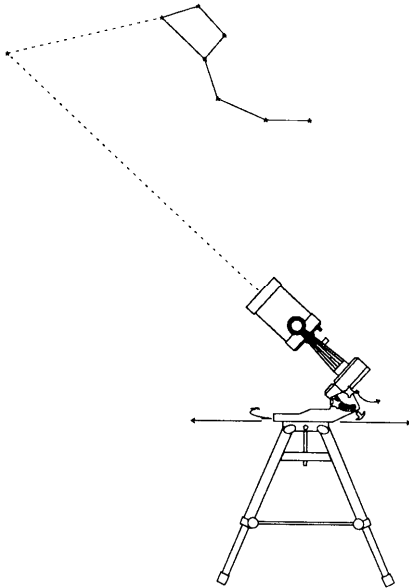


POLAR ALIGNMENT AND RA CALIBRATION

Polar alignment is the process by which the telescope's axis of rotation (called the polar axis) is aligned with (i.e. made parallel to) the Earth's axis of rotation. Once aligned, a telescope with a 23:56-hr clock drive will track the stars as they move across the sky. The result is that objects observed through the telescope appear stationary (i.e., they will not drift out of the field of view) in the eyepiece.



In each hemisphere, there is a point in the sky around which all the other stars appear to rotate, called the celestial pole. For example, in the northern hemisphere all stars move around the north celestial pole. When the telescope's polar axis is pointed at the celestial pole, it is parallel to the Earth's rotational axis. For those in the northern hemisphere, finding the celestial pole is not too difficult. Fortunately, we have a visible star less than a degree away. This star, Polaris (also called the Pole Star or North Star), is the end star in the handle of the Little Dipper (Ursa Minor).

Polar aligning

1. Set the telescope up so that the polar axis (fork arm) is pointing roughly north by rotating the tripod.
2. Check the alignment of the finder scope (and Telrad) by placing a low power eyepiece in the telescope. Point the telescope at a bright star and center it in the eyepiece. If the star does not also appear near the center of the finder scope (and Telrad), have the instructor/TA adjust the finder scope (and Telrad) so the star is in the crosshairs (or center circle).
3. Loosen the declination lock and move the telescope so that the declination setting circle reads 90°. Hopefully, when this is done the tube is parallel to the polar axis. To confirm that the tube is parallel to the polar axis, feel along the side of the fork arm. When the metal plate near the declination pivot feels like it is balanced equally around the fork arm, **then** the polar axis and the tube are parallel. If this does NOT correspond with a 90° reading on one side of the telescope, use the side with the sticker. Note where 90° appears on the sticker, and make future declination readings from that location on the sticker. **You will not unlock the declination circle until you look for another target (see back).**
4. Adjust the mount in altitude and azimuth (by moving the tripod) until Polaris is visible in the finder. Once visible in the finder, raise the telescopes wheels off the ground so the tripod cannot roll.
5. To find the true celestial pole, adjust the knobs so that Polaris moves about 1/3 the way from the center to the edge of the finder scope field (44 arcminutes, which is approximately $\frac{3}{4}$ of one degree), in the direction that the star Kochab appears relative to Polaris to the unaided eye. Kochab is at the cup end of the Little Dipper (see Figure 1 on back), the first bright star from Polaris towards the handle of the Big Dipper. Make the adjustments using the altitude and azimuth adjustment knobs. Do not move the tube itself. **Remember, when using the azimuth adjustment**, if there are two adjustment knobs, one of them should be loose at all times. Kochab will move throughout the semester. Check Kochab's location each time you polar align.
6. Double-check that the declination circle still reads 90°. If it does, you are properly polar aligned. If it does not read 90° go back to step 3.
7. **Once you are polar aligned, do not adjust the altitude or azimuth again.**
8. **On the back are directions for using the setting circles/coordinates.**

Polar Alignment and RA Calibration

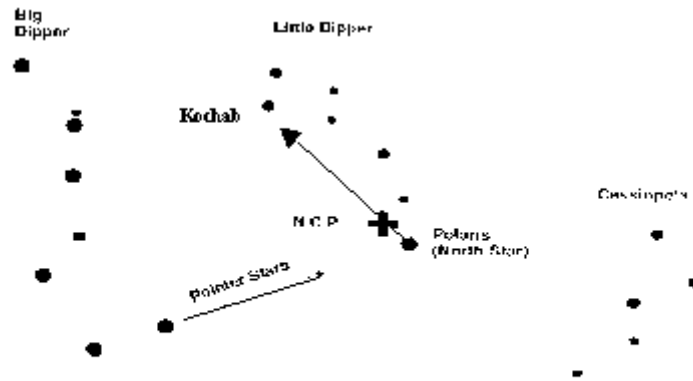


Figure 1. Picture illustrating in which direction to move Polaris, as seen through the finder scope.

Calibrating the RA and Declination Setting Circles

- In order to set the Right Ascension (RA) circle, you must first choose a bright star that you know. It is strongly recommended that it be one near the target object you want to observe. Good candidates are on the bright star list handed out earlier.
- Unlock the RA and/or declination locks and center the bright star in the finder scope and the eyepiece. **Remember not to move the telescope mount (altitude and azimuth) after the telescope has been polar aligned.**
- If you haven't already done so, start the clock drive so that the telescope tracks the star. Look up the coordinates of the bright star.
- Physically move the RA setting circle, but not the telescope, until the proper coordinates line up with one of the R.A. indicators. Make sure you **use the inner set** of numbers on the RA circle. Use this indicator for the rest of your observing session. Note that the R.A. setting circle has a marker every five minutes with each hour labeled. The outer numbers are for the southern hemisphere, when you align with the South Celestial Pole.
- Check the coordinates of the declination circle. If you did your polar alignment correctly, the declination circle should be set to the declination of the bright star. If the declination circle is off by more than 2 degrees, go back and repeat step 3 of the Polar Alignment procedure. **Do not try to adjust the declination setting circle.** If this does not improve matters, make sure you pick a bright star near your target. Then note the offset between the true declination and what your telescope reads, and proceed by applying a declination correction to future targets.

Your primary RA/dec calibration should be done with a known bright star. However, you may want to confirm your alignment and setting circles with a second star and also, as a third check, Polaris. Polaris is located at RA 2 h 30 min, declination +89 degrees. But use this ONLY as a third check.

To find your target objects:

- Loosen the locks and move the telescope tube **one axis at a time** to the Right Ascension and declination of the object you want to observe. **Do not move the RA setting circle**, only the telescope tube. Hopefully, you have planned your observing session well in advance and have the coordinates written down.
- Look in the low power eyepiece for the object. If the object is not visible in the eyepiece, look for the object in the finder scope. If the object is visible in the finder, center the object in the crosshairs of the finder then look for it in the eyepiece. If you still can't find the object, go back and repeat step B of the "Setting circles" instructions.
- Once the object has been found and sketched update the RA circle to the coordinates of the centered object and repeat steps B through G to find your next object.