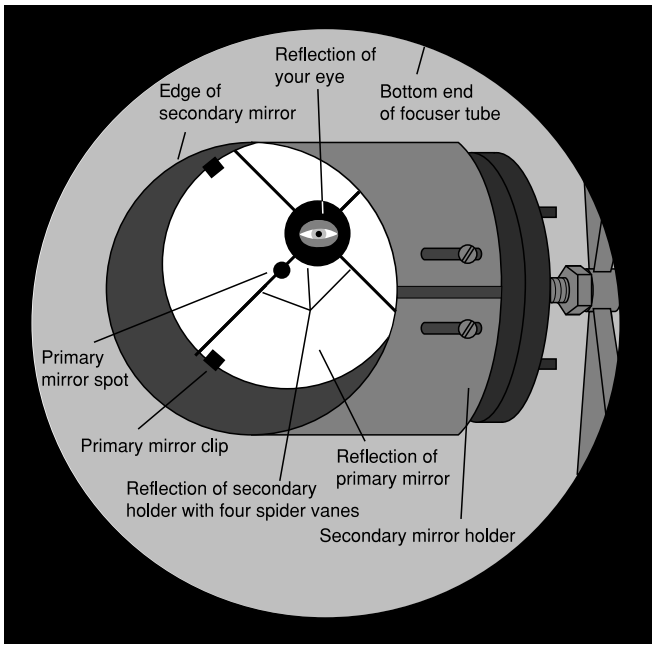

Figure 4A. The view down the focuser tube of a Newtonian reflector with eyepiece removed. In this example, the optical system is badly out of collimation.

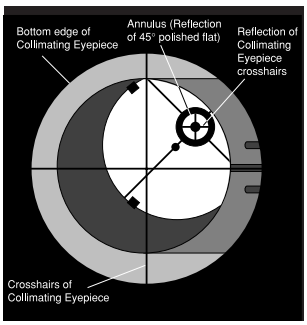

Figure 4B. Secondary mirror centered under focuser tube, viewed through the collimating Eyepiece (as are the next two illustrations).

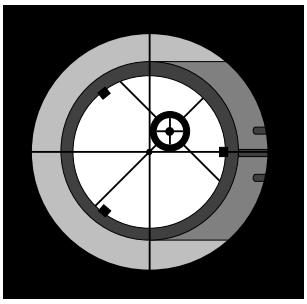

Figure 4C. Secondary mirror correctly aligned (tilted).

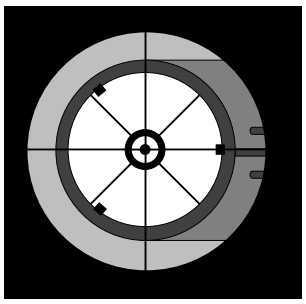

Figure 4D. Primary mirror correctly aligned. The telescope's optical system is now collimated.

Use a Collimation Tool

To aid in centering your line of sight down the focuser drawtube, and in centering the mirror reflections during collimation, it is very helpful to use a precision collimating tool containing crosshairs, such as the Orion Collimating Eyepiece #3640. We highly recommend that you purchase one, as you will use it for as long as you own this, or any, reflecting telescope.

Mechanically Centering the Mirrors in the Optical Tube

With the telescope pointed away from the Sun, stand a couple feet away from the front of the telescope and look down the optical tube. Check that the secondary (or diagonal) mirror is positioned in the center of the tube. Use a ruler if necessary to measure the distance from the center of the secondary mirror holder to the inside of the tube along each of the four "spider" vanes; the distance should be roughly the same along each vane. The spider adjustment is set at the factory, so it will probably be fine right out of the box.

Should you have to adjust the secondary mirror position, do so by turning the socket-head screws on the ends of the spider vanes; the screw heads are located on the outside of the optical tube (refer to Figure 3). You will need the small Allen wrench (provided) for this. Unthread one bolt a small increment while threading in the opposite bolt the same increment. Work with two bolts at a time until the mirror is centered.

Now check that the primary mirror is roughly centered in the optical tube. There should be an equal amount of space between the edge of the primary mirror and the inside of the optical tube all the way around. A quick visual inspection usually suffices. If the primary is obviously not centered, it will need to be repositioned in its mirror cell.

Centering the Secondary Mirror Under the Focuser

Next, if there is an eyepiece in the telescope, remove it. Look down into the open focuser drawtube at the secondary (diagonal) mirror. It should be centered in the field of view. You will see the secondary mirror and mirror holder as well as reflections of the secondary mirror and holder and the primary mirror, and your eye. It's pretty confusing, so refer to Figure 4A to sort them all out. (This figure shows what you would see if both the primary and secondary mirrors were out of alignment and the secondary mirror were not centered below the focuser tube.)

If the secondary mirror is not in the center of the focuser drawtube, it must be adjusted. It helps to put a piece of white paper on the inside of the optical tube opposite the focuser. The white paper forms a bright background behind the secondary mirror as you look down the focuser drawtube, making it easier to distinguish the mirror holder from the background.

The secondary mirror is moved forward and back on a threaded rod that extends from the secondary mirror into the four-vane spider center support. The threaded rod has nuts on both sides of the spider to hold it in place (see Figure 3). By threading the two nuts in one direction or the other, you can move the rod forward or back to correctly center the secondary mirror under the focuser. When you've achieved the correct position (Figure 4B), make sure the two nuts are threaded against the spider center support to hold the rod securely in place.

Adjusting the Tilt of the Secondary Mirror

Look in the focuser drawtube and see if the entire reflection of the primary mirror is visible and precisely centered in the secondary mirror. It's centered if there is an even ring of space between the reflection and the edge of the secondary mirror (Figure 4C). If there isn't, you'll need to adjust the tilt of the secondary mirror. (It helps to adjust the secondary mirror in a brightly lit room with the telescope pointed toward a bright white surface, such as white paper or a wall.)

First, loosen the four socket-head alignment screws in the secondary mirror holder enough to be able to rotate the holder with your hand. Now look into the focuser and rotate the holder slightly one way, then the other, until the reflection of the primary mirror is as centered in the secondary mirror as it will get. It still may not be perfectly centered yet, but that's OK. Now secure the holder in that rotational position by threading the four alignment screws back in.

If the entire primary mirror reflection still is not visible and centered in the secondary mirror, adjust the secondary mirror tilt further by alternately loosening one of the four alignment screws and tightening the opposite one a turn or so. Remember, the goal is to center the primary mirror reflection in the secondary mirror, as depicted in Figure 4C. Don't worry that the reflection of the secondary mirror (the smallest circle, with the reflection of your eye in it) and spider are off-center (as also is the case in Figure 4C); you'll fix that in the next step.

Adjusting the Tilt of the Primary Mirror

The final adjustment is made to the primary mirror. It will need adjustment if, as in Figure 4C, the secondary mirror is centered under the focuser and the reflection of the primary mirror is centered in the secondary mirror, but the small reflection of the secondary mirror (with your eye inside) is off-center.

The tilt of the primary is adjusted with the three wing nuts at the bottom of the optical tube, behind the primary mirror. Turn one wing nut at time, no more than one turn at a time, then look into the focuser again and see if the secondary mirror reflection has moved closer to the center of the primary mirror reflection. You'll soon get a feel for which wing nuts to turn in which direction and how far, until finally the secondary mirror reflection is dead center. (It helps to have two people for primary mirror collimation, one to look in the focuser while the other adjusts the wing nuts.)

The collimation bolts are spring-loaded, so once you achieve the correct mirror tilt, just leave the wing nuts as they are; the mirror will remain in the adjusted position.

The view through the Collimating Eyepiece should now resemble Figure 4D. The secondary mirror is centered in the focuser; the reflection of the primary mirror is centered in the secondary mirror, and the reflection of the secondary mirror is centered in the reflection of the primary mirror.

Your telescope is in precise collimation—optically primed for peak performance! Once again, confirm the collimation by conducting a star test.

6. Observing Tips and Techniques

Pick a location away from streetlights and bright yard lighting. Avoid viewing over rooftops and chimneys, as they often have warm air currents rising from them, which distorts the image seen in the eyepiece. Similarly, you should not observe through an open window from indoors.

"Seeing" and Transparency

Atmospheric conditions vary significantly from night to night. "Seeing" refers to the steadiness of the Earth's atmosphere at a given time. In conditions of poor seeing, atmospheric turbulence causes objects viewed through the telescope to "boil". If, when you look up at the sky with just your eyes, the stars are twinkling noticeably, seeing is bad and you will be limited to viewing with low powers (bad seeing affects images at high powers more severely). Planetary observing may also be poor. Make sure you are not looking over buildings or any other source of heat; that will also cause image degradation.

In conditions of good seeing, star twinkling is minimal and images appear steady in the eyepiece. Seeing is best overhead, worst at the horizon. Also, seeing generally gets better after midnight, when much of the heat absorbed by the Earth during the day has radiated off into space.

Especially important for observing faint objects is good transparency—air free of moisture, smoke, and dust. All tend to scatter light, which reduces an object's brightness. Transparency is judged by the magnitude of the faintest stars you can see with the unaided eye (6th magnitude or fainter is desirable).

Cooling the Telescope

All optical instruments need time to reach "thermal equilibrium" to achieve maximum stability of the lenses and mirrors, which is essential for peak performance. When moved from a warm indoor location into the cooler outdoor air, a telescope needs time to cool to the outdoor temperature. The bigger the instrument and the larger the temperature change, the more time is needed.

For your Premium DSE, allow at least 1 hour for it to equilibrate. If the scope has to adjust to more than a 40° temperature change, allow two to four hours. In the winter, storing the telescope outdoors in a shed or garage greatly reduces the amount of time needed for the optics to stabilize.

Do You Wear Eyeglasses?

If you wear eyeglasses, you may be able to keep them on while you observe, if your eyepieces have enough "eye relief" to allow you to see the whole field of view. You can try this by looking through the eyepiece first with your glasses on and then with them off, and see if the glasses restrict the view to only a portion of the full field. If they do, you can easily observe with your glasses off by just refocusing the telescope the needed amount.

Let Your Eyes Dark-Adapt

Don't expect to go from a lighted house into the darkness of the outdoors at night and immediately see faint nebulas, galaxies, and star clusters—or even very many stars, for that matter. Your eyes take about 30 minutes to reach perhaps 80% of their full dark-adapted sensitivity. Many observers notice improvements

after several hours of total darkness. As your eyes become dark-adapted, more stars will glimmer into view and you'll be able to see fainter details in objects you view in your telescope. Exposing your eyes to very bright daylight for extended periods of time can adversely affect your night vision for days. So give yourself at least a little while to get used to the dark before you begin observing.

To see what you're doing in the darkness, use a red-filtered flashlight rather than a white light. Red light does not spoil your eyes' dark adaptation like white light does. A flashlight with a red LED light is ideal, or you can cover the front of a regular incandescent flashlight with red cellophane or paper. Beware, too, that nearby porch lights, streetlights and automobile headlights will ruin your night vision.

Eyepiece Selection

Always start viewing with your lowest-power, widest-field eyepiece. After you've located and looked at the object with a low-power eyepiece, switch to a higher-power eyepiece and see if the object looks better or worse. Keep in mind that at higher power, an image will always be fainter and less sharp (this is a fundamental law of optics). Many viewers use the lowest-power eyepiece practically all the time! Naturally, higher magnifications are desirable for viewing some celestial objects, but stay with low powers when searching for an object and for extended viewing.

To calculate the power, or magnfication of a telescope, divide the focal length of the telescope by the focal length of the eyepiece.

Telescope focal length ÷ Eyepiece focal length = Magnification

For example, if you're using an Orion 10" Premium DSE, which has a focal length of 1422mm, and a 26mm eyepiece, the power would be

1422 ÷ 26 = 55x.

We recommend having a selection of three to six eyepieces of different focal lengths so that you can choose the optimal magnification, brightness level, and contrast for each object and for different observing conditions.

Some exotic, extra-heavy eyepieces may cause enough imbalance on the tube that you will need to adjust the counterweight for optimum telescope balance.

7. Astronomical Viewing

How to Find Interesting Celestial Objects

To find celestial objects with your telescope, you first need to become reasonably familiar with the night sky. Unless you know how to recognize the constellation Orion, for instance, you won't have much luck locating the Orion Nebula. A simple planisphere, or star wheel, can be a valuable tool for learning the constellations and seeing which ones are visible in the sky on a given night.

A good star chart or atlas can come in very handy for helping find objects among the dizzying multitude of stars overhead. Except for the Moon and the brighter planets, it's pretty time-consuming and frustrating to hunt for objects randomly, without knowing where to look. You should have specific targets in mind before you begin looking through the eyepiece.

Start with a basic star atlas, one that shows stars no fainter than 5th or 6th magnitude. In addition to stars, the atlas will show the positions of a number of interesting deep-sky objects, with different symbols representing the different types of objects, such as galaxies, open star clusters, globular clusters, diffuse nebulas, and planetary nebulas. So, for example, your atlas might show that there is a globular cluster sitting just above the lid of the "Teapot" pattern of stars in Sagittarius. You then know to point your telescope in that direction to home in on the cluster, which happens to be 6.9-magnitude Messier 28.

The Moon

Viewing of the Moon, with its rocky, cratered surface, is one of the easiest and most interesting ways to use your telescope. The best time to observe our one and only natural satellite is during a partial phase, that is, when the Moon is not full. During partial phases shadows on the surface reveal more detail, especially right along the border between the dark and light portions of the disk. A full Moon is too bright and devoid of surface shadows to yield a pleasing view.

The Planets

The planets don't stay put like the stars, so you'll have to refer to charts published monthly in Astronomy , Sky & Telescope, or other astronomy magazines to locate them. Venus, Mars, Jupiter, and Saturn are the brightest objects in the sky after the Sun and the Moon. Your Deep Space Explorer is capable of showing you these planets in some detail. Other planets may be visible but will likely appear starlike. Because planets are quite small in apparent size, optional higher-power eyepieces are recommended and often needed for detailed observations. Not all the planets are generally visible at any one time.

JUPITER The largest planet, Jupiter, is a great subject for the Deep Space Explorer . You can see the disk of the giant planet and watch the ever-changing positions of its four largest moons-Io, Callisto, Europa, and Ganymede. Higher-power eyepieces should bring out the cloud bands on the planet's disk.

SATURN The ringed planet is a breathtaking sight when it is well positioned. The tilt angle of the rings varies over a period of many years; sometimes they are seen edge-on, while at other times they are broadside and look like giant "ears" on each side of Saturn's disk. A steady atmosphere (good seeing) is necessary for a good view. You will probably see a bright "star" close by, which is Saturn's brightest moon, Titan.

VENUS At its brightest, Venus is the most luminous object in the sky, excluding the Sun and the Moon. It is so bright that sometimes it is visible to the naked eye during full daylight! Ironically, Venus appears as a thin crescent, not a full disk, when at its peak brightness. Because it is so close to the Sun, it never wanders too far from the morning or evening horizon. No surface markings can be seen on Venus, which is always shrouded in dense clouds.

MARS The Red Planet makes its closest approach to Earth every two years. During close approaches you'll see a red disk, and may be able to see the polar ice cap. To see surface detail on Mars, you will need a high-power eyepiece and very steady air!

The Stars

Stars will appear like twinkling points of light. Even powerful telescopes cannot magnify stars to appear as more than a point of light! You can, however, enjoy the different colors of the stars and locate many pretty double and multiple stars. The famous "Double-Double" in the constellation Lyra and the gorgeous two-color

double star Albireo in Cygnus are favorites. Defocusing a star slightly can help bring out its color.

Deep-Sky Objects

Premium Deep Space Explorers are short-focal-length, "fast" Newtonians that are ideally suited for wide-field viewing of deep-sky objects. Under dark skies, you can observe a wealth of such objects, including gaseous nebulas, open and globular star clusters, and a variety of different types of galaxies. Most deep-sky objects are very faint, so it is important that you find an observing site well away from light pollution. Take plenty of time to let your eyes adjust to the darkness. Don't expect these subjects to appear like the photographs you see in books and magazines; most will look like dim gray smudges. (Our eyes are not sensitive enough to see color in deep-sky objects except in few of the brightest ones.) But as you become more experienced and your observing skills get sharper, you will be able to ferret out more and more subtle details.

Consult a star atlas or deep-sky observing guide for information on finding and identifying deep-sky objects. Some good sources to start with are the Edmund Mag 6 Star Atlas, Turn Left at Orion, and The Universe From Your Backyard.

8. Care and Maintenance

Care of the Tube and Base

Give your telescope reasonable care and it will last a lifetime. Store it indoors or in a dry garage or observatory; DO NOT leave it outside where it is exposed to rain, humidity, or direct sunlight. When the telescope is not in use, keep it covered with a plastic tarp or drop cloth or an Orion Scope Saver to keep dust and dirt off.

An important design characteristic of your telescope is the controlled friction of the bearing surface materials. To preserve the optimum friction, never lubricate the bearings! Oil, wax, grease, silicone, or graphite will greatly impair the mechanical performance of the telescope, as the tube will swing wildly at the slightest touch. Simply keep the bearing surfaces clean with a dry cloth. Any household spray cleaner will work fine to clean any foreign material or oil from the surfaces. The base is made of cabinet-grade "Melamine" laminate, and will take quite a bit of wear and tear.

The optical tube is a "Sonotube," a thick spiral-wound paper bonded with waterproof glue. Sonotubes are used for pouring concrete columns, so they are very strong. The material is quite stable even with variation in humidity. Sonotubes are far and away the most popular tubes for Dobsonian telescopes. However, if stored outside for long periods, exposed to the elements, Sonotube can warp and begin to unravel.

Transporting your Premium Deep Space Explorer

When transporting your telescope, separate the base from the tube and put the tube on a soft surface (back seat, blanket, etc.) to keep it from getting banged around.

When shipping your telescope, should you have to, you must protect the first-surface primary mirror.

1. Remove the primary mirror cell and mirror from the telescope tube assembly.
2. Blow any dust or particles from the mirror. It is best to use a blower bulb. Do not use canned air or hair dryers. Blowing with your breath is better than not doing anything.
3. Protect the surface of the mirror. Do not touch it. The mirror MUST be covered with a soft, nonabrasive material. In order of preference: original tissue wrap, lots of lens cleaning tissue, a clean 100% cotton cloth or shirt, facial tissue, or toilet paper.
4. Pack the mirror assembly and telescope well. Always use the original packing material if possible. If not, you should "double box" the mirror assembly to insure adequate protection.

Care of the Optics

Any quality optical lens cleaning tissue and optical lens cleaning fluid specifically designed for multi-coated optics can be used to clean the exposed lenses of your eyepieces or finder scope. Never use regular glass cleaner or cleaning fluid designed for eyeglasses. Always apply the fluid to the tissue, never directly on the optics. Gently wipe the lens, taking care not to rub too hard. Use lots of tissue on larger lenses. Don't take eyepieces apart for cleaning!

Cleaning First-Surface Mirrors

Cleaning is seldom needed (perhaps once a year) and is best done only when definitely needed. Covering your telescope will prevent the mirrors from getting dirty. Small specks of dust or flecks of paint have virtually no affect on performance, so don't clean your mirror too often; it's too much trouble for little reason! Improper cleaning can scratch mirror coatings.

The primary mirror and secondary mirror of your telescope are front-surface aluminized and overcoated with hard silicon monoxide, which prevents the aluminum from oxidizing. These coatings normally last through many, many years of use before requiring recoating (which is easily done).

The diagonal mirror is more likely to require cleaning, since it is right up near the eyepiece. It should be cleaned by blowing dust off first, then wiping gently with cleaning tissue dampened with lens fluid. Be extra gentle when cleaning first-surface mirrors; be especially careful not to rub grit over the surface. Very tiny, barely visible "sleeks" are not unusual and don't affect performance. A "sleek" will only be visible when looking from an angle at the mirror, while a scratch will be visible all the time.

A primary mirror does not need to be spotless to function properly. The light-gathering surface of the mirror vastly exceeds the surface area of dust particles that may accumulate. When you notice dust particles on the surface of the mirror, they may be blown off using a blower bulb. However, there will come a time when the primary mirror will need to be cleaned; this should be done with care.

Distilled water can be used to cleanse the mirror. Over a sink, rinse the mirror cell assembly with the distilled water. Hold the mirror cell assembly at a steep angle so the water will run off the surface of the mirror. If necessary, dirt and grease smudges can be removed with a wet cotton ball. Use one cotton ball for every wipe of the mirror.

For a REALLY dirty mirror, or every three to five years, a more thorough cleaning of the mirror can be undertaken. The mirror must be separated from the mirror cell assembly: remove the safety tape wrapping and carefully cut the silicone glue which holds the mirror to the particle board baking plate. Take extra precautions not to scratch the mirror during this step.

Fill a dish tub or sink with a gallon of distilled water, add 10 drops of Ivory liquid soap or lens cleaning solution that is safe for multi-coated eyepieces. Soak the mirror, aluminized side up, for about 10 minutes. Then, with the mirror still under water, use a cotton ball and gently wipe the mirror. Wipe in one direction only, and after each wipe discard the cotton ball and use a fresh one for the next wipe. After the mirror is clean, rinse with distilled water. Hold the mirror at a steep angle and use a blower bulb to help the water droplets drain from the surface; a cotton ball can be used to soak up some of the excess water. Air dry.

Once dry, clean any remaining silicone from both the back of the mirror and the particle board backing plate. Use silicone glue (clear silicone caulking works well) to reattach the mirror to the backing plate. The mirror cell assembly is now ready to be reinstalled.

With very little maintenance, your Orion Deep Space Explorer will provide years of viewing pleasure.

Enjoy the view!

9. Specifications

10" Premium DSE

Mirror: Pyrex, hand figured

Mirror Coatings: Enhanced 94%-reflective aluminized; silicon monoxide overcoat

Primary mirror focal length: 1422mm

Primary mirror diameter: 10 inches

Secondary mirror diameter: 2.14 inches

Focal ratio: f/5.6

Weight: 77 lbs. (base 33 lbs., tube assembly 44 lbs.)

Tube length: 61 inches

Tube diameter (o.d.): 13 inches

Power with 26mm eyepiece: 55x

12.5" Premium DSE

Mirror Glass: Pyrex, hand figured

Mirror Coatings: Enhanced 94%-reflective aluminized; silicon monoxide overcoat

Primary mirror focal length: 1524mm

Primary mirror diameter: 12.5 inches

Secondary mirror diameter: 2.60 inches

Focal ratio: f/4.8

Weight: 98 lbs. (base 37 lbs., tube assembly 61 lbs.)

Tube length: 65 inches

Tube diameter (o.d.): 15 inches

Power with 26mm eyepiece: 59x

Premium Deep Space Explorers are made in the U.S.A.

One-Year Limited Warranty

This Orion Premium Deep Space Explorer Reflector is warranted against defects in materials or workmanship for a period of one year from the date of purchase. This warranty is for the benefit of the original retail purchaser only. During this warranty period Orion Telescopes & Binoculars will repair or replace, at Orion's option, any warranted instrument that proves to be defective, provided it is returned postage paid to: Orion Warranty Repair, 89 Hangar Way, Watsonville, CA 95076. If the product is not registered, proof of purchase (such as a copy of the original invoice) is required.

This warranty does not apply if, in Orion's judgment, the instrument has been abused, mishandled, or modified, nor does it apply to normal wear and tear. This warranty gives you specific legal rights, and you may also have other rights, which vary from state to state. For further warranty service information, contact: Customer Service Department, Orion Telescopes & Binoculars, P. O. Box 1815, Santa Cruz, CA 95061; (800) 676-1343.

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