

OWNER'S MANUAL  
**DOBSONIAN TELESCOPE**

ZHUMELL Z8 DELUXE DOBSONIAN REFLECTOR TELESCOPE



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your world within reach



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Zhumell customers know that there are plenty of ways to experience the world. They also understand that, however you choose to explore it, the best experience is one that fully immerses you in the world's most striking details.

That's where our optics products come in. We strive to put high-performance products in the hands of our customers so that they can experience the world up close, with their own eyes.

With Zhumell, you get field-tested, precision-crafted optics at the best possible value. So even if you're just starting out as an amateur birder or astronomer, you don't have to settle for entry-level products. Zhumell customers enjoy life's pursuits, hobbies, and adventures in rich, colorful detail- the kind of detail that only high-performance optics can produce.

At Zhumell, we design our binoculars, telescopes, and spotting scopes for discerning, price-conscious users who are uncompromising on quality. If you're looking for accessibly priced optics that will bring your world within reach, you're looking for Zhumell.

**Enjoy the dob.**

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# CARING FOR YOUR ZHUMELL DOBSONIAN TELESCOPE

Zhumell telescopes are precision astronomical instruments designed for ease of use and versatility in their application. As with any telescope, Zhumell telescopes require some technical knowledge of stellar movement and optical properties. We have provided basic instructions for telescope use and astronomical viewing in this manual.

Your Zhumell Dobsonian Telescope is built with the highest-quality optics and top-notch construction to provide years of reliable functionality, but will require proper care.

If, after reading this manual, you still have questions about your Zhumell telescope, please visit <http://www.zhumell.com> for more helpful tips and contact information. Our customer service representatives are available to address any problems you encounter with your telescope. Please let us know about your experiences; we would like to hear your feedback.

**Enjoy your Zhumell.**

# CARING FOR YOUR ZHUMELL DOBSONIAN TELESCOPE

## WARNINGS

- Do not use telescope or finderscope to look at the sun without an appropriate solar filter. Doing so will cause permanent and irreversible eye damage.
- Never use an eyepiece filter as a solar filter. Only solar filters will completely cover the opening of the optical tube and provide proper eye protection.
- Make sure no screws are loose before using telescope.
- Do not drop or shake your telescope as doing so may damage the optics, or harm you or the people around you.

# USING YOUR ZHUMELL DOBSONIAN TELESCOPE

## COLLIMATION

Periodically, you will find that it is necessary to align the optical components of your telescope. This procedure is called collimation. There is no collimator included with the Zhumell Dobsonian, but regular collimation is recommended for optimum telescope usage.

1. Remove the eyepiece from the eyepiece holder and insert laser collimator into eyepiece holder. Secure the laser collimator by tightening thumbscrew.
2. Turn the thumbscrew located on the side of the collimator to turn on the collimator.
3. Look through the hole in the side of collimator to see where the laser is reflected onto the reticle. If you cannot see the laser reflected back onto the reticle, align the secondary mirror by adjusting the secondary mirror collimation screws until the laser is reflected onto the inside of the collimator.
4. Loosen 3 locking screws on bottom of optical tube (the thin ones that stick farther out from the back of the mirror).
5. Align the laser to the center of the reticle by adjusting the 3 primary mirror adjustment screws (the thick screws in the back of the mirror). Do not over-turn these screws (max of  $\frac{1}{4}$  turn at a time).
6. Tighten the 3 locking screws on bottom of optical tube to lock the primary mirror into place.

## CLEANING AND MAINTENANCE

A telescope is carefully aligned during construction, and great care should be taken to maintain this alignment over the life of the telescope. Cleaning should be done as little as possible and then only with mild soap solution and a soft, lint-free cloth. Do not rub elements when cleaning. Blot optical components gently and allow telescope to air-dry. Store telescope in its box or in a telescope case when not in use. Do not use pure alcohol or solvents to clean any parts of the telescope. Do not remove optical elements from the telescope as doing so may affect the alignment of optical components when reassembled. If telescope needs realignment, contact Zhumell or another professional.

1. Brush telescope optics with camelhair brush or blow off dust with an ear syringe (can be purchased at any pharmacy). Do not use a commercial photographic lens cleaner.
2. Remove organic materials (e.g. fingerprints) with short gentle strokes using soft white tissue paper and a solution of three parts distilled water and one part isopropyl alcohol. You may also add one drop of biodegradable dish soap to one pint of the homemade solution. Do not use lotioned or scented tissues as they could damage the optics of your telescope.
3. Wipe down the outside of your telescope with a dry cloth to remove condensation prior to packing up your telescope. Do not wipe any of the optical surfaces. Instead, allow the optics to dry naturally in warm indoor air prior to packing up your telescope.
4. Protect your telescope from excessive heat. For example, do not store your telescope in a sealed car on a warm day. Excessive storage temperatures can damage your telescope.

# SPECIFICATIONS FOR YOUR ZHUMELL DOBSONIAN TELESCOPE

## OPTICAL TUBE ASSEMBLY

Zhumell Z8	
Objective/Aperture	203 mm / 8 inches
Focal Length	1200
Limiting Magnitude	14.04
Focal Ratio	F/5.91

**Eyepiece Format:** 1.25 inch, and 2 inch

**Finderscope:** 8x50

**Mount Type:** Dobsonian

**Tube Mount:** Cradle Mount

**Mount Adjustment:** Altitude-Azimuth

**Materials:** Wood, Melamine

## PARTS LIST

### Box 1 of 2

- Dobsonian optical tube
- Plastic tube cover
- 2 silver side bearings
- Battery pack for cooling fan
- Newtonian collimator
- 32 mm eyepiece (2 inch format)
- 9 mm eyepiece (1.25 inch format)
- Moon filter (1.25 inch format)

### Box 2 of 2

- 8x50 finderscope
- Handle
- 10 long black Allen screws
- 2 medium silver Allen screws
- 3 medium silver Phillips screws
- Allen wrench

- 3 black plastic feet
- 2 short black Phillips screws
- Eyepiece holder shelf
- 2 large round black wood base plates
- Lazy susan (2 metal discs with a black plastic roller in the middle)
- One black knob, with a thick screw, spacer, large washer, small ball bearing washer, and small plain washer
- 2 large black wood side panels for the base
- 1 small black wood side panel for the base

### Not Included

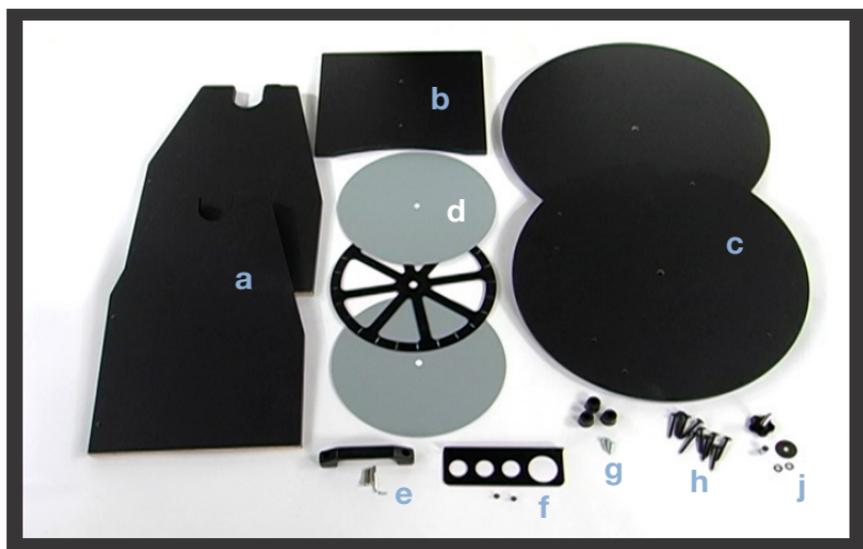
- Philips Screwdriver
- AA Batteries

**All Holes have been predrilled**

# ASSEMBLY OF YOUR ZHUMELL DOBSONIAN TELESCOPE

Unbox and gather the pieces for base assembly. You will need:

- a.** Base Sides (2)
- b.** Base Front
- c.** Base Plates (2)
- d.** Bearing Plates (3)
- e.** Handle (and (2) silver Allen screws)
- f.** Eyepiece Tray (and (2) black Phillips screws)
- g.** Feet (3)
- h.** Long Black Allen Screws (10)
- i.** Allen Wrench
- j.** Adjustment Bolt (with (2) washers, (1) ball bearing, and (1) Axle Sleeve)



# ASSEMBLY OF YOUR ZHUMELL DOBSONIAN TELESCOPE

## ① BASE ASSEMBLY

First, you will be assembling the telescope base housing. This will be the structure that holds your scope in place.



**STEP 1:** Screw the handle onto the Base Front using the (2) pre-drilled holes on the front. Make sure that it is secure.



**STEP 2:** Connect the Base Front to the Left Base Side using the pre-drilled holes in the Base Front and (2) Long Black Allen Screws



**STEP 3:** Repeat with the Right Base Side to complete the box. Be sure that all three sides are firmly attached and feel stable.

# ASSEMBLY OF YOUR ZHUMELL DOBSONIAN TELESCOPE



**STEP 4:** To attach the Eyepiece Tray to the Right Base, it's easiest to turn the assembly on its side. Attach the tray using the (2) pre-drilled holes and (2) black Phillips screws. Return the base to standing position and make sure the tray is secure.

**YOU ARE NOW READY TO BEGIN THE ASSEMBLY OF THE BASE PLATE. THIS WILL BE THE PART THAT ALLOWS YOUR BASE HOUSING AND TELESCOPE TO ROTATE IN A "LAZY SUSAN" STYLE.**



**STEP 5:** First, the feet must be attached to the Base Plate. Choose the Base Plate with (1) center hole and (3) holes around the edge. **IMPORTANT:** The feet must be attached to the side with a brass center hole. Screw all (3) feet in place, with the wider side facing the board, using (3) medium silver Phillips screws.



**STEP 6:** Choose the Base Plate with (1) center hole and (6) holes around the edge. Flip the base housing upside-down and align the six pre-drilled holes with the base plate.

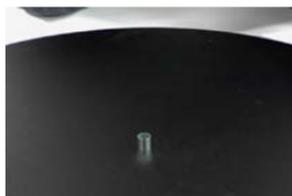
# ASSEMBLY OF YOUR ZHUMELL DOBSONIAN TELESCOPE



**STEP 7:** Be sure the side with recessed holes is facing away from the base housing. Screw (6) long black Allen screws into these holes until they are flush with the surface.



**STEP 8:** To assemble the Adjustment Bolt, hold the parts in your hand in this order: Small Washer; Ball Bearing; Large Washer. Place them on the threaded bolt in that order, with the small washer closest to the plastic knob.



**STEP 9:** Place the Base Plate with feet on level ground, feet facing downward. Insert the Axle Sleeve into the center hole.

# ASSEMBLY OF YOUR ZHUMELL DOBSONIAN TELESCOPE



**STEP 10:** Arrange the Bearing Plates with the “wagon wheel” plate sandwiched between the two light blue plates. Place this whole assembly onto the Axle Sleeve centered on the Base Plate. Check that it rotates smoothly.



**STEP 11:** Pick up the Base Plate and Base Housing assembly and place it on top of the Base Plate and Bearing Plate Assembly, aligning the center hole with the Axle Sleeve. The top assembly should now rotate freely over the bottom Base Plate.



**STEP 12:** Screw the Adjustment Bolt (with washers and ball bearing) into the Axle Sleeve, through all of the assembled base parts. This will be your means to rotate and secure your Dobsonian.

# ASSEMBLY OF YOUR ZHUMELL DOBSONIAN TELESCOPE

## ② OPTICAL TUBE ASSEMBLY

Unbox and gather the pieces for the Optical Tube Assembly. These are -



- a.** Dobsonian Optical Tube
- b.** Finderscope
- c.** Silver Side Bearings (2)
- d.** Laser Collimator

- e.** Battery Pack for Cooling Fan
- f.** 1.25-inch 9mm Plossl Eyepiece
- g.** 2-inch 30mm Plossl Eyepiece
- h.** 1.25-inch Moon Filter.

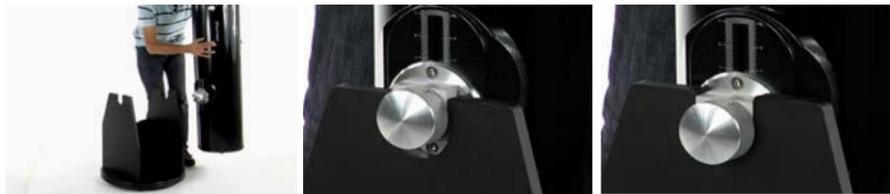


**STEP 1:** Remove the (2) bolts found on the opening on one side of the OTA. This is where you will connect the silver Side Bearing. Align the bearing (top bolt first) and tighten into place. Repeat on the other side of the OTA.

# ASSEMBLY OF YOUR ZHUMELL DOBSONIAN TELESCOPE



**STEP 1:** Remove the (2) bolts found on the opening on one side of the OTA. This is where you will connect the silver Side Bearing. Align the bearing (top bolt first) and tighten into place. Repeat on the other side of the OTA.



**STEP 2:** You are now ready to place the OTA onto the Base Assembly. Be sure to have the base assembly ready to align with the OTA before you lift the optical tube. The indentations on the Base Assembly will perfectly fit the silver Side Bearings on the OTA.



**STEP 3:** Locate the Finderscope Bracket on the OTA. Loosen the thumbscrew on the bracket with your fingers and slide the Finderscope into place. Tighten the screw so that the Finderscope is secure.

**You are now ready to insert an eyepiece and begin using your Zhumell Dobsonian telescope. Continue reading for instructions and viewing tips.**

# BASICS FOR YOUR ZHUMELL DOBSONIAN TELESCOPE

## USING 1.25-INCH EYEPIECES



1. The 1.25-inch is the most commonly used eyepiece format. The measurement of 1.25 inches is the diameter of the eyepiece tube, measured on the chrome side.
2. The eyepiece holder and Crayford focuser come already attached to the optical tube, next to where the finderscope is mounted.
3. Remove the plastic dust cover from the eyepiece holder.
4. Loosen the silver thumbscrew closest to the eyepiece hole. (It is part of the 1.25-inch adapter. More on this adapter in the 2 - inch eyepiece section.)
5. Take out your 1.25-inch eyepiece. Remove the plastic covers and pull up the rubber to use the eyecup.
6. Slide the chrome end of the eyepiece into the eyepiece holder.
7. View through the eyepiece and focus as needed. (See focusing section.)
8. To remove the eyepiece, loosen the silver thumbscrew.
9. Pull out the eyepiece from the holder.
10. Use the plastic dust covers to protect the eyepiece and focuser during storage.

# BASICS FOR YOUR ZHUMELL DOBSONIAN TELESCOPE

## USING 2-INCH EYEPIECES



1. The 2-inch eyepiece format is the largest. 2 inches is the diameter of the eyepiece tube, measured on the chrome side.
2. Loosen the silver thumb screw underneath the eyepiece opening.
3. Pull the adapter out of the focuser.
4. Take out your 2-inch eyepiece. Remove the plastic covers.
5. Slide the chrome end of the eyepiece into the focuser.
6. Tighten the bottom thumbscrew to hold eyepiece in place.
7. View and focus as desired.
8. To remove, loosen the thumbscrew and pull the eyepiece out of the focuser.
9. For storage, replace the adapter with the dust cover.

# BASICS FOR YOUR ZHUMELL DOBSONIAN TELESCOPE

## ALTITUDE AND AZIMUTH

1. Your Zhumell Dobsonian is adjustable along two axes - altitude (up/down) and azimuth (left/right). Adjustments to the telescope's position can be made along one or both axes at the same time.
2. Gently take hold of the end of the OTA and move it either left or right (it will spin about its central azimuth bolt) or up and down (it will rotate on the Side Bearings on the OTA).
3. The telescope can be positioned to view anywhere in the night sky, but be sure to let it move naturally - never force your telescope to move.

## FOCUSING THE IMAGE

1. With an eyepiece in the focuser, loosen both back thumbscrews on the left side on focuser.
2. Push or pull the focuser gently until image becomes as clear as possible.
3. Alternatively, turn the large, up-down, rack-and-pinion knobs to adjust the focus. The black knob will adjust in smaller increments than the large silver knobs.
4. The back thumbscrew will completely lock the focus. The front thumbscrew will lock the push/pull ability, so that only the rack-and-pinion knobs can be used to adjust focus.
5. Tighten both knobs to completely lock the focuser.

# BASICS FOR YOUR ZHUMELL DOBSONIAN TELESCOPE

## TRANSPORTATION

- 1. IMPORTANT** - never try and transport both the base and OTA as a single unit. Gently lift the OTA off the base and secure in a telescope case for transportation. Move the base separately, as a single unit, and handle with care.
- 2.** If you do not have a case for your Dobsonian, let common sense dictate your transportation storage. It is vital that the OTA does not roll or move around at all during travel, as this will affect the telescope alignment. Pad and secure your telescope accordingly.

# VIEWING THROUGH YOUR ZHUMELL DOBSONIAN TELESCOPE

Never look at the sun without using a solar filter. Do not use a regular eyepiece as a solar filter. When using a solar filter, do not remove the full lenscap, view only through the small opening. Looking at the sun without proper use of a solar filter can cause permanent eye damage, including blindness.

When viewing through the telescope, the image will appear to be upside-down and inverted. This is normal and is a result of the optical system design. It can be corrected by using an erecting prism when viewing, but it is not necessary to do so.

Using your finderscope will help you locate celestial much more quickly as the finderscope is equipped with a wider field of view than your telescope. To simplify focusing while viewing, start with the lowest power magnification and work up to the desired power.

When viewing faint deep-sky objects, images will not show color. The human eye is not able to distinguish the differences in color found in such dim images. The lack of color is due to human anatomy, not any limitations of telescope construction.

# VIEWING THROUGH YOUR ZHUMELL DOBSONIAN TELESCOPE

## CHECKING AND ALIGNING YOUR FINDERSCOPE

Finderscope alignment is the first step to fine-tuning your Zhumell Dobsonian setup and viewing celestial objects. Follow these steps to properly set up and align your finderscope.

1. Insert the lowest-power eyepiece into the eyepiece adapter. Focus eyepiece to view an easily recognizable, stationary distant object like a sign or lightpole.
2. Look through the finderscope, but be careful not to move the telescope in any way. Adjust the finderscope focus by turning the eyepiece of the finderscope back and forth until the image is in focus. Check to see if the object viewed through your telescope eyepiece is lined up at the center of the finderscope crosshairs. If not, your finderscope must be re-aligned.
3. To align your finderscope, slightly loosen the thumbscrews which on the finderscope bracket. Gently move the finderscope until the crosshairs are centered on your object. Tighten the thumbscrews to secure the finderscope in this position. It may take many tries to get it exactly right, but it will make finding objects much, much easier when you're ready to use your telescope.

## OBSERVATION TIPS

### SELECTING A VIEWING SITE

The ideal site for using your Dobsonian is in the middle of nowhere. Most users don't have access to the darkest of skies, however, so select a site that is both far from light pollution and practical for you. Avoid street lights, yard lighting, rooftops, and chimneys, and never observe through an open window indoors. Be sure your site is out-of-town or very dark and has clear view of a large portion of the sky.

# OBSERVATION TIPS FOR YOUR ZHUMELL DOBSONIAN TELESCOPE

## COOLING YOUR TELESCOPE

To achieve optimum stability of its lenses and mirrors, your telescope needs to reach “thermal equilibrium” before use. When moved to a warmer or colder environment, the air inside the telescope needs time to adjust to match the outdoor temperature. The bigger the telescope, the more time will be needed to reach equilibrium.

Dobsonian telescopes are some of the largest available, so you will need to allow at least 30 minutes for yours to reach thermal equilibrium. If the scope experiences more than a 40° temperature change, allow at least an hour. In the colder months, storing your telescope in a shed or garage greatly reduces the time needed for equilibrium. Similarly, keeping your telescope covered in the sun prevents the air inside from warming too drastically.

## SEEING AND TRANSPARENCY

Atmospheric conditions are of the utmost importance when considering viewing conditions for your astronomical binoculars. These conditions are commonly referred to as “seeing.” When seeing is good, star twinkling is minimal and objects appear steady in your lenses. Seeing is best overhead, worst at the horizon, and generally better after midnight. You can’t see the stars without looking through the atmosphere, so the clearer the air and the higher your altitude, the better seeing conditions you will encounter.

# OBSERVATION TIPS FOR YOUR ZHUMELL DOBSONIAN TELESCOPE

A reliably quick way to judge seeing conditions is to look at bright stars about 40° above the horizon. If the stars appear to twinkle, there is significant atmospheric distortion and viewing at high magnification will not be ideal. If these stars are steadily bright, chances of successful viewing at high magnification are much better.

Judging the transparency of the air is also important in determining viewing conditions. The best air is free of moisture, dust, and smoke, which tend to scatter light, reducing a viewed object's brightness.

How many stars can you see with your naked eye? If you are unable to see stars of magnitude 3.5 or dimmer, transparency in your area is poor. A good indicator star for this test is Megrez (mag. 3.4) - the star in the Big Dipper connecting the handle to the dipper. If Megrez is not visible, elements in the air will negatively affect your view.

## DARK-ADAPTING YOUR EYES

When you go out into the dark, your eyes need time to adjust. You will initially be able to see only a fraction of the stars and objects your eyes are capable of. Remain in the dark (don't look at any lights or cell phones) for at least 30 minutes, and your eyes should be around 80% of their full dark-adapted sensitivity. Every time bright light comes into your eye, the dark-adapting process will start over.

When eyes are fully dark-adapted, you will probably still need to see what you're doing. Use a red-light flashlight to maneuver around the area. A regular flashlight covered in red cellophane will work, but red LED lights are best.

# OBSERVATION TIPS FOR YOUR ZHUMELL DOBSONIAN TELESCOPE

## TRACKING CELESTIAL OBJECTS

The Earth is always rotating about its polar axis, completing one full rotation every 24 hours. This is what defines our “day”, and we see it in the apparent movement of sun and stars throughout each rotation. In the same way that the sun rises and sets each day, the stars in the sky rise and set each night. The motion translates to a rate of approximately  $.25^\circ$  per minute, or 15 arc-seconds per second. This is commonly referred to as the sidereal rate.

As you observe any celestial object, remember that it is in motion. You will need to continuously update your telescope’s position throughout a viewing session, which is where your Dobsonian’s fine altitude and azimuth adjustments become useful. As an object begins to leave your field of view, gently nudge the OTA in the correct direction and bring it back to center.

Remember, the higher the magnification at which you’re viewing, the smaller your field of view. Objects will appear to move faster as you raise magnification, and more frequent positional adjustments will need to be made.

## SELECTING AN EYEPIECE

By using eyepieces of different focal lengths, many different magnifications can be achieved with your Zhumell Dobsonian telescope. The best place to start is with the included 9mm and 32mm Plossl eyepieces for higher and lower magnifications, respectively. Many astronomers own a large number of eyepieces in order to customize their equipment based on the object being viewed. To calculate the magnification of a telescope/eyepiece combination, divide the focal length of the telescope by the focal

# OBSERVATION TIPS FOR YOUR ZHUMELL DOBSONIAN TELESCOPE

length of the eyepiece.

No matter which eyepiece you intend to use, always start by using the lowest-power (longest focal length) eyepiece to locate and center the object. Lower magnification means a wider field of view, making it easier to find an object and justify your scope in its direction.

Once you've centered the desired object using your lowest-power eyepiece, go ahead and make the switch to a higher magnification. Make further centering adjustments, and continue to work up if desired. Higher magnifications are useful for small and bright objects like planets and double stars. Viewing the Moon with increased magnification also yields great results.

Deep-sky objects, however, typically look best at medium and low magnifications. This is because they tend to be faint, yet have apparent width. Deep-sky objects often fall from view at higher magnifications, since the image becomes dimmer. This is not an unbreakable rule, since many galaxies are bright enough for high magnification, but words as a decent rule-of-thumb.

Regardless of the object, or what recommendations are made, the best way to become familiar with proper viewing magnifications is to experiment. Always start with low magnification and wide field-of-view and work your way up. If the view continues to improve, continue increasing power. If the image begins to degrade, back off the magnification and use a lower-power eyepiece.

# COOL VIEWS WITH YOUR ZHUMELL ASTRONOMICAL BINOCULARS

## THE MOON

The Earth's moon is one of the easiest and most rewarding targets at which to point your binoculars. Its rocky, cratered surface is close enough to be rendered in some detail, and allows for satisfying exploration. The best time for lunar viewing is during its partial phases, when shadows fall on the craters and canyon walls to give them definition. Even though the full moon may look like a tempting target, the light is too bright and the definition too low for optimal viewing.

## THE STARS

Through your binoculars, stars will appear much as they do to the naked eye - as tiny points of light against a dark sky. Even powerful binoculars cannot magnify stars to appear as anything more than these pinpoints. You can, however, enjoy the different colors of their glow and locate many beautiful double- and multiple-stars. Two popular targets are the "Double-Double" in the constellation Lyra and the two-color double star Albireo in Cygnus.

## THE PLANETS

The planets are beautiful and popular targets for astronomers, but they can be more difficult to keep track of than the stars or moon. Planetary position charts can readily be found online or in any astronomical publication. Sun and Moon aside, the brightest objects in the night sky are Venus, Mars, Jupiter, and Saturn. The apparent size of planets can be quite small, but high-power binoculars provide an adequately enjoyable view.

# ADVANCED OBSERVATION

## JUPITER

Jupiter is our solar system's largest planet. Through your binocs, you can easily see the planet and observe the changing positions of its four largest moons: Io, Callisto, Europa, and Ganymede. With the right conditions, you may be able to see cloud bands wrapped around the planet and the famous Great Red Spot.

## SATURN

This infamously ringed planet can be a fantastic sight through your binoculars. The tilt-angle of the rings varies over a period of many years, so they may be seen edge-on (like a thin line) or broadside (like giant "ears" on each side of the planet). You will need a good steady atmosphere to achieve a worthwhile view of Saturn. If you look closely enough, you can see the Cassini division - a thin, dark gap in the rings. You can also often make out one or more of Saturn's moons, including the largest - Titan.

## VENUS

At its brightest, Venus is the most luminous of all the planets - so bright that it is occasionally visible in full daylight. Venus appears as only a thin crescent at its brightest, and it is never found far from morning or evening horizon. No surface detail can be seen on Venus as it is surrounded by dense cloud cover.

## MARS

Mars makes a close approach to our planet once every two years, which is the best time to observe it. With your binoculars, you'll be able to see a salmon-colored disk marked with dark patches and possible a whitish polar ice cap. Surface detail on Mars is only observable during prime conditions with a high-power magnification.

# ADVANCED OBSERVATION

## DEEP-SKY OBJECTS

With dark skies, ideal viewing conditions, and powerful astronomical binoculars, you can observe a number of amazing objects outside our solar system - commonly referred to as “deep-sky objects”. These include star clusters, galaxies, gaseous nebulas, and more. With primary conditions, your binoculars are well equipped to gather the light necessary to view these objects, but you will need to find a viewing site well away from light pollution and give your eyes plenty of time to fully dark-adapt. As you continue to view, your eyes will become trained, and more and more subtle details from these objects will become apparent. Don't expect to see color, however, as human eyes are not sensitive enough to distinguish color from faint light.

## STARHOPPING

Starhopping is the most common and simplest way to reliably track down objects in the night sky. It uses relative positioning, beginning at a star with a known location and progressing to other stars closer and closer to the destination object. It's been used for hundreds of years, and - with practice - will never let you down when finding an object. Starhopping can be very difficult at first, so be patient and keep trying!

You will need a small number of additional resources to successfully employ Starhopping as your night-sky positioning technique. A star chart or atlas that shows stars to at least magnitude 5 is required. Choose one that shows the positions of many deep-sky objects to give yourself a wealth of options. If you don't already know the positions of the constellations in the night sky, you will need a planisphere as well.

# ADVANCED OBSERVATION

Begin by choosing brighter deep-sky objects as your destination. The brightness of an object is measured by its visual magnitude; the brighter an object, the lower its magnitude. Choose an object with a visual magnitude of 9 or lower. Most beginners start with the Messier objects, some of the brightest and most beautiful deep-sky objects, first catalogued about 200 years ago by French Astronomer Charles Messier.

Using your star chart, determine in which constellation your object lies and locate that constellation in the night sky. Turn your binoculars to face this general direction. Find the brightest star in this constellation and center your view on it. Consult your star chart again, and determine the next brightest star between your currently focused star and your object destination. Move your binoculars slightly to focus and center this next star.

Continue on this course, using each star as a guidepost for the next, until you reach the area in the sky in which the object of your hunt should be seen. Center the object and bring it into focus. You've just found a deep-sky object.

If the object is still not in view, retrace your starhopping steps and start again. Remember, expertise in this hobby will require both patience and practice. **Good luck out there!**

# ASTRONOMY FORMULAS FOR YOUR ZHUMELL DOBSONIAN TELESCOPE

## MAGNIFICATION

To determine the magnification of a telescope and eyepiece combination, divide the telescope focal length by the eyepiece focal length.

Magnification (x) = Telescope Focal Length (mm)/Eyepiece Focal Length (mm)

Ex: 3mm Eyepiece with a 203x1200mm telescope.

Magnification =  $1200\text{mm}/32\text{mm}$

Magnification = 37.5x

## FOCAL RATIO

To determine the focal ratio of a telescope, divide the focal length of the telescope by the aperture.

Focal Ratio (f/x) = Telescope Focal Length (mm)/Aperture (mm)

Ex: Focal Ratio of a 203x1200mm telescope.

Focal Ratio (fx) =  $1200\text{mm}/203\text{mm}$

Focal Ratio (fx) = f/5.9

# ASTRONOMY FORMULAS FOR YOUR ZHUMELL DOBSONIAN TELESCOPE

## LIMITING MAGNITUDE

To determine the limiting magnitude of a telescope, use the aperture in the following formula for an approximation.

$$\text{Limiting Magnitude} = 7.5 + 5\text{LOG}(\text{Aperture in cm})$$

Ex: Limiting Magnitude of a 203x1200mm telescope.

$$\text{Limiting Magnitude} = 7.5 + 5\text{LOG}(20.3\text{cm})$$

$$\text{Limiting Magnitude} = 7.5 + (5 \times 1.307)$$

$$\text{Limiting Magnitude} = 14.03$$

## RESOLVING POWER

To determine the resolving power of a telescope under ideal conditions, divide the aperture into 4.56.

$$\text{Resolving Power} = 4.56/\text{Aperture (in inches)}$$

Ex: Resolving Power of a 203x1200mm telescope.

$$\text{Aperture (in.)} = 203\text{mm}/25.4 = 8\text{in.}$$

$$\text{Resolving Power} = 4.56/8\text{in.}$$

$$\text{Resolving Power} = .57$$

# ASTRONOMY TERMINOLOGY

**DECLINATION (DEC.)** - The astronomical equivalent of latitude. Declination describes the angle of a celestial object above or below the celestial equator. The sky over the northern hemisphere has a positive declination. The sky over the Southern hemisphere has a negative declination. For example, Polaris (the North Star) which lies nearly directly over the North Pole, has a declination value of  $90^\circ$ .

## **RIGHT ASCENSION (R.A.)** -

The astronomical equivalent of longitude. Right ascension measures the degree of distance of a star to the east of where the ecliptic crosses the celestial equator. R.A. is measured in hours, minutes, and seconds as opposed to degrees. It is different than the term "meridian", which is used in referring to lines of longitude. Right ascension is referred to in "hour circles". There are 24 hour circles of right ascension which run from the north to south celestial poles.

**CELESTIAL EQUATOR** - The celestial equator is the line of declination which lies directly above the Earth's equator. The celestial equator lies halfway between the north and south celestial poles and serves as the  $0^\circ$  point in measuring declination.

**ECLIPTIC** - The ecliptic is the apparent path of the sun through the sky over the course of the year. Since we view the sun from different angles throughout the year, it appears to move in relation to other stars. The vernal (spring) and autumnal (fall) equinoxes lie at the points where the ecliptic intersects the celestial equator. The vernal equinox is where right ascension is at 0h (hours). The autumnal equinox can be found at 12h R.A.

**ZENITH** - The zenith is the point in the celestial sphere directly above your head. The zenith varies depending upon your location. In general, the declination point of your zenith is equal to the latitude at which you are standing on Earth.

**EPHEMERIS** - The ephemeris of a planet or the sun or the moon is a table giving the coordinates of the object at regular intervals of time.

The coordinates will be listed using declination and right ascension. Other information such as distance and magnitude may be listed in ephemerides (plural of ephemeris).

**ALTITUDE** - The altitude of a celestial object is the angular distance of that object above the horizon. The maximum possible altitude is the altitude of an object at the zenith,  $90^\circ$ . The altitude of an object on the horizon is  $0^\circ$ . Altitude is measured from your point of observation and does not directly correlate to points on the celestial sphere.

**AZIMUTH** - Azimuth is the angular distance around the horizon measured eastward in degrees from the North Horizon Point. Thus, the North Horizon Point lies at an azimuth of  $0^\circ$ , while the East Horizon Point lies at  $90^\circ$ , and the South Horizon Point at  $180^\circ$ . Azimuth is measured from the point of observation and does not directly correspond to points on the celestial sphere.

**ANGULAR DISTANCE** - Angular distance is the size of the angle through which a telescope tube or binocular aiming at one object must be turned in order to aim at another object. If you must rotate the equipment from the zenith to the horizon, the angular distance between the two points would be  $90^\circ$ .

# TELESCOPE TERMINOLOGY

**OBJECTIVE** - The objective is the front lens of a telescope. The listed measurement for objective lenses is the lens diameter. A larger objective allows more light to enter a telescope and provides a brighter image. The objective diameter is also sometimes referred to as the aperture of a telescope.

**FOCAL LENGTH** - The focal length of a telescope is the distance from the point where light enters a telescope (the objective) to the point where the image is in focus. In telescopes with the same size objective, a longer focal length will provide higher magnification and a smaller field of view.

**MAGNIFICATION** - The magnification of a telescope is determined by the relationship between the focal length of the telescope and the focal length of the eyepiece used. A greater difference in these focal lengths results in a greater the magnification of the telescope. Every telescope has a maximum useful magnification of about 60 times the diameter of the objective in inches. Magnification beyond the maximum useful magnification will provide dim, low-contrast images.

**FOCAL RATIO** - The focal ratio of a telescope is a description of the relationship between the focal length and objective lens size of a telescope. Visually, a smaller focal ratio (also called f-stop) provides a wider field of view. Photographically, the lower the f-stop, the shorter the exposure time needed to capture an object on film.

**LIMITING MAGNITUDE** - The limiting magnitude of a telescope describes the faintest object you can see with a telescope. The magnitude of a star describes its brightness. The larger the magnitude of an object, the fainter it appears to be. The brightest stars have a magnitude of 0 or less.

**RESOLVING POWER** - The resolving power, or Dawes' Limit, of a telescope is the ability to view closely spaced objects through a telescope. The resolving power of a telescope is measured in seconds of arc. The smaller the resolving power, the better you will be able to separate binary stars when viewing through your telescope.

**ABERRATION** - Aberrations are degradations in image, which can occur due to optical system design or improper alignment of optical system components. The most common types of aberration are chromatic aberration, spherical aberration, coma, astigmatism, and field curvature.

**COLLIMATION** - Collimation is the alignment of optical components within an optical system. Improper collimation will distort an image and may result in aberrations present in the image. Most reflector telescopes have collimation adjustments which can be made in order to reduce aberrations and image distortion. Refractor telescopes do not require collimation nearly as often as reflector telescopes.

# FAQs FOR YOUR ZHUMELL DOBSONIAN TELESCOPE

## **CAN I TAKE THE OPTICAL TUBE OFF OF THE MOUNT WHEN I MOVE THE SCOPE?**

The optical tube on Zhumell Dobsonian telescopes can easily be taken off of its base. Removing the optical tube assembly from the base makes moving your Dobsonian much easier and will help prevent damage to the mount or optical tube during transport. To remove the optical tube from the mount, simply lift the tube out of the cradle mount by grasping the silver side bearings.

## **HOW DO I KNOW WHEN I NEED TO COLLIMATE MY TELESCOPE?**

When the optics of a telescope are out of alignment, image clarity will be lost. In extreme cases, you may not even be able to focus an image. If you notice that you are having problems achieving focus, try collimating your telescope. It is recommended that reflector telescopes be collimated every time they are used.

## **THE IMAGE I SEE IN MY FINDERSCOPE IS NOT THE SAME AS THE IMAGE I SEE THROUGH MY TELESCOPE. WHAT IS WRONG?**

In order for the finderscope to show the same part of the sky which your telescope should see, the finderscope must be aligned. Since the finderscope has less magnification and a wider field of view than the telescope, it will help you zero in on stars once it is properly aligned with the optical tube.

## **CAN I TAKE ASTROPHOTOGRAPHS THROUGH MY DOBSONIAN?**

Astrophotography generally requires long exposure times in order to compensate for the limited amount of light available for shots of stars and planets. Since long exposures are required, your Dobsonian telescope will not work well for astrophotography. Due to the rotation of the Earth and the apparent movement of the stars, a tracking motor or go-to system is best-suited for astrophotography. If you are considering trying astrophotography, we recommend looking into purchasing an equatorial (EQ) mount with a motor drive or go-to system.

# FAQs FOR YOUR ZHUMELL DOBSONIAN TELESCOPE

## **CAN I USE THE OPTICAL TUBE FROM MY DOBSONIAN ON ANY OTHER MOUNTS?**

The optical tube from your Dobsonian telescope will work on any type of mount, as long as the mount is able to support the weight and size of the optical tube while still moving freely. In order to use the optical tube from your Dobsonian telescope on an equatorial mount, you will need to purchase the correct size tube rings and a dovetail plate; these will allow you to attach the optical tube to the mount. Tube rings can be purchased in many different sizes and are available through many astronomical retailers. In order to determine the correct tube ring size, measure the diameter of the optical tube (which is larger than the diameter of the primary mirror). If you have questions about whether a particular mount will work the optical tube, please check with the mount's manufacturer about the specifications for the mount.

## **WHY IS IT CALLED A DOBSONIAN TELESCOPE?**

Although it is based on the Newtonian optical tube design, the Dobsonian gets its name from the person who developed the type of mount used on most Dobsonian telescopes. John Dobson revolutionized the world of astronomy by making telescopes out of "junk". One of his first telescopes was made from a ship's porthole window, scrap wood, and cardboard. Dobson's approach to design drastically reduced the price of telescopes and made the price of large aperture telescopes accessible to amateur astronomers. John Dobson was known for both his ingenuity in using common materials and his outreach to the general public through the San Francisco Sidewalk Astronomers.

