

Loomis-Michael Telescope Procedures
Last Revision: December 2, 2010

This write-up is intended for use by students who have taken the Telescope Class and are on the access list. It is not a sufficient substitute for the class. If anyone finds an error or omission or has suggestions about revisions, please leave a note in the logbook at the observatory. STAHR officers will edit the write-up accordingly.

Most of the material here is just descriptions of routine procedures; however, in a few cases there are CAPITALIZED WORDS which refer to the few but extremely important rules of safety. If you plan on using the equipment in the observatory, DO NOT IGNORE these – they have been worked out after over 25 years of experience with the observatory's instrumentation, and if you disregard them, you may wind up with broken equipment or an injury.

Names of officers and contact information are routinely posted on the blackboard. If you have general questions feel free to call us during normal hours. If an emergency occurs, do not hesitate to call us, whatever the time.

1. Getting up to the telescope

Once you have successfully passed the Telescope Class and have swipe access to the observatory, you are welcome to come up any time that the telescope is not otherwise reserved or being used.

2. Opening up

A. Logging-In and the Logbook

First log into the logbook on the desk. Put the date, your name, and the time you begin. Take a quick look at the last entry before you and make certain that nothing is broken or damaged that you need to look out for. This can be especially important if there has been any electrical failure. When you leave, log the time, what you did, anything interesting that you saw (or that saw you) and ANY PROBLEMS you had. This is especially important if it needs fixing, so we know exactly what happened and can fix it early.

If you have problems while you are observing that really need an answer, i.e. you are stuck, call one of the names on the blackboard. If it is after midnight, though, call only if you have a problem such that you cannot leave until it is solved (e.g. roof won't close, telescope is on fire). Otherwise, if you have general problems or questions, log them in the logbook and a staff member will try to leave you an answer (so the next time you come up, you might want to skim the entries since you were here, to see if we got around to it).

B. Weather at the Observatory

Now you are ready to open the dome, PROVIDED IT IS NOT A) RAINING, B) SNOWING, OR C) TOO WINDY. To tell if it is too windy, look at the weather gauges on the wall. You can also call the Science Center control center 5-5561, tell them you are calling from the telescope, and ask them for the wind speed – highest as well as average. IF THE WIND IS BLOWING 25 M.P.H. OR OVER AND/OR GUSTING 30 M.P.H OR OVER DO NOT OPEN UP THE DOME. Fold your tent, log out, and silently steal away. Unpleasant things can happen to the shutter in high winds. It usually is wrenched off its tracks and you will not be able to close it again.

C. Shutter and Lights

To open the shutter (the big long slot in the dome) find the set of plugs over by the door and plug in the cable which runs from the top of the dome, into the upper outlet. Do this first. Make sure to turn off the white lights before opening the shutter. People in the astrophysics department often use the Clay Telescope (located on the roof) for astrophotography, and any bright light will overexpose their pictures – making them very, very angry with you.. Switch on the red lights by turning the knob (next to the door where you entered) clockwise. Now turn the little red knob (on the top of the gray box) away from you. The shutter will begin to open. Do not worry if it makes loud thumps, groans, creaks, sighs, and wailings on the way up – it always does. Wait until you hear the motor stop before you turn the knob back to the center, otherwise the shutter will not be open all the way.

You will notice that when the shutter reaches the top, the view straight overhead is blocked. If you do not like that, then before you open the shutter, put either the ladder or the bleachers up against the wall directly underneath the shutter. Climb up and pull the handle attached to the chain hanging from the shutter. Look to see what is happening on the other end of the chain and you will notice that there are two hooks on the bottom third of the shutter which hook onto the upper part. Pulling the chain disconnects the lower part. If you have someone with you, pull the chain and hang onto it while they open the shutter. After the top part is clear of the hooks, you can let go of the chain, and since the hooks are spring-loaded, when you close the shutter they will automatically re-engage. If, however, you are alone, you will need to hook the chain into the small slot on the right-hand edge of the lower part before you climb down, so that it will stay disconnected while you go and open the shutter. Before you leave, you will want to climb up and unhook the chain so that it re-connects. It is **EXTREMELY IMPORTANT** to make sure that the hooks latch on properly, because otherwise the shutter may break loose unexpectedly during an observing session. This leads to the following:

One of the most important rules of the telescope is **NEVER CLIMB OUT ON THE ROOF THROUGH THE SHUTTER OPENING**. There are two reasons for this; one is that you may fall off the roof, and the second is that occasionally the detachable part of the shutter decides to detach itself, and it then comes sliding down the tracks and crashes down at the bottom, and you will not have time to get out of the way. The shutter weighs around a ton, and will definitely kill you. Do not risk it.

3. Rotating the dome

Once you have successfully opened the shutter, turn the red knob back to the center position. Now unplug the wall and overhead cable. Never leave the overhead cable plugged in while you are observing, because in turning the dome, you may get the cable too tight and it will break.

Now plug the black plug on the gray cord into the lower outlet (the two screws on the cable should face the floor). If you turn the red knob to the right, the roof will rotate clockwise; to the left, counterclockwise. Again, do not worry about thumps and wailings.

4. The Telescope

The observatory houses a large, 10 inch refractor which can be used for observations through the opened dome.

A. Telescope Parts

The telescope consists of the main tube, the ‘finder scope’ (located beside the eyepiece), and the Ross camera (the short, fat tube clamped on half-way up). The motor is housed in the pier.

Please DO NOT open up the doors to the pier, let alone put your hands in. It is not insulated and uses enough power to knock you down.

B. Motor and Lights

Turn on the motor and lights (the two switches on the north side of the base of the telescope). You will want to leave the motor on all the time you are observing, because it powers both the tracking mechanism and the control paddle. However, ALWAYS TURN THE MOTOR OFF BEFORE YOU LEAVE. The lights are the little guys on the two setting circles; the Dec circle lights are bright enough, but to read the RA circle you will need the flashlight (on the desk or in the drawer or somewhere around).

C. Moving the Telescope

The control paddle is the little metal box attached to the cable running from the telescope. This operates the clamps and the slow motion. The top two buttons are the clamps. To unclamp either clamp, press the bottom half of the button down. You will get a bang and a flash of light from the motor. (You will discover that you get the bang or the click whether or not the telescope was already unclamped or clamped; i.e. you can never tell whether it was or not. It should not create a problem; it can just be a little disconcerting at first.)

There are two ways to move the telescope. One is to unclamp it and move it either with the ropes attached to it or by holding onto the end of it and pulling (never move the telescope by pushing or pulling on the finder scope); the other is to clamp it and use the slow motion controls on the control paddle. This is only useful when you are actually sighting on something through the telescope.

Another very important rule comes up here; NEVER LET THE TELESCOPE GET MOVING TOO QUICKLY. It is beautifully balanced, and moves very smoothly, but this is deceptive; it weighs a couple of tons, and with that much mass can get up a lot of momentum. If it gets going really fast, you may not be able to stop it before it crashes into something, and the impact may break all sorts of things, like the objective lens. So the rule is that if you are moving it any real distance, hang onto both ropes, one in each hand, move it slowly, and WATCH IT.

If, while trying to move the telescope, you find that it suddenly does not want to move, DO NOT FORCE IT. Make sure it is unclamped; if it still will not move, one of the cables is probably wrapped around too tight. Check the cable running from the telescope to the mount, up beside the RA circle. If the telescope has been rotated too many times around one way, this cable will be wrapped as tight as it can go, and if you force the telescope, one of the wires inside the cable may break. Also, keep an eye on the two ropes, the overhead roof cable, and the paddle clamp box cable. They tend to get tangled around the telescope as well.

D. Lens Caps

Climb up either on the pier or the bleachers and move the telescope toward you until you can reach the top of the finder scope and take the lens cap off. Finally, pull down the other end of the telescope and take off the primary lens cap. Once you're done, make sure to put the lens caps you removed back on.

5. Using the Setting Circles

You can move the telescope manually to point it at objects you'd like to look at, or you can use the setting circles to precisely locate objects based on their celestial coordinates (*R.A.* – Right Ascension, and *Dec* – Declination)

A. Reading Coordinates off the Setting Circles

There are three setting circles on the telescope, of which you should use the largest two. Warning: DO NOT attempt to adjust the circles. The R.A. circle does not move at all, and we are constantly trying to keep the Dec circles correct.

The biggest circle is the declination circle, and the middle one is the right ascension circle. From now on these will be abbreviated as Dec and RA. For a description of the theory of celestial coordinates, see Norton's Star Atlas. For basic observing purposes, however, it is sufficient to know that, just as there is latitude and longitude on Earth, so there is R.A. and dec in the heavens. Every object, be it star, nebula, galaxy, planet, or comet, has their positions can be found in one of more of the standard atlases on the desk. Planetary positions can be found in the American Ephemeris and Nautical Almanac on the desk. If a comet appears which is sufficiently bright for us to see it from Cambridge (a rare occurrence!) we will post positions for it on the board. The same goes for any interesting asteroids that might be passing by.

Now observe the right ascension circle. It is divided into 24 hours, and there are 12 tick arms in between each hour. Since there 60 minutes in an hour, there are 5 minutes per tick mark.

The R.A. for objects will almost always be given in hours, minutes, and tenths of minutes, such as 20 40.2. It is impossible to try to estimate tenths, so simply round off.

If you find that you want to set a position on the R.A. circle and the number you want happens to be round at the back of the circle, so that you can't see it, notice that there are 2 pointers on the telescope which point to positions on the R.A. circles, 180 degrees apart from each other, and therefore 12 hours apart. So if the pointer you are using is somewhere around A at 12 hours apart, and you want to get to 19 33, which is up top at B and invisible, then move the telescope in the direction X, until the pointer you've been disappears over the top in the direction of 19 33 at 8. Now the other pointer will come into view in direction Y. If you set it at $19\ 33 - 12 = 7\ 33$, then your pointer will be at 19 33.

B. Before You Start: R.A. Corrections

If you ever get confused as to which pointer you should be using, the answer is simply to use the same one the whole time. It does not matter which, since the R.A. circle reading is essentially a relative one. The reason is that the tracking mechanism, which follows the motion of the stars, is not on all the time, so that if you point the telescope at a star and the R.A. circle says 10 hours, and you turn off the motor and come back an hour later, the star will have moved; and if you turn the telescope to find it again, the reading on the circle will change. *However, the true R.A. of a star does not change so we have to figure out a correction factor for the R.A. circle every time.* In other words, if you want to locate something by its position, you need to find out how much the RA is off by that night. Once you have figured the correction fact, it will, remain the same for as long as you keep the motor on.

The basic method for doing an R.A. correction is to find a star you know (see list on the wall), center it in the finder scope (at the intersection of the crosshairs), read the R.A. circle, and compare it with the star's true R.A.; the difference will be the correction factor. For example: supposing you have the telescope centered on a star whose true R.A. is 4 24. The circle reads 15 18. The difference

between the two is 10 54. This means that the apparent RA – what is on the RA circle – will always be 10 54 greater than the true RA. Therefore, you will have to add 10 54 to the true R.A. of whatever you want to look at, and set the telescope on this corrected R.A. Another example: If a star's true R.A. is 22 10 and the circle reads 6 25, the correction factor is plus 8 15 true to apparent.

It is a good idea to check your factor, by picking another bright star and setting the telescope on its declination and corrected R.A. If the star is not close to center, your factor is off. If it is not there at all, you are really off. Are you sure, you had the right star the first time? Check your math and try again. Doing a fresh correction on the second star and checking it on the first will probably reveal any error in math.

Any time you are really having trouble doing an R.A. correction for whatever reason, it is always possible, if you know the general area of the object you want to observe, to set the declination, clamp it, unclamp the R.A. and sweep in the area. Once you find the object, then you can do a correction of it.

7. Declination Circle

The dec circle actually comprises 360 degrees, but it is marked from 0-90-0-90 instead. Fortunately, we only use about 150 of that, so it is not a problem. The circle is marked off in degrees and tens of degrees (not tenths – look out). Each tick mark is a degree. Dec positions are given in degrees and minutes, like +20 11, or –05 53. Again, it is obviously impossible to estimate sixtieths of a tick mark, so round off to the nearest fourth or fifth or however confident you feel.

Two problems sometimes occur with the dec circle. The more common is that the reading will be the negative of what it should be (opposite sign). This happens if you move the telescope through a certain series of motions and happens about half the time. You will discover it while doing the RA correction, as mentioned before. You should just be careful to remember it. If you are unsure, point the telescope straight up; the dec should be around plus 42.

In addition, it occasionally happens that the dec circle gets loose and goes off, and will therefore be inaccurate. However, again you will discover the fact while doing the RA correction, you can do a dec correction at the same time. These are tricky, because you have to be careful to do it in the right direction, i.e. plus a degree or minus a degree. If the dec is negative of what it should be, it will need to be corrected the other way.

8. Eyepieces

We have a number of eyepieces in the wooden box in the second drawer from the top of the filing cabinet. The eyepieces are, in focal length, 26-mm, 15-mm, 12.5-mm, 9mm, and 4-mm. The standard to use is the 26-mm since it has the widest field of view and makes it easier to locate things. Once you have found something, you may want to try the 15-mm or 12.5-mm. These are higher magnification and may produce clearer detail. The 9-mm and 4-mm are usually only useful on very clear and steady nights, because if the seeing is jumpy they are hard to focus. Experiment!

To put in an eyepiece, loosen the twist-clamp on the side of the eyepiece holder one or two turns – never let it get really loose or the whole gismo will fall apart, and it is a trick to re-assemble. (If this happens, log it and leave it to us). Slide the eyepiece in and tighten the clamp until you are sure the eyepiece is securely in.

The right-angle prism is for use when you are looking at something high overhead and you are getting a crick in your neck. Stick the black end into the eyepiece holder and the eyepiece into the brass end. This has no clamp, so be careful it does not fall out. You will also need to re-focus.

The big brass eyepiece needs the big brass adapter sitting beside the box. Put it into that, clamp it, and then unscrew the eyepiece holder from the telescope and screw in the adapter. It will not want to go in, but it will eventually. If you are unsure at which place the eyepiece holder unscrews it is the point at which the resultant hole will be the same size as the adapter!

Please do not attempt to clean or disassemble the eyepieces. Anything except special lens paper will scratch them, even the softest cloth. Also, if you take them apart the little lenses will fall out and get lost. If an eyepiece is really dirty, log the fact and we will clean it. Also be careful when carrying the eyepieces about – do not let them bump together in your pocket. Try to have only one out of the box at a time. It is also best to leave the box in the drawer. If you put it on the pier or bleachers, it might fall or get stepped on.

9. Clean-up

We have posted a check-list on the dome door of all the tasks you need to do before leaving the dome. **MAKE SURE THAT YOU'VE DONE EVERYTHING ON THE CHECKLIST BEFORE YOU LEAVE!**

Enjoy using the telescope!

Clear skies,
The STAHR Board