SPACE EXPLORATION COLLECTION

Telescope AR-90/900 EXOS-1/EQ4

Art. No. 9800740

Instruction manual



Achromatic Refractor (AR)

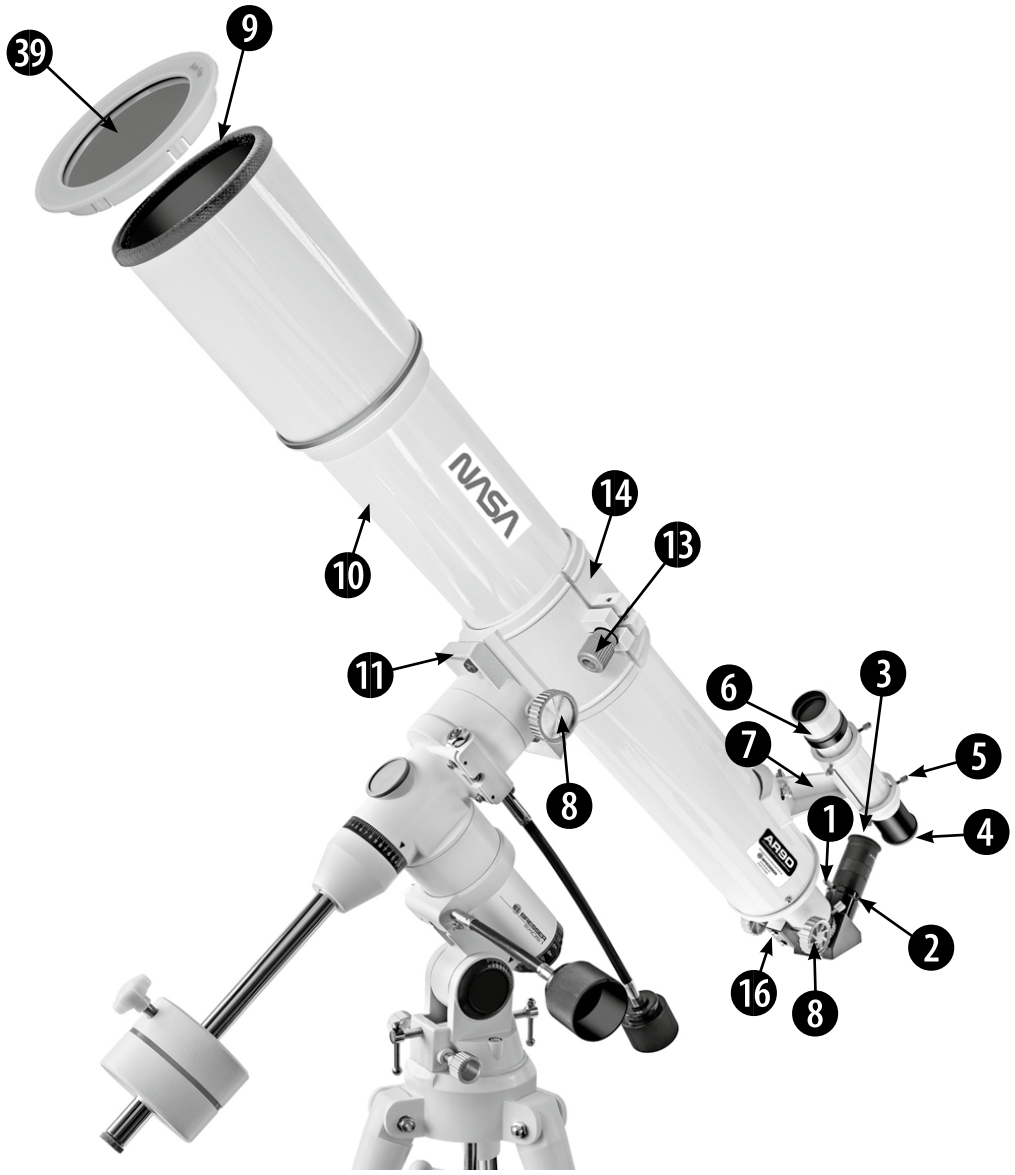


Fig. 1a: Achromatic Refractor

AR-90 Achromatic Refractor with EXOS-1	
Item number	9800740
Optical design	achromatic refractor
Clear aperture	3.5” = 90 mm
Focal length	900 mm
Focal ratio	f/10
Resolving power	1.27 arc sec
Coatings	multi-coated
Mount EXOS-1	Aluminium-Guß, German type equatorial
RA- und DEC-Antriebssystem	über flexible Wellen
Max. practical power	180x
Tripod	adjustable steel-tube field tripod ST-1
Net weight	12.25 kg

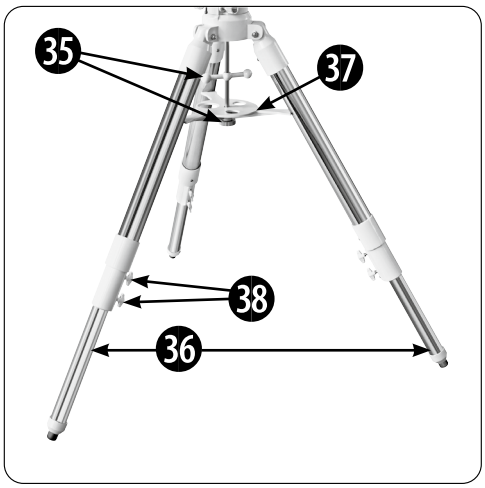


Fig. 1b: The Tripod

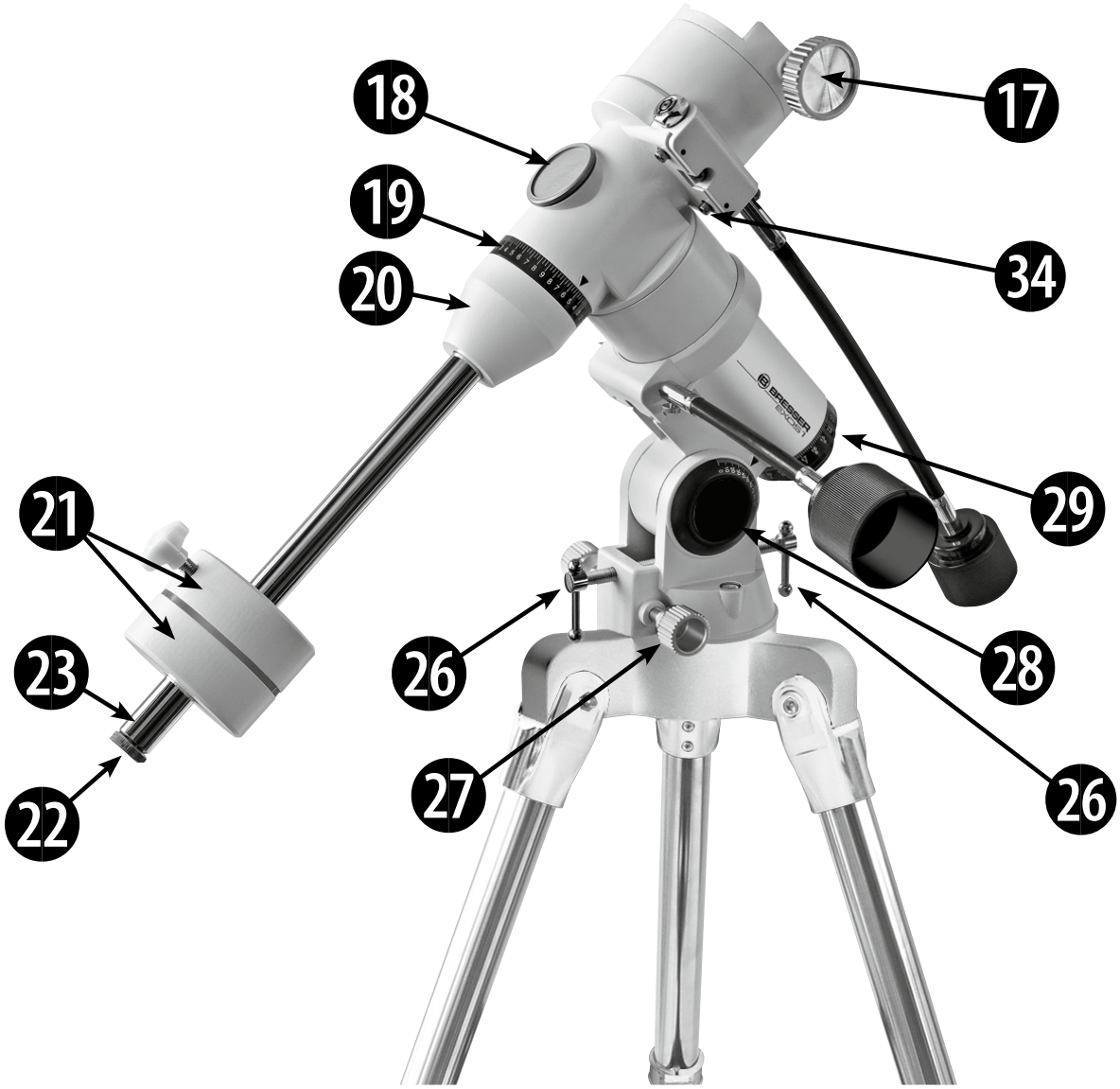


Fig. 1c: The mount



DANGER!

Solar observation only by using the included solar filter and in combination with the dedicated telescope. The solar filter must be mounted in front of the lens, i.e., before the sunlight enters the telescope.

BEFORE EVERY SOLAR OBSERVATION:

Remove the optical finderscope from the telescope tube to avoid unintentional looking at the sun!

Important safety information

- Check the solar filter before each solar observation to ensure it is undamaged. Hold it up to a bright light source to detect cracks and/or holes. Do not use the telescope for solar observation if the solar filter is even slightly damaged. In this case, contact the manufacturer to obtain the right spare parts.
- Always use the solar filter provided when observing the sun. Ensure it is correctly installed on this telescope according to the instructions. The usage of the solar filter is only recommended in combination with this telescope.
- Never look into the sun through an eyepiece/telescope without any certified solarfilter. A moonfilter can never be used to observe the sun. A moonfilter is only suitable for observing the moon. The solarfilter must be mounted onto the telescope aperture, not onto the eyepiece. Otherwise the ray of light bundled by the lens immediately destroys the filter foil and can instantly cause eye damage or even complete blindness.
- Before each sun observation, check that the sun filter is firmly in place. Accidental detachment from the lens opening can cause immediate and permanent eye damage and blindness.
- If the sun filter cannot be mounted firmly enough on the tube, improve the fit by applying several self-adhesive felt strips or similar between the sun filter and the lens aperture. Never use the solar filter if it cannot be properly attached to the telescope. In such a case, always contact our customer service first.
- Be careful when observing the sun. Even a brief glance through the unprotected lens may lead to major eye damage or even complete blindness.
- Children must not be allowed to use the telescope to look at the sun, even if the right filter is fitted. Children must be under constant supervision.
- Never leave the optics unattended. Children and inexperienced adults may use the telescope for solar observation without suitable safety measures and blind themselves.
- Do not observe without interruption. Make frequent breaks (approx. every three minutes).
- Do not look at the sun after an eye operation or other eye ailment without medical approval.
- Waves / creases in the foil are normal and not a product defect.
- Do not expose the device to high temperatures.

Looking at or near the Sun will cause instant and irreversible damage to your eye!

Fig. 1

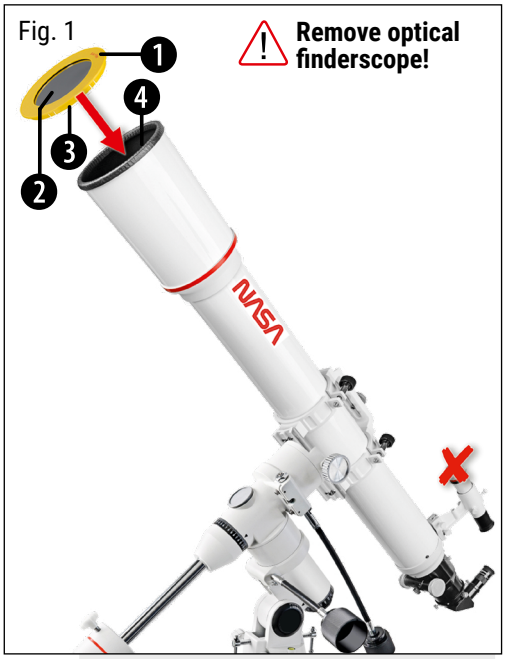
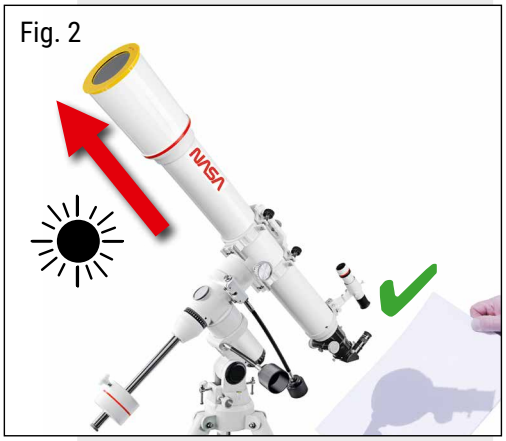


Fig. 2



Installing the solar filter (Fig. 1)

1. Make sure the optics is turned away from the sun before and during the installation.
2. Hold the filter only on the external frame (1). Never touch the foil (2) to avoid any damages on it.
3. Insert the filter carefully with the clamp ring (3) first into the free opening (4) of the telescope.

NOTE!
Turn away the optics from the sun before removing the solar filter. The extremely powerful bundling of light and heat by a bare lens may damage the lens adhesive in the eyepiece.

Pointing the telescope at the sun
Start with checking the solar filter - it has to be completely intact and firmly installed onto the telescope. It is very easy to point the telescope to the sun - just hold a piece of white paper about 20cm behind the telescope tube and watch the shadow on the paper. See Fig. 2. Point the telescope to the approximate position of the sun and watch the outline of the telescope shadow on the paper. Move the telescope until the area of the shadow is at its minimum. Now the sun can be observed through the telescope with the 20mm eyepiece. For finding the sun, please only use the 20mm eyepiece and without the Barlow lens. After you have centered the sun in the field of view of the eyepiece you can increase power by using the Barlow lens to see more details.

Attaching and using the solar viewfinder (accessory depends on model)
Depending on the telescope type purchased and the scope of delivery, a special solar viewfinder is used. it works according to a simple projection method and can therefore be used safely to find the sun. To do this, remove the LED viewfinder for night observation from the optical tube and insert the solar viewfinder into the holder. Of course, this solar viewfinder must be adjusted with the telescope on one axis before first use. To do this, adjust the sun in the telescope as described above using the cast shadow method and then center the point-shaped sun projection with the viewfinder adjustment screws in the center of the viewfinder's lens.

Notes on use: Eyepiece magnification
Please use only the 20 mm eyepiece supplied for solar observation either by itself or together with the 2x Barlow lens to limit maximum magnification to 18x or 35x. Greater magnification, e.g. using the 4 mm eyepiece, yields blurred solar images. This is a design feature and not a defect.

Maintenance and cleaning
Clean the foil only if it is absolutely neccessary! For cleaning use a lint-free and soft cloth and moisten it with a little water. Then clean the foil with the cloth very carefully and without pressure. Note that the foil is very sensitive and it must not be used even with minor damages!

To avoid premature aging of the filter, it is recommended to store the filter in a light-protected environment when it is not in use.

Declaration of Conformity

Product Type:	Solar Filter
Product Name:	Solar Filter for Telescopes
Filter category:	E15, E16

Bresser GmbH declares that the above-named product corresponds to the following directives and relevant standards in its conception and design as well in the version marketed by us.

Directive:	Harmonized Standards:
PPE 89/686/EEC	EN 1836:2005, cl. 4.1.4.4
./.	ISO 12312-2:2015

This declaration is no longer valid in the event of a change to the product which has not been coordinated with us.

Bresser GmbH, Gutenbergstr. 2, D-46414 Rhede, Germany

Your personal window to the universe

Observe the feather structure of an eagle from 150 yards or study the rings of the planet Saturn from a distance of 800 million miles. Focus beyond the Solar System and observe majestic nebulae, ancient star clusters, and remote galaxies. Refer to Figures 1a through 1c for the following features:

Description of the features (Fig. 1a to 1d)

1 Eyepiece Thumbscrews: Tightens the eyepiece (see 3) in place. Tighten to a firm feel only.

2 Eyepiece Holder: Holds eyepiece in place. Holders supplied for 1.25“ Diagonal Prism (not shown): Provides a more comfortable right-angle viewing position. Slide the diagonal prism directly into the eyepiece holder (see 2) and tighten the thumbscrew on the eyepiece holder to a firm feel only.

3 Eyepiece: Place the supplied eyepiece into the eyepiece holder or the diagonal prism and tighten in place with the eyepiece thumbscrew (see 2). The eyepiece magnifies the image collected in the optical tube.

1 Which eyepiece is suitable for which application? See p. 13 “choosing an eyepiece”

4 8 x 50mm Viewfinder: (6x30 only for smaller models) A low-power, wide-field sighting scope with reticle that enables easy centering of objects in the telescope eyepiece.

5 Viewfinder Collimation Screws: Use these screws to adjust the alignment of the viewfinder.

6 Viewfinder Front Cell and Locking Ring: Adjust the front cell to focus the viewfinder. See step 3, page 10 for more details. The viewfinder is supplied with a small dust cover placed over the front cell.

7 Viewfinder Bracket: Holds the viewfinder in place.

8 Focus Knobs: Moves the telescope’s focuser drawtube in a finely-controlled motion to achieve precise image focus. The Telescope can be focused on objects from a distance of about 500 ft. to infinity. Rotate the focus knobs to focus on objects.

4 How do I adjust the finderscope? See p. 11

9 Dust Cover: Place the dust cover (not visible in photo) over the optical tube when storing the telescope.

NOTE:

The dust cover should be replaced after each observing session. Allow time for any dew that might have collected during the observing session to evaporate prior to replacing the dust cover.

7 How do I mount the viewfinder? See p. 11

10 Optical Tube: The main optical component that gathers the light from distant objects and brings this light to a focus for examination through the eyepiece.

11 Cradle Assembly: Attaches to mount base. See 9.

13 Cradle Ring Lock Knobs (2 pcs.) and Washers

14 Cradle Rings: Part of the cradle assembly (see 11); hold the optical tube firmly in place.

15 Viewfinder Bracket Screws: Tighten to a firm feel to hold viewfinder securely in place (see 4). See page 10 for more information.

16 Focus Lock Knob: Designed to prevent the focuser drawtube from moving when a heavy accessory, such as a camera, is attached to

11 Want to learn more about mounting the telescope? See p. 8-10 (EXOS-1) / p. 11-12 (EXOS-2)

the focuser assembly. For normal observing with an eyepiece and diagonal prism, it is not necessary to use the lock knob.

17 Dec. Lock: Controls the manual movement of the telescope. Turning the Dec. lock counterclockwise unlocks the telescope enabling it to be freely rotated by hand about the Dec. axis. Turning the Dec. lock clockwise (to a firm feel only) tightens the lock and prevents the telescope from being moved free, but engages the manual Dec. drive shaft.

18 Polar Viewfinder Cap (for EXOS-2 models only): Remove this cap when using the polar viewfinder (see 29).

19 Declination (Dec.) Setting Circle: See APPENDIX A, page 25, for more information.

20 Counterweight Shaft Base: Thread, along with the shaft, to the mount. See page 9 (EXOS-1) or 12 (EXOS-2) for more information.

21 Counterweight and Counterweight Lock Knob: Counterbalances the weight of the optical tube, and adds stability to the mount. Tighten the lock knob on the side of the counterweight to a firm feel to prevent the weight from sliding on the shaft.

22 Counterweight Shaft: Slide the counterweight onto this shaft (see 21).

23 Counterweight Safety Cap: Prevents the counterweight from accidentally slipping off the end of the counterweight shaft.

24 R.A. manual Drive Assembly:

26 Latitude Adjustment: Sets the latitude of your observing location. The two handle screws work in a „push - pull“ operation—as you tighten one, loosen the other. The T-handle above the azimuth control knobs (see 27)is the North T-handle screw (South in the Southern Hemisphere). This side of the mount must be pointed North (South in the Southern hemisphere) during the polar alignment procedure.

27 Fine Azimuth Control Knobs: Fine tune the side-to-side movement of the telescope when centering Polaris in the telescope eyepiece or when using the polar alignment viewfinder.

28 Latitude Dial: Set the latitude of the observing site on this dial using the latitude T-handle screws. For more information see Step 6, page 9.

29 Polar Alignment Viewfinder (EXOS-2 only): Allows you to precisely polar align the telescope.

30 Polar Alignment Viewfinder Reticle and LED Knob (EXOS-2 only): Rotate the knob to switch on or off the LED that illuminates the reticle within the polar alignment finder. Be sure to turn off the LED when finished with the polar viewfinder. Powered by (factory-supplied) batteries contained within. Polar viewfinder LED illumination is available seperately.

31 Right Ascension (R.A.) Setting Circle: See APPENDIX A, page 25.

32 R.A. Setting Circle Lock Knob: Rotate the knob to lock the R.A. Setting Circle in place.

33 R.A. Lock: Controls the manual movement of the telescope. Turning the R.A. lock counterclockwise unlocks the telescope enabling it to be freely rotated by hand about the R.A. axis. Turning the R.A. lock clockwise (to a firm feel only) tightens the lock and prevents the telescope from being moved free, but engages the R.A. manual shaft.

34 DEC-manual drive assembly

35 Tripod Leg Adjustment Knobs: Tighten to a firm feel to secure tripod legs.

36 Variable Height Tripod Legs: Supports the telescope mount. The mount attaches to the top of the tripod.

37 Accessory tray: Set extra eyepieces and other accessory on this convenient tray.

38 Tripod Leg Braces: Make the tripod more secure and stable. See Fig. 3.

17 Important:
Before loosening the DEC lock, hold the optical tube in place; otherwise it might swing through and cause damage to the mount or even hurt the operator.

27 Want to learn more about adjusting the latitude scale? See p. 15, step 6.

29 Want to learn more about the polar finder? See p. 30.

DEFINITION:
In this manual, you will find the terms “right aszension (RA), Declination (DEC), Elevation and Azimut”. These terms are explained on p. 25

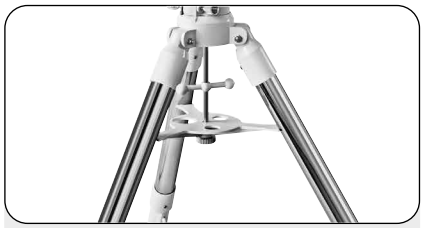


Fig. 3: The tripod

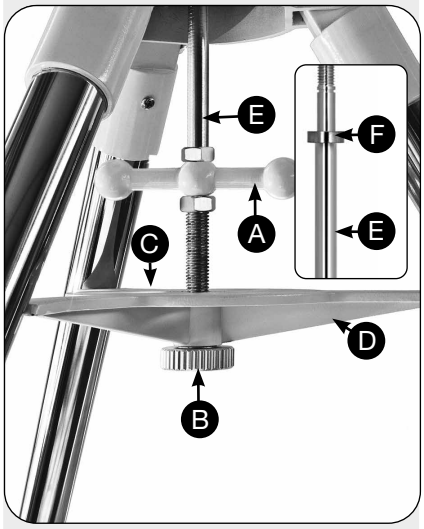


Fig. 4: Fastening the spacing plate and distance washer in place.

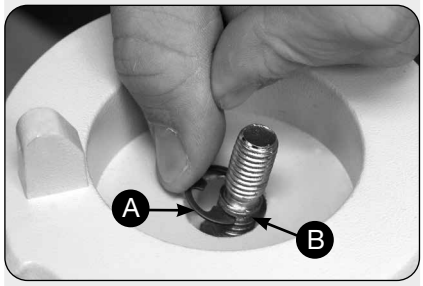


Fig. 4a: Threaded rod fastening using the C-clip

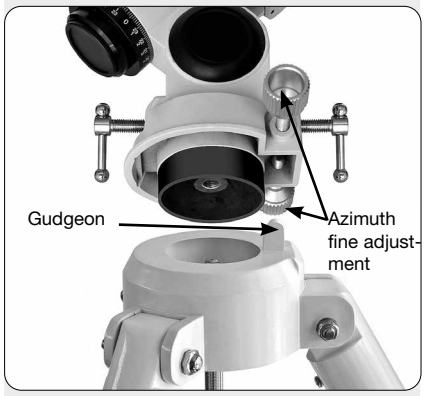


Fig. 5: installing the mounting on the tripod.

Assembling

(EXOS-1 mount on ST-2 tripod)

Telescope Assembly

As you unpack your telescope, carefully note the following parts. The assembly is shipped in separate boxes.

- Equatorial mount with polar alignment finder
- Heavy duty, adjustable steel tube tripod with leg braces, three tripod leg lock knobs, and a captive mount locking knob
- Optical tube assembly, dust cover, focuser, eyepiece holder, tube cradle assembly and fixing screws
- Eyepiece
- Diagonal prism (only for AR models)
- Counterweight and counterweight shaft
- 8x50 / 6x30mm viewfinder

How to Assemble Your Telescope

The giftboxes contain the optical tube assembly and its components, the tripod with the equatorial mount and the accessories.

1. Remove the components from the packaging and familiarise yourself with them. Please refer to illustrations 1a to 1d for details of telescope assembly. When removing the tripod from its packaging keep it parallel to the floor as the inner legs may otherwise slide out as they are not yet screwed tight.

2. Locking the tripod legs. Spread the legs until the spider vanes of the accessory plate are tautened (illustration. 3).

3. Fastening the spacing plate in place. To fasten the central screw (illustration 4, A) on the tripod first screw the tensioning screw (illustration 4, B) on. This can be screwed right down as it serves to clamp the spacing plate against the tripod legs. You can now insert the plate (illustration 4, C) from above on the central screw. Make sure the plate bars (illustration 4, D) show downwards.

Attention:
It‘s important the following step is applied to avoid any damage to the thread.

To prevent the threaded rod (illustration 4, E) being screwed into the mount too far use the gapping washer (illustration 4, F) supplied. Insert it from above on the threaded rod so that the wider chamfered side shows downwards. The spacing ring must be on the threaded rod „step“. Now push the threaded rod from below through the tripod base and slide the C-clip (illustration 4a, A) on the recess (illustration 4a, B) in the threaded rod

4. Fastening the mount on the tripod head. Place the mounting on the tripod head. Make sure the projection on the tripod is between the azimuth adjustment screws (illustration 5). To do so first loosen the azimuth screws sufficiently to allow space for the projection. Place the mounting on the tripod top in such a way that the projecting cylinder on the base fits into the hole in the tripod base centre and fasten it in place using the central screw. Tighten the screw hand tight.

5. Fastening the counterweight on the counterweight rod: insert the base of the counterweight rod (20, illustration 1d) on the threaded end of the rod and screw it on the counterweight rod (22, illustration 1). Then screw both in the thread on the base of the declination axis and counter screw rod to base. If you look through the large drill hole in the counterweight

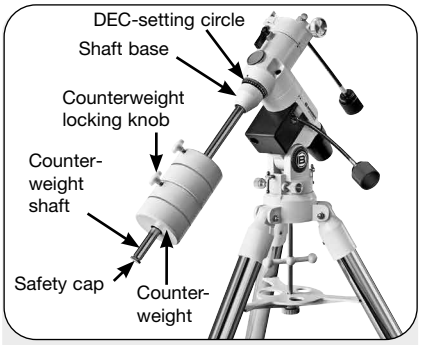


Fig. 6a: Attach counterweight assembly (EXOS-1)

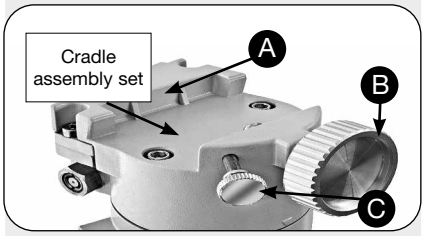


Fig. 7: Mounting the cradle assembly to the mount shaft (EXOS-2)

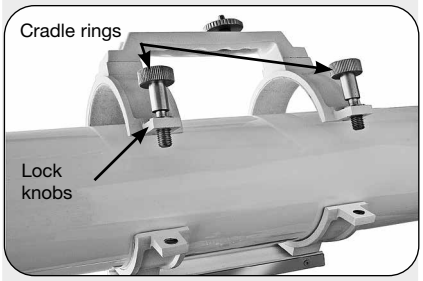


Fig. 8a: Place the optical tube in rings and loosely tighten the cradle ring lock knobs.

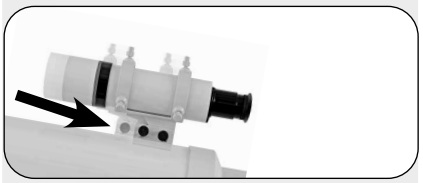


Fig. 9b: Viewfinder assembly. Slide bracket into slot.

you will see the bolt blocking the hole. Move the counterweight slightly to make it disappear in its drill hole and reveal the hole. If it doesn't, carefully loosen the counterweight screw until the bolt moves. Remove the safety cover (23, illustration 1d) from the rod. Hold the counterweight firmly whilst moving it to about the middle of the counterweight rod (22, illustration 1d). Tighten the counterweight fastening screw and then replace the safety cover.

NOTE:
If the counterweight ever slips, the safety cap (23, Fig. 1d) prevents the counterweight from sliding entirely off the shaft. Always leave the safety cap in place when the counterweight is on the shaft.

6. Set the latitude. Setting the latitude is easier if it is set before you attach the optical tube to the assembly. Locate the latitude dial (28, Fig. 1d); note that there is a triangular pointer above the dial located on the mount. The pointer is not fixed; it moves as the mount moves.
   Determine the latitude of your observing location. See APPENDIX B: LATITUDE CHART, page 28-29, for a list of latitudes, or check an atlas. Move the latitude T-handle screws in order to move the mount until the pointer points to your latitude. The two T-handle screws (EXOS-2 only) work in a „push - pull" operation—as you tighten one, loosen the other. When the pointer points at your latitude, tighten both screws until they make contact with the mount. The EXOS-1 has on screw with similar operation.
   At your observing site, set up the telescope assembly so that this leg approximately faces North (or South in the Southern Hemisphere).
7. Attach the cradle assembly to the mount – Models R and N: Remove the optical tube from the cradle and slide the cradle assembly (11, Fig. 1a) onto the cradle mounting slot. See Fig. 7. The rounded base of the cradle assembly fits into the rounded portion of the mounting slot. Tighten both the cradle locking knob and the secondary locking knob to a firm feel.
8. Position optical tube – Models AR and NT: Unscrew the cradle ring lock knobs (13, Fig. 1a) and open the cradle rings. While firmly holding the optical tube (10, Fig. 1a), position it onto the cradle rings (14, Fig. 1a) with the mid-point of the optical tube's length lying roughly in the center of the cradle ring assembly. Point the tube so that the front end (this end comes shipped with the dust cover (9, Fig. 1a) over it) is oriented as depicted in Fig. 1a. Then close the cradle rings (14, Fig. 1a) over the optical tube. Loosely tighten the cradle ring lock knobs just to hold the tube securely in place until you balance it. See Balancing the telescope, page 13.
9. Attach viewfinder bracket (Abb. 9b). Locate the viewfinder bracket screws (15, Fig. 1a and Fig. 9a) and remove the nuts from the screws. Slide the holes in the viewfinder bracket over the viewfinder bracket screws. Replace the nuts and tighten to a firm feel only.

9a. Attach viewfinder tube:. Back off the viewfinder collimation screws (5, Fig. 1a) and slide the viewfinder tube into the bracket. Orient the viewfinder eyepiece as depicted in Fig. 1a. Tighten the collimation screws to a firm feel. See Aligning the viewfinder, page 14.

10. Insert the eyepiece: NT models (Fig. 10a): Lift to remove the dust cap from the eyepiece holder on the focuser assembly. Set the dust cap aside in a safe place and replace it when you have finished observing to protect the eyepiece assembly. Back off the eyepiece thumbscrews (1, Fig. 1a) and insert the supplied 25mm eyepiece (3, Fig. 1a) into the the eyepiece holder. Tighten the holder thumbscrews to a firm feel to secure the eyepiece. AR models (Abb. 10b): Lift to remove the dust cap from the eyepiece holder on the focuser assembly. Set the dust cap aside in a safe place and replace it when you have finished observing to protect the eyepiece assembly. Back off the eyepiece thumbscrews (1, Fig. 1a) and slide the diagonal prism into the holder and tighten the thumbscrews to a firm feel only. Insert the supplied 25mm eyepiece (3, Fig. 1a) into the the diagonal prism. Tighten the prism's thumbscrews to a firm feel to secure the eyepiece.

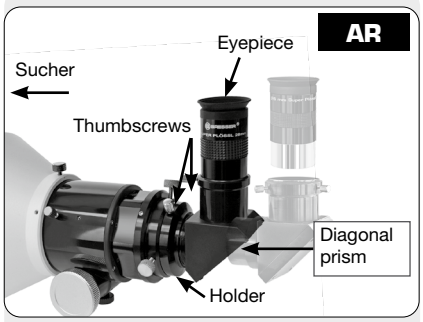


Fig. 10b: Insert eyepiece into diagonal prism and tighten thumbscrews.

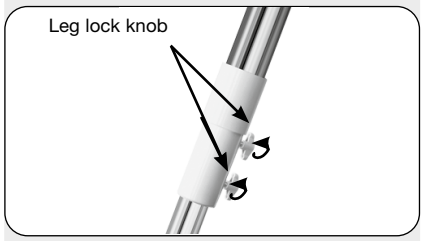


Fig. 11: Adjust the tripod height using the leg lock knobs.

11. Adjust the height of the tripod: Adjust the height of the tripod by loosening the tripod lock knobs (Fig. 11). Extend the sliding inner section of each tripod leg to the desired length; then tighten each knob. Adjust the tripod to a height that is comfortable for viewing.

Getting Started! – First Steps

Balancing the Telescope

In order for the telescope to be stable on the tripod and also for it to move smoothly, it must be balanced. To balance the telescope, unlock the Right Ascension or R.A. lock (33, Fig. 1d). When this axis is unlocked, the telescope pivots on the R.A. axis. Later in the procedure, you will also unlock the Declination or Dec. lock (17, Fig. 1d). When unlocked, the telescope pivots on the Dec. axis. Most of the motion of the telescope takes place by moving about these two axes, separately or simultaneously. Try to become familiar with these locks and observe how the telescope moves on each axis. To obtain a fine balance of the telescope, follow the method below:

1. Firmly hold the optical tube secure so that it cannot accidentally swing freely. Loosen the R.A. lock (33, Fig. 1d). The optical tube now moves freely about the R.A. axis. Rotate the telescope so that the counterweight shaft is parallel (horizontal) to the ground.
2. Unlock the counterweight lock knob and slide the counterweight (21, Fig. 1d) along the counterweight shaft until the telescope remains in one position without tending to drift down in either direction. Then re-tighten the counterweight lock knob, locking the counterweight in position.
3. Again, hold the optical tube so that it cannot accidentally swing freely. Lock the R.A. lock (33, Fig. 1d), and unlock the Dec. lock (17, Fig. 1d). The telescope now is able to move freely about the Dec. axis. Loosen the cradle ring lock knobs (13, Fig. 1a) so that the main tube slides easily back and forth in the cradle rings. Move the main tube in the cradle.

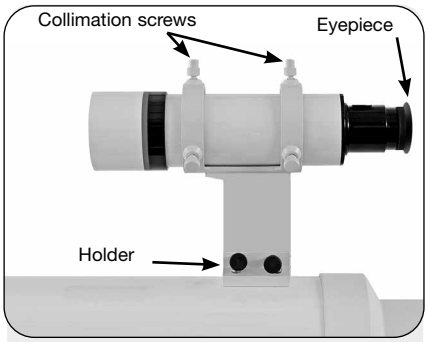


Fig. 14: 8x50 Finder scope assembly

Aligning the Viewfinder

The wide field of view of the telescope's viewfinder (4, Fig. 1a) provides an easier way to initially sight objects than the main telescope's eyepiece (3, Fig. 1a), which has a much narrower field of view. If you have not already attached the viewfinder to the telescope tube assembly, follow the procedure described in step 9, page 9.

In order for the viewfinder to be useful, it must be aligned to the main telescope, so that both the viewfinder and telescope's optical tube (10, Fig. 1a) point at the same position in the sky. This alignment makes it easier to find objects: First locate an object in the wide-field viewfinder, then look into the eyepiece of the main telescope for a detailed view.

To align the viewfinder, perform steps 1 through 4 during the daytime; perform step 5 at night. Both the 6 x 30mm and the 8 x 50mm viewfinders align in an identical manner. Refer to Fig. 14.

1. Remove the dust covers from the optical tube and the viewfinder.
2. If you have not already done so, insert the low-power 25mm eyepiece (3, Fig. 1a) into the eyepiece holder of the main telescope.
   See step 10, page 13.
3. Look through the viewfinder eyepiece at an object at least one-half mile away (Tip: Remove the viewfinder tube from the bracket to simplify this operation). If the distant object is not in focus, turn the focus lock ring counterclockwise to loosen the viewfinder front cell (6, Fig. 1a). Twist the front cell until focus is achieved and retighten the focus lock ring.
4. Unlock the R.A. lock (33, Fig. 1d) and the Dec lock (17, Fig. 1d) so that the telescope turns freely on both axes. Then point the main telescope at a tall, welldefined and stationary land object (e.g., the top of a telephone pole) at least 200 yards distant and center the object in the telescope's eyepiece. Focus the image by turning the focus knobs (8, Fig. 1a). Retighten the R.A. and Dec. locks.
5. Look through the viewfinder and loosen or tighten, as appropriate, one or more of the viewfinder collimation thumbscrews (5, Fig. 1a) until the viewfinder's crosshairs are precisely centered on the object you previously centered in the main telescope's eyepiece. You are now ready to make your first observations with your telescope.

ATTENTION:
Never point the telescope directly at or near the Sun at any time! Observing the Sun, even for the smallest fraction of a second, will result in instant and irreversible eye damage, as well as physical damage to the telescope itself.

6. Check this alignment on a celestial object, such as a bright star or the Moon, and make any necessary refinements, using the method outlined above in steps 3 and 4.

With this alignment performed, objects first located in the wide-field viewfinder will also appear in the telescope's eyepiece.

Tips

Further Study....

This manual gives only the briefest introduction to astronomy. If you are interested in pursuing further studies in astronomy, a few topics are suggested below that are worth reading up on. Try looking up some of these in the optional Autostar glossary. Also included below is a small sampling of books, magazines, and organizations that you might find helpful.

Topics

1. How is a star born? How does a solar system form?
2. How is the distance to a star measured? What is a light year? What is red shift and blue shift?
3. How are the craters on our Moon formed? Is there water under the surface of the Moon?
4. What is a black hole? A neutron star? A gamma burster? An Einstein lens?
5. What are stars made of? Why are stars different colors? How is the elementa composition of a star determined? What is an Lyman Alpha forest?
6. What is the difference between a Type 1 and a Type II supernova?
7. What is the importance of studying the composition of comets? Where do comets come from?
8. How old is our Sun? Will our Sun evolve into a planetary nebula or go supernova?
9. What is the Inflationary Big Bang? What is dark matter? What are MACHO's?
10. How are extrasolar planets discovered? What is an accretion (or protoplanetary disk?
11. What are the differences between elliptical, spiral, and irregular galaxies? Can globular clusters be older than the universe itself?

Books

1. The Guide to Amateur Astronomy by Jack Newton and Philip Teece
2. The Sky: A User's Guide by David Levy
3. Turn Left at Orion by Guy Consolmagno & Dan Davis
4. Astrophotography for the Amateur by Michael Covington
5. Observing for the Fun of It by Melanie Melton
6. Will Black Holes Devour the Universe? and 100 Other Questions about Astronomy by Melanie Melton

Magazines

1. Sky & Telescope, Box 9111, Belmont, MA 02178
2. Astronomy, Box 1612, Waukesha, WI 53187

Organizations

1. Astronomical League, Executive Secretary, 5675 Real del Norte, Las Cruces, NM 88012
2. The Astronomical Society of the Pacific, 390 Ashton Ave., San Francisco, CA 94112
3. The Planetary Society, 65 North Catalina Ave., Pasadena, CA 91106

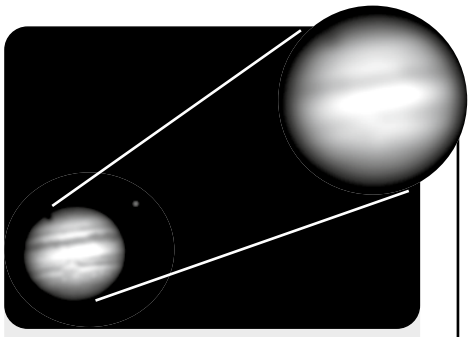


Fig. 15a+b: Jupiter; examples of the right amount of magnification and too much magnification.

Note: Seeing conditions vary widely from night-tonight and site-to-site. Turbulence in the air, even on an apparently clear night, can distort images. If an image appears fuzzy and ill-defined, back off to a lower power eyepiece for a more well-resolved image.

(see Fig. 15a and 15b below).

Choosing an Eyepiece

A telescope's eyepiece magnifies the image formed by the telescope's main optics. Each eyepiece has a focal length, expressed in millimeters, or "mm." The smaller the focal length, the higher the magnification. For example, an eyepiece with a focal length of 9mm has a higher magnification than an eyepiece with a focal length of 25mm.

Your telescope comes supplied with a Plössl 25mm eyepiece which gives a wide, comfortable field of view with high image resolution.

Low power eyepieces offer a wide field of view, bright, high-contrast images, and eye relief during long observing sessions. To find an object with a telescope, always start with a lower power eyepiece such as the Super Plössl 26mm. When the object is located and centered in the eyepiece, you may wish to switch to a higher power eyepiece to enlarge the image as much as practical for prevailing seeing conditions.

The power, or magnification of a telescope is determined by the focal length of the telescope and the focal length of the eyepiece being used. To calculate eyepiece power, divide the telescope's focal length by the eyepiece's focal length. For example, a 25mm eyepiece is supplied. The focal length of the 8" Messier series model is 900mm (see Specifications, page 23-24).

Telescope Focal Length ÷ Eyepiece Focal Length = Eyepiece Power

Telescope Focal Length = 1000mm

Eyepiece Focal Length = 25mm

$$\text{Magnification} = \frac{\text{Telescope Focal Length}}{\text{Eyepiece Focal Length}} = \frac{1000\text{ mm}}{25\text{ mm}} = 40$$

The magnification is therefore 40X (approximately).

Tips

Too Much Power?

Can you ever have too much power? If the type of power you're referring to is eyepiece magnification, yes, you can! The most common mistake of the beginning observer is to "overpower" a telescope by using high magnifications which the telescope's aperture and atmospheric conditions cannot reasonably support.

Keep in mind that a smaller, but bright and well-resolved image is far superior to one that is larger, but dim and poorly resolved (see Figs. 15a and 15b). Powers above 200X should be employed only under the steadiest atmospheric conditions.

Important Note:

Objects appear upside-down and reversed left-for-right when observed in the viewfinder. With refracting telescope models, objects viewed through the main telescope with the diagonal mirror in place are seen right-side-up, but reversed left-for-right. This image inversion is of no consequence when observing astronomical objects, and in fact all astronomical telescopes yield inverted images.



WARNING

Never use a Telescope to look at the Sun! Looking at or near the Sun will cause instant and irreversibledamage to your eye. Eye damage is often painless, so there is no warning to theobserver that damage has occurred until it is too late. Do not point the telescope or its viewfinder at or near the Sun. Do not look through the telescope or its viewfinder as it is moving. Children should always have adult supervision while observing.

Observation

Observing by Moving the Telescope Manually

After the telescope is assembled and balanced as described previously, you are ready to begin manual observations. View easy-to-find terrestrial objects such as street signs or traffic lights to become accustomed to the functions and operations of the telescope. For the best results during observations, follow the suggestions below:

- When you wish to locate an object to observe, first loosen the telescope's R.A. lock (33, Fig. 1d) and Dec. lock (17, Fig. 1d). The telescope can now turn freely on its axes. Unlock each axis separately and practice moving your telescope. Then practice with two unlocked axes at the same time. It is very important to practice this step to understand how your telescope moves, as the movement of an equatorial mount is not intuitive.
- Use the aligned viewfinder to sight-in on the object you wish to observe. When the object is centered in the viewfinder's crosshairs, re-tighten the R.A. and Dec. locks.
- A telescope's eyepiece magnifies the image formed by the telescope's main optics. Each eyepiece has a focal length, expressed in millimeters, or "mm." The smaller the focal length, the higher the magnification. For example, an eyepiece with a focal length of 9mm has a higher magnification than an eyepiece with a focal length of 25mm. Low-power magnification eyepieces offer a wide field of view, bright, high-contrast images, and relief of eye strain during long observing sessions. To observe an object with a telescope, always start with a low power eyepiece such as the 25mm supplied with your telescope. When the object is centered and focused in the eyepiece, switch to a higher power eyepiece to enlarge the image as much as practical for prevailing viewing conditions.
- Once centered, an object can be focused by turning one of the knobs of the focusing mechanism (8, Fig. 1a). Notice that when observing astronomical objects, the field of view begins to slowly drift across the eyepiece field. This motion is caused by the rotation of the Earth on its axis. Objects appear to move through the field more rapidly at higher powers. This can be compensated with the RA drive shaft or the (optional) RA drive motor.

Observe the Moon

Point your telescope at the Moon (note that the Moon is not visible every night). The Moon contains many interesting features, including craters, mountain ranges, and fault lines. The best time to view the Moon is during its crescent or half phase. Sunlight strikes the Moon at an angle during these periods and adds a depth to the view. No shadows are seen during a full Moon, making the overly bright surface to appear flat and rather uninteresting. Consider the use of a neutral density Moon filter when observing the Moon. Not only does it cut down the Moon‘s bright glare, but it also enhances contrast, providing a more dramatic image.

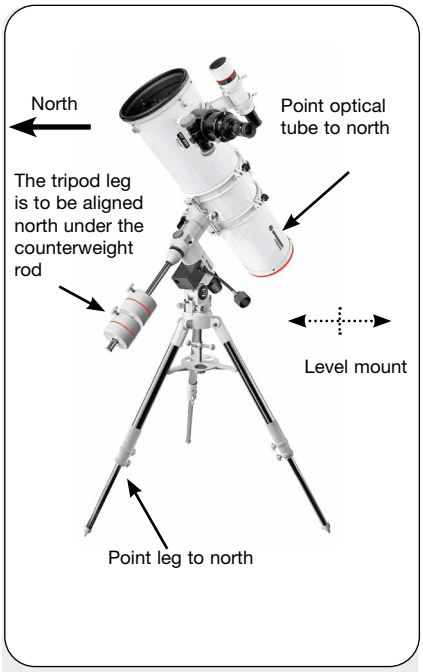


Fig. 16a: The polar home position, side view.



Fig. 16b: The polar home position, front view.

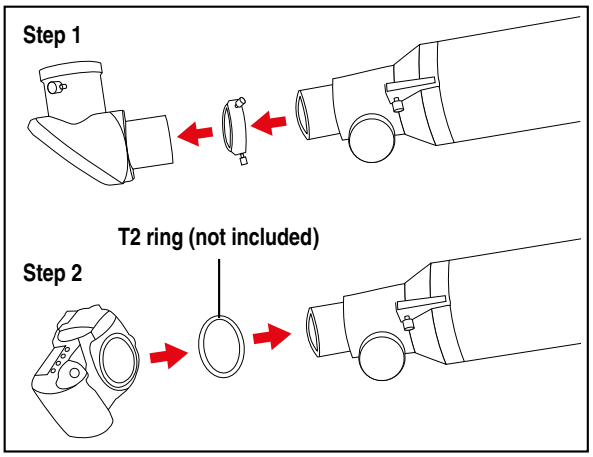
Setting the Polar Home Position

1. Level the mount, if necessary, by adjusting the length of the three tripod legs.
2. Unlock the R.A. Lock (33, Fig. 1d). Rotate the Optical Tube Assembly until the counterweight shaft is pointing straight down over the mount. See Figs. 16a and 16b.
3. If you have not already done so, lift the telescope assembly and turn it so that the tripod leg beneath the counterweight rod faces approximately North (South in the Southern Hemisphere). Release the Dec. lock (17, Fig. 1d) of the tripod, so that the optical tube (10, Fig. 1a) may be rotated. Rotate the optical tube until it points North (or South in the Southern Hemisphere). Then re-tighten the lock. Locate Polaris, the North Star, if necessary, to use as an accurate reference for due North (or Octantis in the Southern Hemisphere). See LOCATING THE CELESTIAL POLE, page 26.
4. If you have not already done so, determine the latitude of your observing location. See APPENDIX C: LATITUDE CHART, page 30-31, for a list of latitudes of major cities around the world. Use the latitude T-handle screws (26, Fig. 1d) to tilt the telescope mount so that the pointer indicates the correct latitude of your viewing location on the latitude dial (28, Fig. 1d). See step 6, page 12 for more information.
5. If steps 1 through 4 above were performed with reasonable accuracy, your telescope is now sufficiently well-aligned to Polaris, the North Star, for you to begin making observations. Once the mount has been placed in the polar home position as described above, the latitude angle need not be adjusted again, unless you move to a different geographical location (i.e., a different latitude).

IMPORTANT NOTE:
For almost all astronomical observing requirements, approximate settings of the telescope's latitude and other settings are acceptable. Do not allow undue attention to precise settings of polar home position of the telescope to interfere with your basic enjoyment of the instrument.

Adapt an DSLR camera

To mount an DSLR camera, a T2 ring suitable for the camera brand is required (e.g. Art.No.: 4921350 or 4920000).



Maintenance

Maintenance guidelines include:

a. Avoid cleaning the telescope's optics: A little dust on the front surface of the telescope's correcting lens causes virtually no degradation of image quality and should not be considered reason to clean the lens.

b. When absolutely necessary, dust on the front lens should be removed with gentle strokes of a camel hair brush or blown off with an ear syringe (available at any pharmacy). DO NOT use a commercial photographic lens cleaner.

c. Organic materials (e.g., fingerprints) on the front lens may be removed with a solution of 3 parts distilled water to 1 part isopropyl alcohol. You may also add 1 drop of biodegradable dishwashing soap per pint of solution. Use soft, white facial tissues and make short, gentle strokes. Change tissues often.

Caution:
Do not use scented or lotioned tissues or damage could result to the optics.

d. If the telescope is used outdoors on a humid night, water condensation on the telescope surfaces will probably result. While such condensation does not normally cause any damage to the telescope, it is recommended that the entire telescope be wiped down with a dry cloth before the telescope is packed away. Do not, however, wipe any of the optical surfaces. Rather, simply allow the telescope to sit for some time in the warm indoor air, so that the wet optical surfaces can dry unattended.

e. Do not leave your telescope inside a car on a warm summer day; excessive ambient temperatures can damage the telescope.

Customer Service

If you have a question concerning your elescope, contact the Bresser Customer Service Department.
In the improbable case of a malfunction, please contact first the Bresser customer service before sending back the telescope. Please give complete error descriptions and specific information about the defective part. The great majority of servicing issues can be resolved by telephone, avoiding return of the telescope to the factory. In any case, we need name, address, phone number and/or email address of the customer.

Contact data:

- Post:
  Bresser GmbH
  Kunden-Service
  Gutenbergstraße 2
  DE-46414 Rhede

- E-Mail:
  service.apd@bresser.de

- Telefon:
  +49 (0) 28 72 - 80 74 0

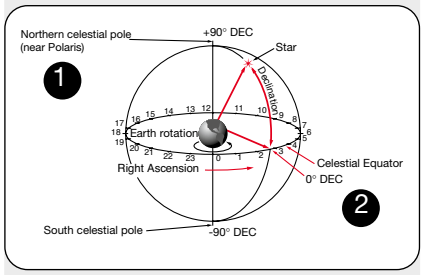


Fig. 33: Celestial sphere

Appendix A: Celestial coordinates

For a sufficient tracking of an celestial object, the telescope mount has to be aligned with the celestial pole.

By doing this, the mount's axes are orientated in this way that they fit to the celesial sphere.

If you want to align the telescope's mount to the celestial pole, you need some knowledge in which way an object at the sky can be located while it is steadily moving across the sphere. This chapter provides a basic knowledge about equatorial coordiates, the celestial pole and how objects can be found by their coordinates. You will also get used to the meaning of "Right aszension" and "Declination"

A celestial coordinate system was created that maps an imaginary sphere surrounding the Earth upon which all stars appear to be placed. This mapping system is similar to the system of latitude and longitude on Earth surface maps. In mapping the surface of the Earth, lines of longitude are drawn between the North and South Poles and lines of latitude are drawn in an East-West direction, parallel to the Earth's equator. Similarly, imaginary lines have been drawn to form a latitude and longitude grid for the celestial sphere. These lines are known as Right Ascension and Declination.

The celestial map also contains two poles and an equator just like a map of the Earth. The poles of this coordinate system are defined as those two points where the Earth's north and south poles (i.e., the Earth‘s axis), if extended to infinity, would cross the elestial sphere. Thus, the North Celestial Pole (1, Fig. 34) is that point in the sky where an extension of the North Pole intersects the celestial sphere. The North Star, Polaris is located very near the North Celestial Pole. The celestial equator (2, Fig. 34) is a projection of the Earth's equator onto the celestial sphere.

Just as an object‘s position on the Earth's surface can be located by its latitude and longitude, celestial objects may also be located using Right Ascension and Declination. For example, you could locate Los Angeles, California, by its latitude (+34°) and longitude (118°). Similarly, you could locate the Ring Nebula (M57) by its Right Ascension (18hr) and its Declination (+33°).

- Right Ascension (R.A.): This celestial version of longitude is measured in units of hours (hr), minutes (min), and seconds (sec) on a 24-hour „clock“ (similar to how Earth‘s time zones are determined by longitude lines). The „zero“ line was arbitrarily chosen to pass through the constellation Pegasus — a sort of cosmic Greenwich meridian. R.A. coordinates range from 0hr 0min 0sec to 23hr 59min 59sec. There are 24 primary lines of R.A., located at 15-degree intervals along the celestial equator. Objects located further and further East of the zero R.A. grid line (0hr 0min 0sec) carry higher R.A. coordinates.

- Declination (Dec.): This celestial version of latitude is measured in degrees, arcminutes, and arc-seconds (e.g., 15° 27‘ 33“). Dec. locations north of the celestial equator are indicated with a plus (+) sign (e.g., the Dec. of the North celestial pole is +90°). Dec. locations south of the celestial equator are indicated with a minus (–) sign (e.g., the Dec. of the South celestial pole is –90°). Any point on the celestial equator (such as the the constellations of Orion, Virgo, and Aquarius) is said to have a Declination of zero, shown as 0° 0‘ 0.

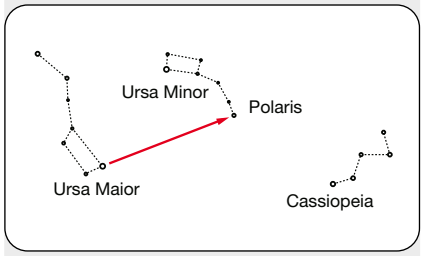


Fig. 34: Locating Polaris

Every celestial object can be exactly determined by these coordinates.Using setting circles prerequisites an advanced observing technique. If you use them for the first time, first point a bright star (the guide star) with known coordinates and adjust the setting circles to them. Now you can do a “star hop” to the next star with known coorditates and compare the setting circles with them. By this way, you will learn which precise handling is necessary for a successful pointing.

Locating the Celestial Pole

To get basic bearings at an observing location, take note of where the Sun rises (East) and sets (West) each day. After the site is dark, face North by pointing your left shoulder toward where the Sun set. To precisely point at the pole, find the North Star (Polaris) by using the Big Dipper as a guide (Fig. 35).

Note:
For nearly every purpose (except long-term astrophotography) average settings of the mount’s azimuth and latitue are sufficient. Therefore it is not necessary to spend too much time on perfekt aligning the celestial pole!

Setting Circles

Setting circles included with the Telescope permit the location of faint celestial objects not easily found by direct visual observation. With the telescope pointed at the North Celestial Pole, the Dec. circle (19, Fig. 1d) should read 90° (understood to mean +90°). Each division of the Dec. circle represents a 1° increment. The R.A. circle (31, Fig. 1d) runs from 0hr to (but not including) 24hr, and reads in increments of 5min.

Using setting circles requires a developed technique. When using the circles for the first time, try hopping from one bright star (the calibration star) to another bright star of known coordinates. Practice moving the telescope from one easy-to-find object to another. In this way, the precision required for accurate object location becomes evident.

To use the setting circles to locate an object not easily found by direct visual observation:

Insert a low-power eyepiece, such as a 25mm, into the focuser assembly. Pick out a bright star with which you are familiar (or is easily located) that is in the area of the sky in which your target object is located. Look up the R.A. coordinate of the bright star, and also of the object you wish to locate, in a star atlas. Point the object at the bright star. Then loosen the R.A. setting circle lock knob (32, Fig. 1d) and turn the R.A. setting circle to read the correct R.A. coordinate of the bright star; lock the R.A. setting circle lock knob onto the object. Next, loosen the R.A. lock (33, Fig. 1d) and turn the telescope in R.A. to read the correct R.A. coordinate of the object. Tighten the R.A. lock (33, Fig. 1d). If the procedure has been followed carefully, the desired object should now be in the telescopic field of a low-power eyepiece.

If you do not immediately see the object you are seeking, try searching the adjacent sky area. Keep in mind that, with the 25mm eyepiece, the field of view is about 0.5°. Because of its much wider field, the viewfinder may be of significant assistance in locating and centering objects, after the setting circles have been used to locate the approximate position of the object.

Tips



Join an Astronomy Club. Attend a Star Party

One of the best ways to increase your knowledge of astronomy is to join an astronomy club. Check your local newspaper, school, library, or telescope dealer/store to find out if there's a club in your area.

At club meetings, you will meet other astronomy and Bresser enthusiasts with whom you will be able to share your discoveries. Clubs are an excellent way to learn more about observing the sky, to find out where the best observing sites are, and to compare notes about telescopes, eyepieces, filters, tripods, and so forth.

Often, club members are excellent astrophotographers. Not only will you be able to see examples of their art, but you may even be able to pick up some "tricks of the trade" to try out on your telescope. Many groups also hold regularly scheduled Star Parties at which you can check out and observe with many different telescopes and other pieces of astronomical equipment.

Appendix B: Latitude Chart

Latitude Chart for Major Cities of the World

To aid in the polar alignment procedure (see page 25), latitudes of major cities around the world are listed below. To determine the latitude of an observing site not listed on the chart, locate the city closest to your site. Then follow the procedure below:

Northern hemisphere observers (N):

If the site is over 70 miles (110 km) north of the listed city, add one degree for every 70 miles. If the site is over 70 miles South of the listed city, subtract one degree per 70 miles.

Southern Hemisphere observers (S):

If the site is over 70 miles (110 km) north of the listed city, subtract one degree for every 70 miles. If the site is over 70 miles South of the listed city, add one degree per 70 miles.

EUROPE

City	Country	Latitude
Amsterdam	Netherlands	52° N
Athen	Greece	38° N
Berlin	Germany	52° N
Bern	Switzerland	47° N
Bonn	Germany	50° N
Borken/Westf.	Germany	52° N
Bremen	Germany	53° N
Dresden	Germany	51° N
Dublin	Ireland	53° N
Düsseldorf	Germany	51° N
Frankfurt/M.	Germany	50° N
Freiburg	Germany	48° N
Glasgow	Scotland	56° N
Hamburg	Germany	54° N
Hannover	Germany	52° N
Helsinki	Finland	60° N
Kopenhagen	Denmark	56° N
Köln	Germany	51° N
Leipzig	Germany	51° N
Lissabon	Portugal	39° N
London	Great Britain	51° N
Madrid	Spanien	40° N
München	Germany	48° N
Nürnberg	Germany	50° N
Oslo	Norway	60° N
Paris	France	49° N
Rom	Italy	42° N
Saarbrücken	Germany	49° N
Stockholm	Schweden	59° N
Stuttgart	Germany	49° N
Wien	Austria	48° N
Warschau	Poland	52° N

UNITED STATES OF AMERICA

City	Country	Latitude
Albuquerque	New Mexico	35° N
Anchorage	Alaska	61° N
Atlanta	Georgia	34° N
Boston	Massachusetts	42° N
Chicago	Illinois	42° N
Cleveland	Ohio	41° N
Dallas	Texas	33° N
Denver	Colorado	40° N
Detroit	Michigan	42° N
Honolulu	Hawaii	21° N
Jackson	Mississippi	32° N
Kansas City	Missouri	39° N
Las Vegas	Nevada	36° N
Little Rock	Arkansas	35° N
Los Angeles	Kalifornien	34° N
Miami	Florida	26° N
Milwaukee	Wisconsin	46° N
Nashville	Tennessee	36° N
New Orleans	Louisiana	30° N
New York	New York	41° N
Oklahoma City	Oklahoma	35° N
Philadelphia	Pennsylvania	40° N
Phoenix	Arizona	33° N
Portland	Oregon	46° N
Richmond	Virginia	37° N
Salt Lake City	Utah	41° N
San Antonio	Texas	29° N
San Diego	Kalifornien	33° N
San Francisco	Kalifornien	38° N
Seattle	Washington	47° N
Washington	District of Columbia	39° N
Wichita	Kansas	38° N

SOUTH AMERICA

City	Country	Latitude
Asuncion	Paraguay	25° S
Brasilia	Brasil	24° S
Buenos Aires	Argentinia	35° S
Montevideo	Uruguay	35° S
Santiago	Chile	34° S

ASIA

City	Country	Latitude
Peking	China	40° N
Seoul	South Korea	37° N
Taipei	Taiwan	25° N
Tokio	Japan	36° N
Victoria	Hongkong	23° N

AFRICA

City	Country	Latitude
Kairo	Egypt	30° N
Cape city	South Africa	34° S
Rabat	Marocco	34° N
Tunis	Tunesia	37° N
Windhoek	Namibia	23° S



Fig. 42: The moon. Note the deep shadows in the craters.



Fig. 43: The giant planet, Jupiter. The four largest moons can be observed in a different position every night.

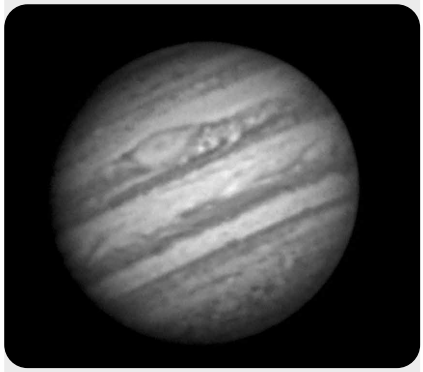


Fig. 43a: Jupiter, here in a higher magnification. Note the detailed cloud structures.

Appendix D: Basic astronomy

In the early 17th century Italian Scientist Galileo, using a telescope smaller than your telescope, turned it skyward instead of looking at the distant trees and mountains. What he saw, and what he realized about what he saw, has forever changed the way mankind thinks about the universe. Imagine what it must have been like being the first human to see moons revolve around the planet Jupiter or to see the changing phases of Venus! Because of his observations, Galileo correctly realized Earth‘s movement and position around the Sun, and in doing so, gave birth to modern astronomy. Yet Galileo‘s telescope was so crude, he could not clearly make out the rings of Saturn.

Galileo‘s discoveries laid the foundation for understanding the motion and nature of the planets, stars, and galaxies. Building on his foundation, Henrietta Leavitt determined how to measure the distance to stars, Edwin Hubble gave us a glimpse into the possible origin of the universe, Albert Einstein unraveled the crucial relationship of time and light, and 21st-century astronomers are currently discovering planets around stars outside our solar system. Almost daily, using sophisticated successors to Galileo‘s telescope, such as the Hubble Space Telescope and the Chandra X-Ray

Telescope, more and more mysteries of the universe are being probed and understood. We are living in the golden age of astronomy. Unlike other sciences, astronomy welcomes contributions from amateurs. Much of the knowledge we have on subjects such as comets, meteor showers, double and variable stars, the Moon, and our solar system comes from observations made by amateur astronomers. So as you look through your telescope, keep in mind Galileo. To him, a telescope was not merely a machine made of glass and metal, but something far more—a window of incredible discovery. Each glimpse offers a potential secret waiting to be revealed.

Objects in Space

Listed below are some of the many astronomical objects that can be seen with your Messer series telescope:

The Moon

The Moon is, on average, a distance of 239,000 miles (380,000km) from Earth and is best observed during its crescent or half phase when Sunlight strikes the Moon’s surface at an angle. It casts shadows and adds a sense of depth to the view (Fig. 50).

No shadows are seen during a full Moon, causing the overly bright Moon to appear flat and rather uninteresting through the telescope. Be sure to use a neutral Moon filter when observing the Moon. Not only does it protect your eyes from the bright glare of the Moon, but it also helps enhance contrast, providing a more dramatic image.

Using your telescope, brilliant detail can be observed on the Moon, including hundreds of lunar craters and maria, described below.

Craters are round meteor impact sites covering most of the Moon’s surface. With no atmosphere on the Moon, no weather conditions exist, so the only erosive force is meteor strikes. Under these conditions, lunar craters can last for millions of years.

Maria (plural for mare) are smooth, dark areas scattered across the lunar surface. These dark areas are large ancient impact basins that were filled with lava from the interior of the Moon by the depth and force of a meteor or comet impact.

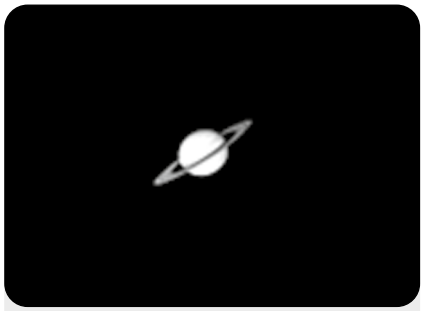


Fig. 44: Saturn with its ring system.

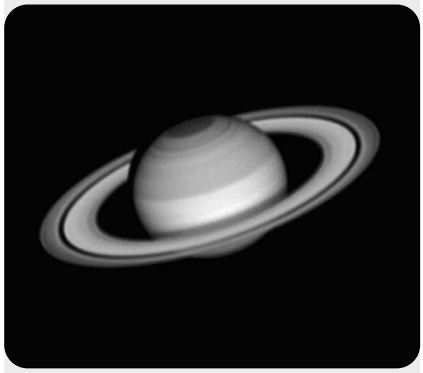


Fig. 44a: Saturn, in a higher magnification. It has the most extensive ring structure in our Solar System.



Fig. 45: A favourite Winter object: M42, the great Orion Nebula.

Twelve Apollo astronauts left their bootprints on the Moon in the late 1960's and early 1970's. However, no telescope on Earth is able to see these footprints or any other artifacts. In fact, the smallest lunar features that may be seen with the largest telescope on Earth are about one-half mile across.

Planets

Planets change positions in the sky as they orbit around the Sun. To locate the planets on a given day or month, consult a monthly astronomy magazine, such as Sky and Telescope or Astronomy. Listed below are the best planets for viewing through your telescope.

Venus is about nine-tenths the diameter of Earth. As Venus orbits the Sun, observers can see it go through phases (crescent, half, and full) much like those of the Moon. The disk of Venus appears white as Sunlight is reflected off the thick cloud cover that completely obscures any surface detail.

Mars is about half the diameter of Earth, and appears through the telescope as a tiny reddish-orange disk. It may be possible to see a hint of white at one of the planet's Polar ice caps. Approximately every two years, when Mars is closest to Earth in its orbit, additional detail and coloring on the planet's surface may be visible.

Jupiter is the largest planet in our solar system and is eleven times the diameter of Earth. The planet appears as a disk with dark lines stretching across the surface (Fig. 43). These lines are cloud bands in the atmosphere. Four of Jupiter's moons (Io, Europa, Ganymede, and Callisto) can be seen as "star-like" points of light when using even the lowest magnification. These moons orbit Jupiter so that the number of moons visible on any given night changes as they circle around the giant planet.

Saturn is nine times the diameter of Earth and appears as a small, round disk with rings extending out from either side (Fig. 44). In 1610, Galileo, the first person to observe Saturn through a telescope, did not understand that what he was seeing were rings. Instead, he believed that Saturn had "ears." Saturn's rings are composed of billions of ice particles ranging in size from a speck of dust to the size of a house.

The major division in Saturn's rings, called the Cassini Division, is occasionally visible through the Telescope. Titan, the largest of Saturn's moons can also be seen as a bright, star-like object near the planet.

Deep-Sky Objects

Star charts can be used to locate constellations, individual stars and deep-sky objects. Examples of various deep-sky objects are given below:

Stars are large gaseous objects that are self-illuminated by nuclear fusion in their core. Because of their vast distances from our solar system, all stars appear as pinpoints of light, irrespective of the size of the telescope used.

Nebulae are vast interstellar clouds of gas and dust where stars are formed. Most impressive of these is the Great Nebula in Orion (M42), a diffuse nebula that appears as a faint wispy gray cloud. M42 is 1600 light years from Earth. (Fig 45)

Open Clusters are loose groupings of young stars, all recently formed from the same diffuse nebula. The Pleiades is an open cluster 410 light years away (Fig. 46). Through the Telescope, numerous stars are visible.

Difficult to imagine stellar distances? Learn more on p. 36



Fig. 46: The Pleiades (M45) is one of the most beautiful open clusters.

Constellations are large, imaginary patterns of stars believed by ancient civilizations to be the celestial equivalent of objects, animals, people, or gods. These patterns are too large to be seen through a telescope. To learn the constellations, start with an easy grouping of stars, such as the Big Dipper in Ursa Major. Then, use a star chart to explore across the sky.

Galaxies are large assemblies of stars, nebulae, and star clusters that are bound by gravity. The most common shape is spiral (such as our own Milky Way), but galaxies can also be elliptical, or even irregular blobs. The Andromeda Galaxy (M31) is the closest spiral-type galaxy to our own. This galaxy appears fuzzy and cigar-shaped. It is 2.2 million light years away in the constellation Andromeda, located between the large “W” of Cassiopeia and the great square of Pegasus.

A “road map” to the stars

The night sky is full of wonders and miracles. Feel free to discover the universe; You just need to follow a few helping lines on the “road map” to the stars!

First, find the Big Dipper, which is part of the Ursa Major constellation. It can be found the whole year through quite easily in Europe and Northern America.

If you draw a line on the sky which prolongs Big Dipper’s handle backwards, you’ll finally reach the constellation of Orion. It is remarkable by the “Orion Belt”: three stars in a line. The great Orion Nebula is located south of the Orion Belt It is one of the most popular objects under amateur astronomers.

Starting at the two “pointer stars” - both stars of the back part of Big Dipper - draw a five times prolonged line north to the pole star. If you go ahead, you’ll finally reach the big star square that is shared by Pegasus and Andromeda.

The summer triangle is a remarkable region left of Big Dipper’s handle. It consists of the three bright stars Vega, Deneb and Altair.

If you prolong the shaft, you get to the constellation of Scorpio. It is bended like a Scorpion’s tail; it also looks like the letter “J”.

American amateurs performed the words “Arc to Arcturus and spike to Spica”. They relate to stellar region that lies in the prolonge area of Big Dipper’s handle. Follow the arc to Arcturus, the northern hemisphere’s brightest star and “spike” downwards to Spica, the 16th-brightest Star of the sky.

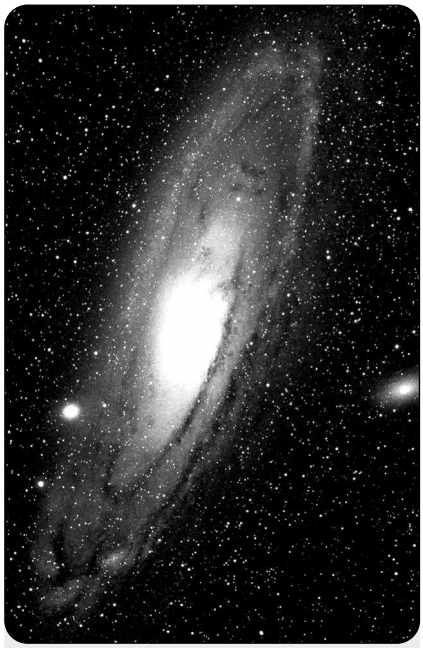


Fig. 47: The Andromeda Galaxy (M31), the biggest one in our local group.

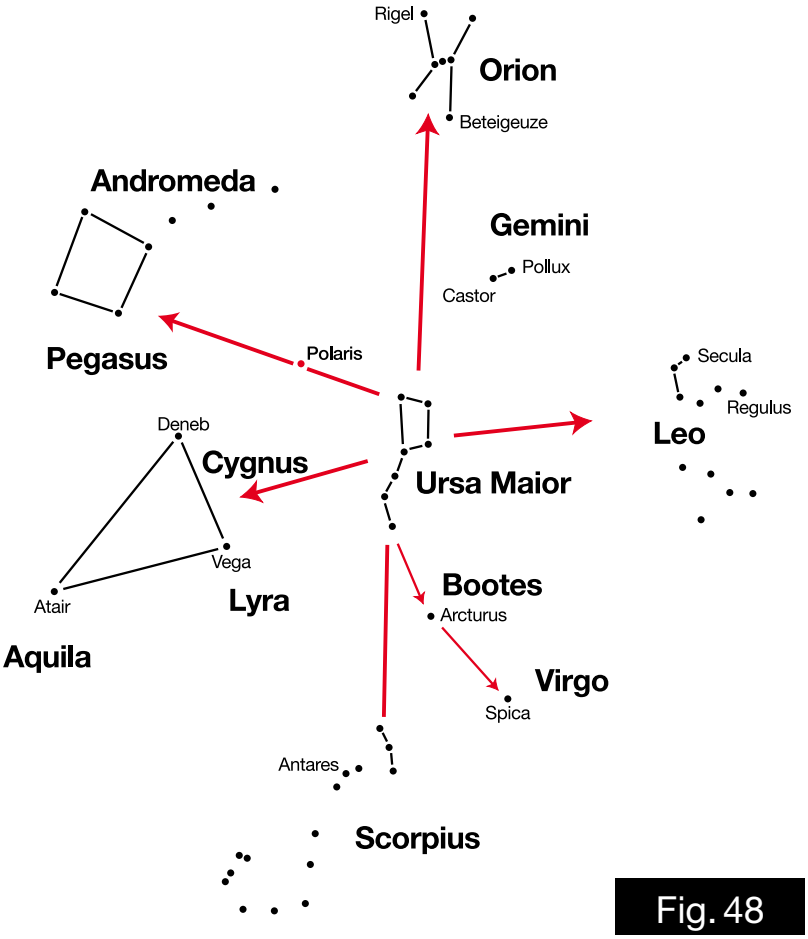


Fig. 48

Messier-Tipps

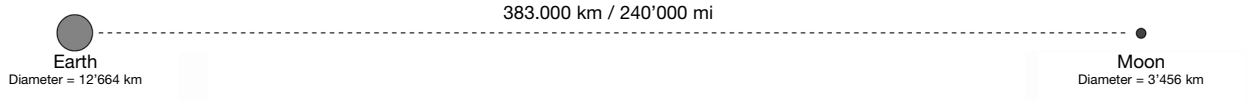
Star Charts

Star charts and planisphere are very useful tools and are great aids in planning a night of celestial viewing.

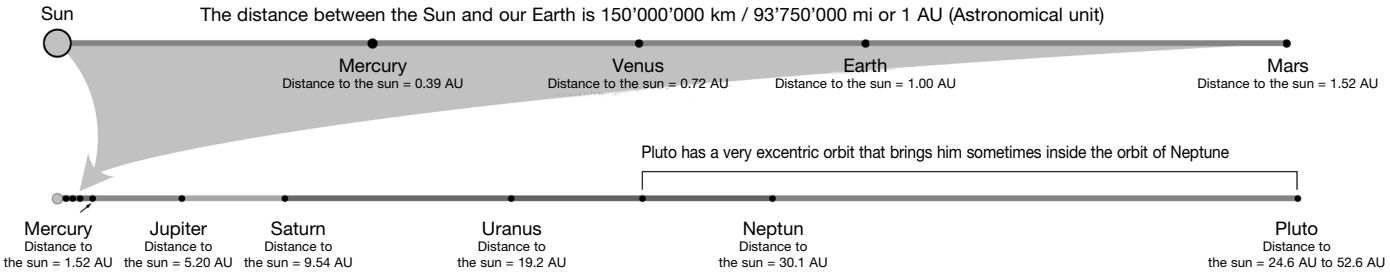
A wide variety of star charts are available in books, in magazines, on the internet and on CD Roms. For all Messier telscopes the star chart software „Cartes du Ciel“ is included with your purchase.

Distances in space

Distance between Earth and Moon

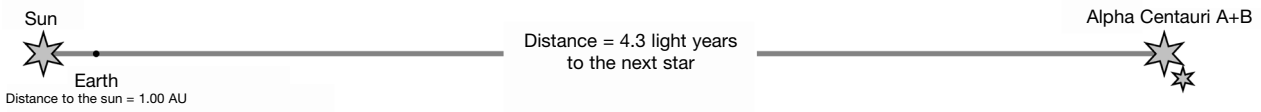


Distance between Planets



Distance between Stars

The distance between our Sun and the nearest star is about 4.3 light years or etwa 40 Billion km. This distance is so enormeous, that in a model where our Earth is 25 mm (1 inch) distant from the sun, the distance to the next star would be 6.5 km/4 mi!



Our home galaxy, the Milky Way, inhabits round about 100'000'000'000 stars. With its spiral arms, it has a diameter of about 100'000 light years.

Distances between galaxies

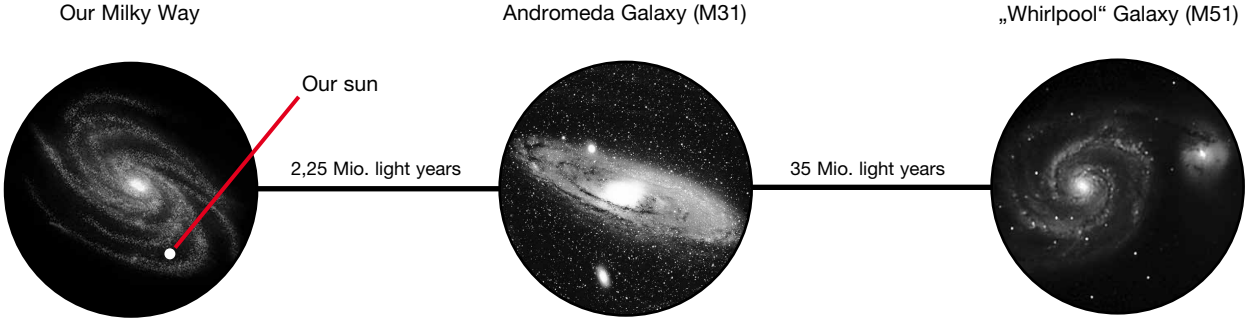


Fig. 49

Winter

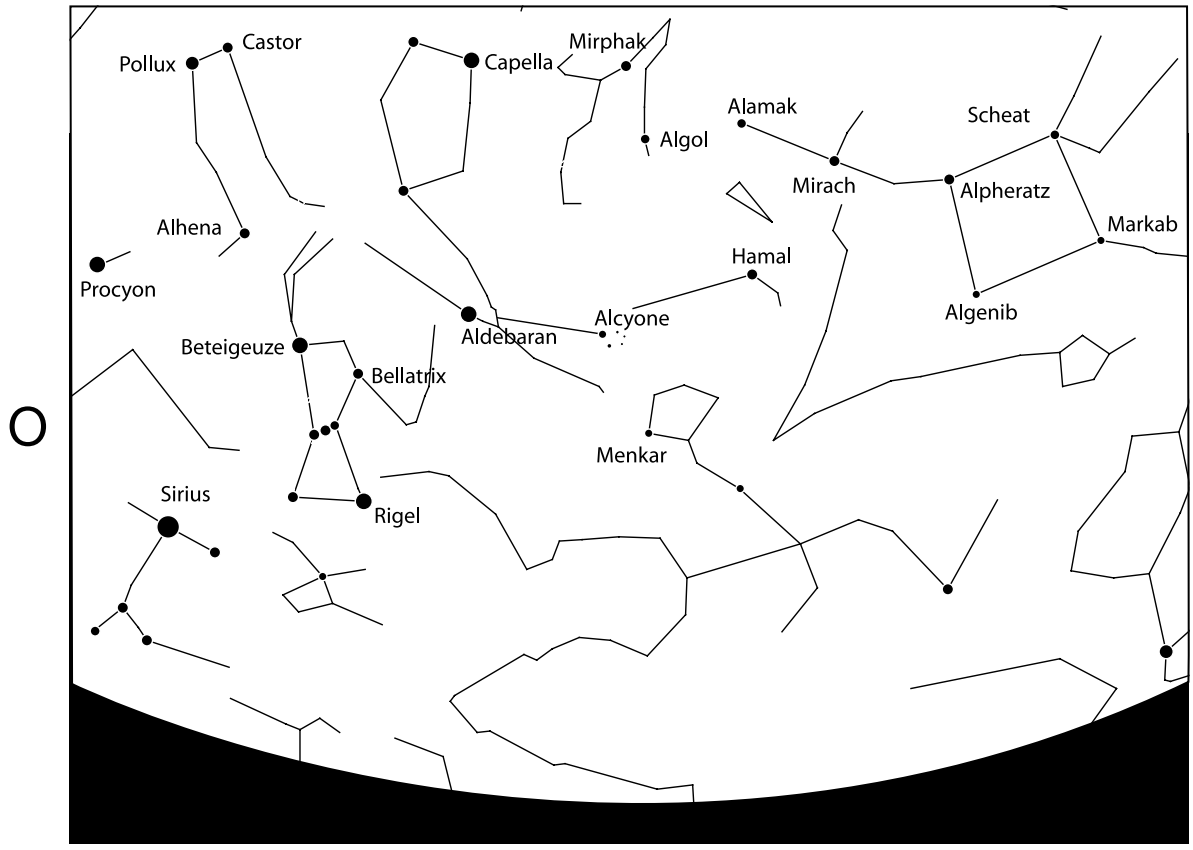


Fig. 50: Sky view (Beginning of January, ca. 22 h), Facing south

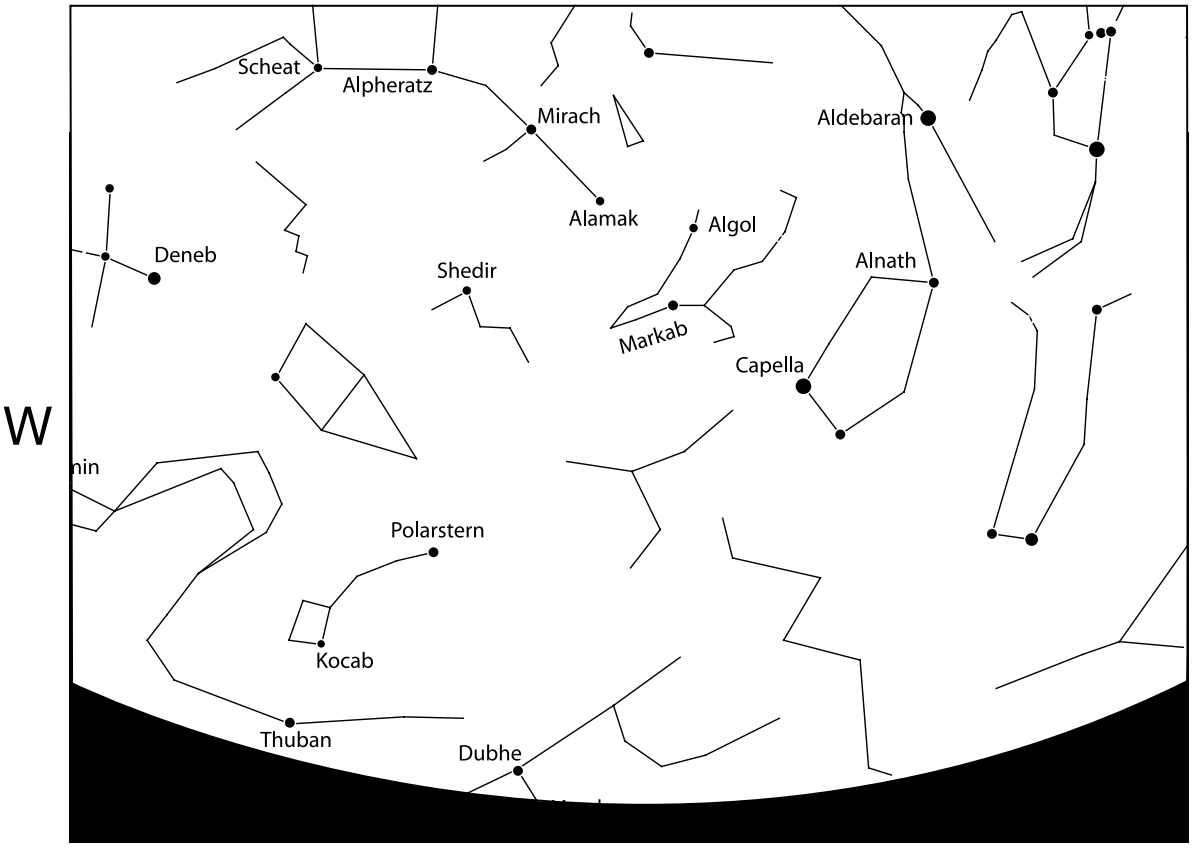


Fig. 50a: Sky view in winter (Beginning of <January, ca. 22 h), facing north

Spring

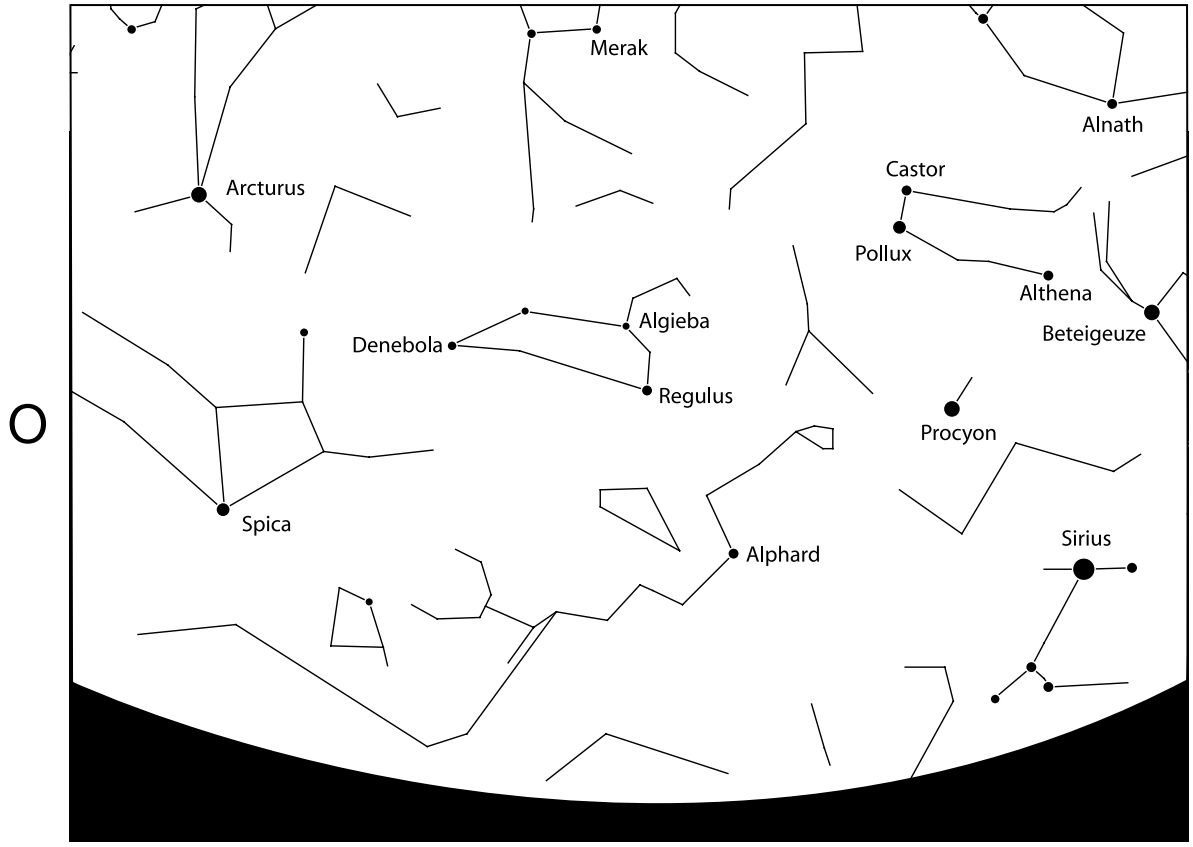


Fig. 51: Sky view in spring (Beginning of April, ca. 22 h), facing south

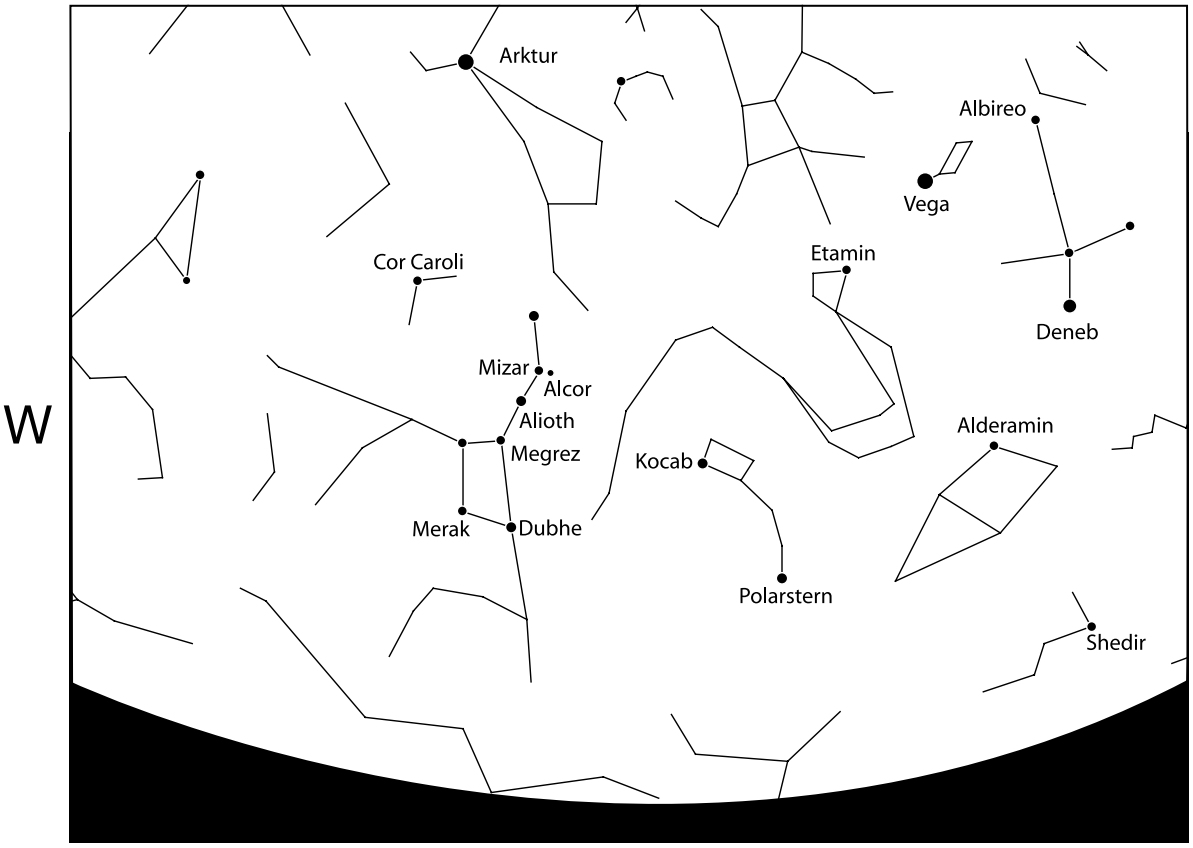


Abb. 51a: Sky view in spring (Beginning of April, ca. 22 h), facing north

Summer

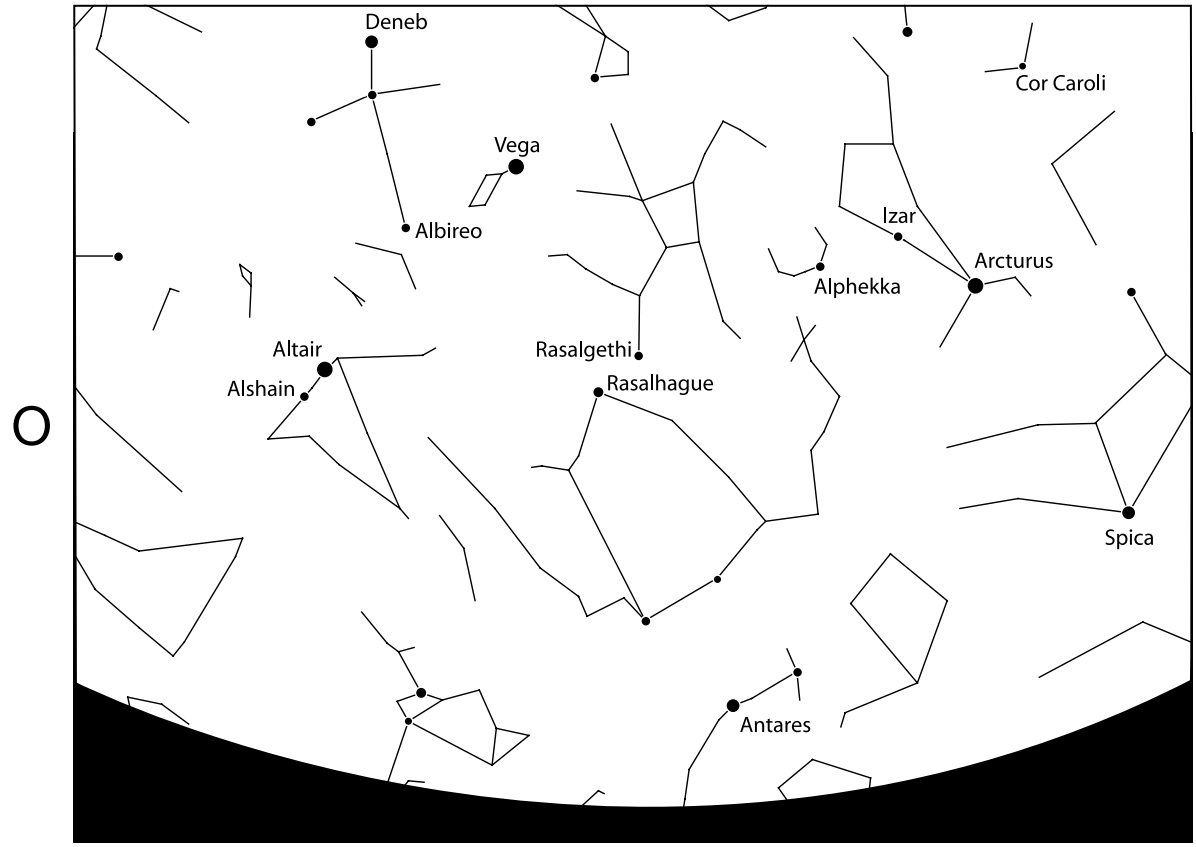


Fig. 52: Sky view in summer (Beginning of July, ca. 22 h), facing south

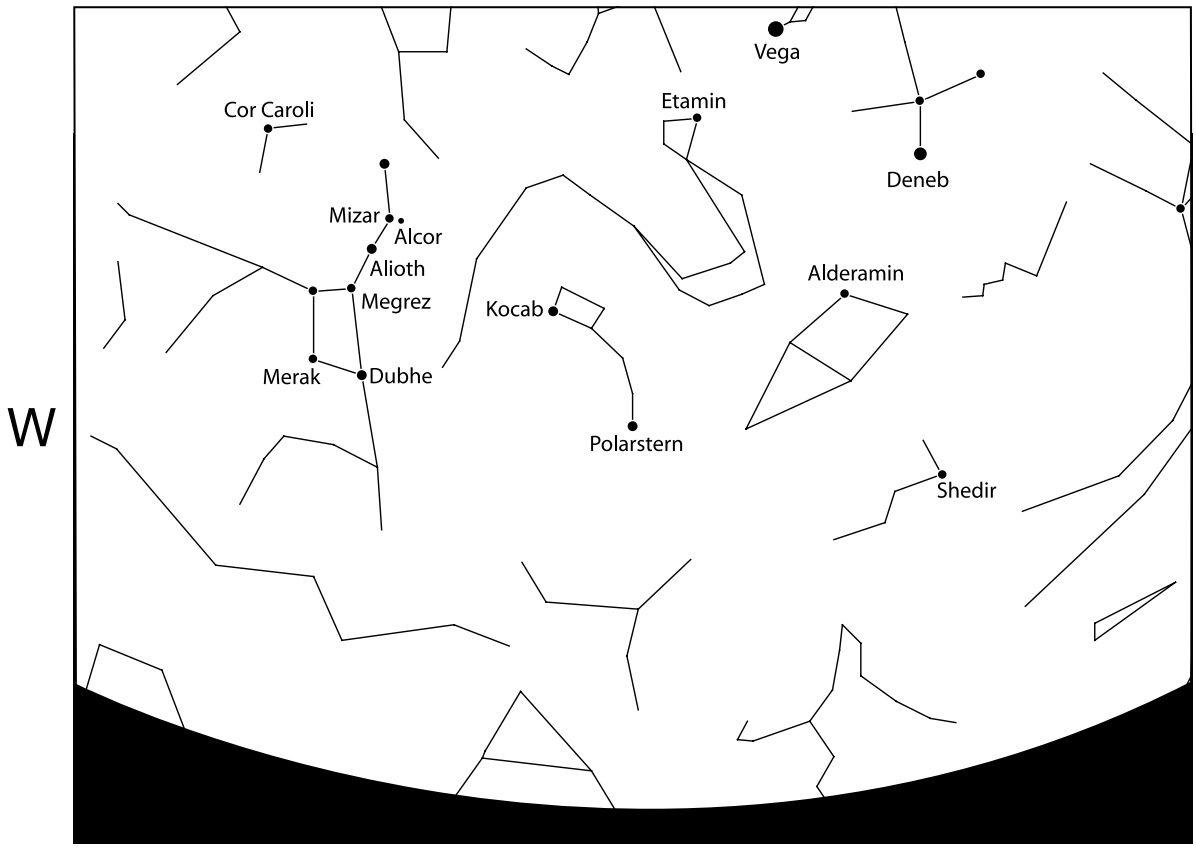


Fig. 52a: Sky view in summer (Beginning of July ca. 22 h), facing north

Autumn

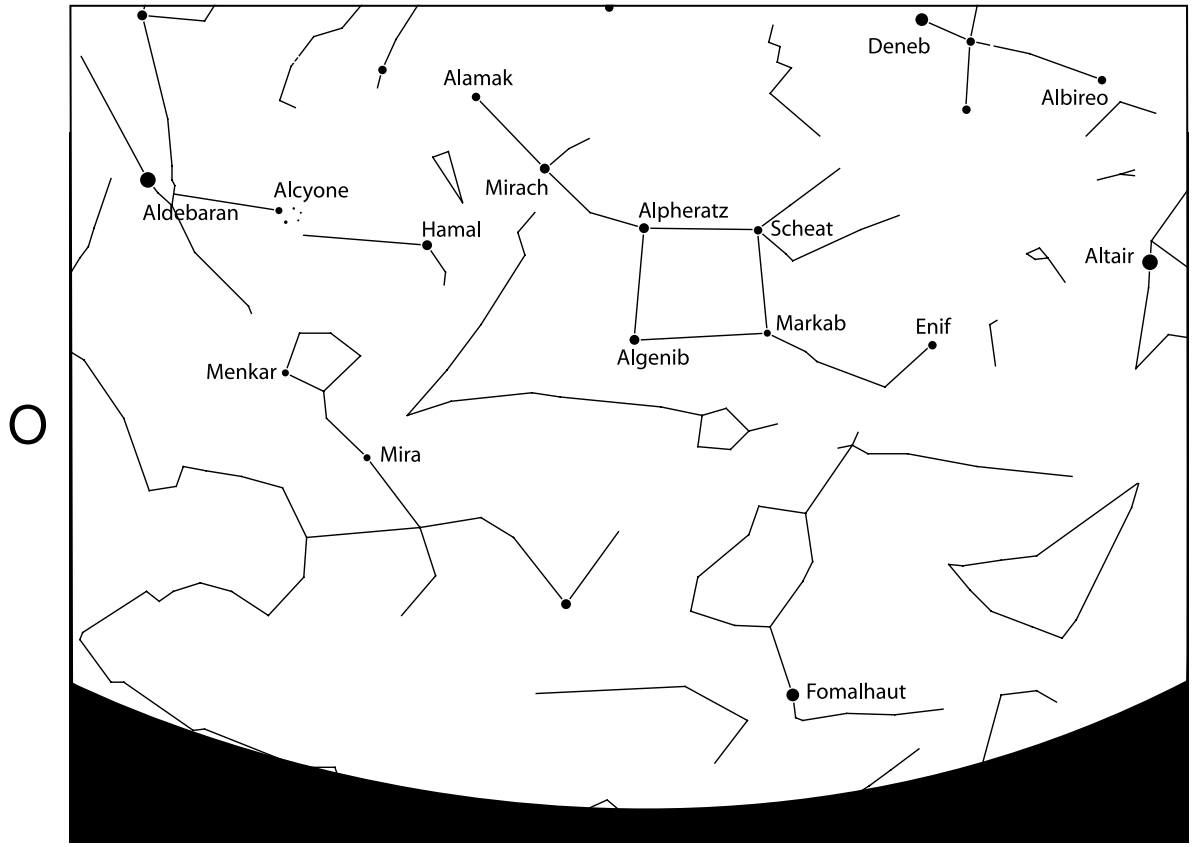


Fig. 53: Sky view in autumn (Beginning of October, ca. 22 h), facing south

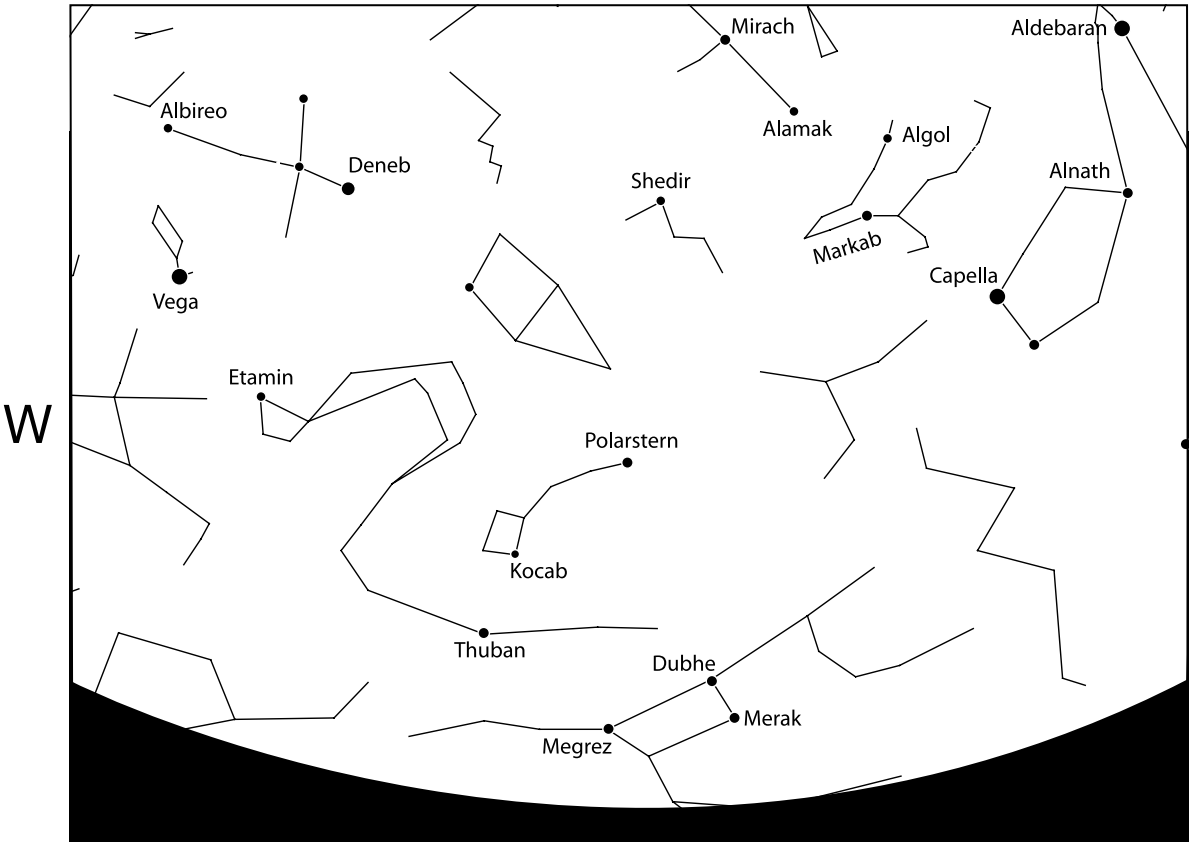


Fig. 53a: Sky view in autumn (Beginning of October, ca. 22 h), facing north

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