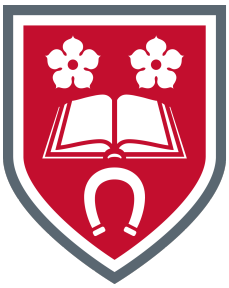

UNIVERSITY OF
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PlaneWave CDK20 Instructions

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Preface

In this document I have tried to pack in as much detail about how to use both the telescope and software. It is important you understand how to use the equipment correctly to prevent damage. When referring to something specific there will be a reference photograph or screen-shot to aid. The images are all in the back of the document to save clutter within the main body. These instructions can be downloaded from https://observatory.olivermalkin.co.uk/ or scan the QR code on the front page. It is an evolving document, do check the website for the most up-to-date version.

Some useful links to websites and software I use are https://clearoutside.com/ and https://stellarium.org/ Stellarium is a really useful planetarium software (which I use to control my telescope at home, along with a program called NINA https://nighttime-imaging.eu/). Clearoutside is a useful website for showing in-depth information about cloud cover in your area. Make sure to set the location to Oadby as the default is Exeter, where FLO are based.

There is a lot of very expensive equipment within the observatory. So, it is highly recommended to read through these instructions first. If you are unsure about something when at the observatory do not guess, please ask someone. The Oadby observatory uses a Paramount MX equatorial mount - sometimes called an EQ mount for short. This style of mount is very useful in astronomy as the right ascension - RA - axis is along the axis of rotation of the sky. Therefore, to track a target only the RA axis needs to move. It is a useful concept to understand and what the RA and DEC axes are.

If you have any questions then please do speak to either Dipali or me - my email can be found on the front page. Best of luck with observing, and clear skies.

Things to bring with you

- Lots of warm clothes - it gets ***very*** cold in the observatory, bring extra even if you don't end up using it
- A red light is always handy, but not entirely necessary if you do not own one
- Hot water bottle - can be nice to warm up with, there is a kettle in the warm room
- Notepad & pens - can be nice to make notes about what you observe
- Snacks - always good for long observation nights, just don't make a mess!

Do not open the dome during high or gusty wind as it can be blown of the runners!

Start up procedure

Some of the following steps can be done in parallel by multiple people, this will speed up the process! If you do not feel confident splitting up the tasks, then complete as a group/pair until you feel confident. If any of the steps below have differing results than expected then replace everything as you found it, lock the dome and let Dipali know in the morning when you return the keys.

Initial set-up

- Enter the dome and disable the alarm by entering the code, you have about 40 seconds to do this. This will disable it across all 3 sites, the warm room and both large and small observatories
- Write your time of arrival and names in the log book

- Connect the red power connector to the hatch drive - make sure it is turned off first before plugging in! [1]
- Turn on the hatch drive, the buttons should illuminate. Hold the "UP" button until the hatch is open - **do not open the hatch further than the red markers on the dome roof** [2]
- Once open, turn the power off and detach the hatch drive power cord and replace in the holder
- Remove plastic covers from both the back of the telescope and computer monitor & chair - store these safely

Powering on the telescope

- Insert the small key into the key-switch located on the base of the pier and turn on - the key cannot be removed once turned on
- Switch on main switch to the right of the key-switch - the red indicator should light up on the switch and dome drive next to the northern pier [3][11]
- Turn on the mount. The mount will now check the balance of the scope. You will hear 2 beeps, each with a different tone. One beep for each axis. The blue led's labelled RA and DEC should stop flashing and go solid blue [4]. If this does not happen or you hear a warning, turn the mount off, wait for 10 seconds and switch back on. If the problem persists then it is unsafe to use the scope
- Turn both switches on the back of the telescope to the "On" position, this will turn the 3 fans on to cool the primary mirror [5]. The hand controller should also light up at this point [13]. If it is not, do not worry as this is only used for the CCD
- Switch on the petals, the red indicator light should be on. Press the green button and wait until all 4 petals have opened. If you are unsure then you can always look inside of the scope using the ladder [8]
- Switch off the petals once the green indicator has lit. If you do not turn them off they can sometimes close unexpectedly due to electrical interference

The telescope is now be ready to connect to TheSkyX!

Connecting TheSkyX to the mount

- Log into the student account, if the user is not the student account then switch user and type .\student in the user and enter the password
- Start TheSkyX software
- Using the "Telescope" tab at the side, connect the telescope using the "Start up" drop down [14]
- When the mount has connected it will ask you to home [15]. When you confirm this the mount will start to slew to the home position [6]
- If not, under the tools "Start Up" drop down select "Find Home", the telescope should move to the home position [14]. This can also be done by double pressing the button on the mounts joystick after you turn the mount on [11]. TheSkyX will not prompt you if the mount is already homed
- As the scope is slewing, listen carefully for 2 sets of 3 beeps, one set per axis. These beeps show that each axis has found the home position correctly. If the scope fails to find home, switch off and try again

The telescope is now ready for use! At this stage the telescope fans should be on, the petals are open, the mount has been homed and the hatch is open.

Observing a target

- Start by finding your object in the "Find" tab [19]
- Click the "Slew" button and then confirm
- After the telescope has slewed you can insert an eyepiece into the back of the telescope [9][10]
- When selecting an eyepiece, the higher the focal length (measured in mm) the wider the FOV. The seeing will limit how small of an eyepiece you can use. Seeing is the term given to how good the air currents are in the atmosphere. If there is a lot of turbulence then the seeing is said to be bad
- Next it is time to move the dome [12]. **The dome can only do 1 rotation in either direction.** To move the dome press and hold the button for the desired rotation. Wait until you hear a click, then release. The potentiometer at the bottom can be used to control the speed of the rotation. When you wish to stop, press and hold the stop button until the dome has stopped. If you press a button too quickly the dome will not start/stop
- Now you need to focus your target! To do this look through the eyepiece and turn the big focusing knob. The smaller one is for fine adjustment. If you are looking at a star, when out of focus it will look like a doughnut. Turn the focuser one way, if the doughnut gets smaller then keep turning in that direction until it gets as small as it can be. If the doughnut gets larger then turn the other way

Note:- If you need to manually enter in the RA and DEC as it is not in TheSkyX's database, you can do so using the "Navigate" window [20]. This is found under the "Tools" dropdown in the "Telescope" tab [16]. Check that you have selected the correct Equinox in this menu, it is usually J2000.

Finishing up

Once you have finished observing for the evening, return everything back to how it was found. Make sure the telescope is parked [18] and the petals are closed [7]. You will need to press the green button first and then the red button due to a bug in the microcontroller's code! Sign out of the computer and turn the monitor off. **Do not turn off the PC!** Put the plastic bags over the back of the scope and the computer. Make sure the hatch is closed, when you are closing it, make sure to not slam it into the lower aperture. Slow down when it gets close and pulse the button to gently close. Make sure everything is as you found it and the dome is clean. Write down what you saw in the log book along with your time of exit. Set the alarm for all sites and lock the dome.

Troubleshooting

If you encounter a problem while in the dome, use common sense to work out if there is an immediate solution. If there is something seriously wrong, like the dome gets stuck, then do not try to attempt to fix this yourself. Simple use the extension lead to close the hatch, or the big stick if you are unlucky and have a power cut. Return everything to its normal position, set the alarm and lock the dome. Tell Dipali in the morning. **If there is an emergency then use the contact numbers on the wall as appropriate.** An emergency does not consist of the dome rotation not working properly, this can wait until the next day. An emergency is the dome has fallen off.

Information about the telescope and CCD

The CCD, which you can get to use in your 3rd year projects, is a G3-11000 made by Moravian Instruments. It has a monochrome OnSemi KAI-11002 sensor with 9 by 9 micron pixels. The full well capacity of 1 pixel is roughly 60,000 e^-. Its sensor is 4032(H) by 2688(W) pixels. There is a 5 slot filter wheel, with 4 filters currently fitted. These are the B, V, R and I standard astro filters. This camera costs roughly £4000 so do not attempt to use it if you have not been trained. https://www.gxccd.com/art?id=366

The OTA, which stands for Optical Tube Assembly, is a PlaneWave CDK20. CDK stands for Corrected Dall-Kirkham. This is a unique design created by PlaneWave. It makes use of a set of correction elements at the end of the light paths to help correct for various problems. The primary mirror is an ellipsoidal shape, and has a spherical secondary mirror. All three of these combined means that the CDK is coma free, has no astigmatism and has a very flat field. The 3D printed baffles connected to the secondary mirror prevent stray light from interfering with your images. Being 3D printed also keeps cost and weight down. The focal length of the scope is 3454mm, F6.8. This OTA costs roughly £30,000 on its own. This does not include the back plane and focusing assembly where you attach your equipment on to. https://planewave.com/product/cdk20-ota/

Reference photos

These photos and screenshots should be used as reference alongside these instructions. It will show expected results as well as where things are!

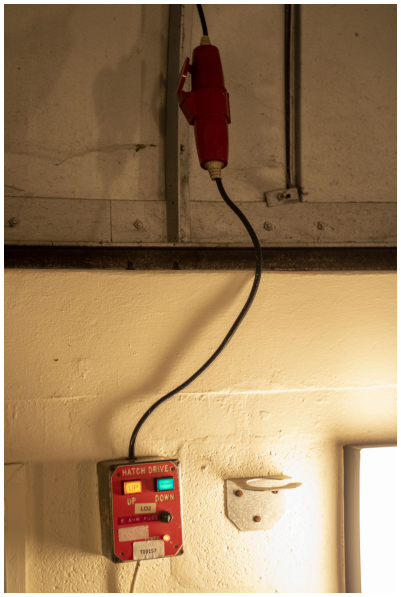

Figure 1: This shows the hatch drive cable connected and the drive switched on

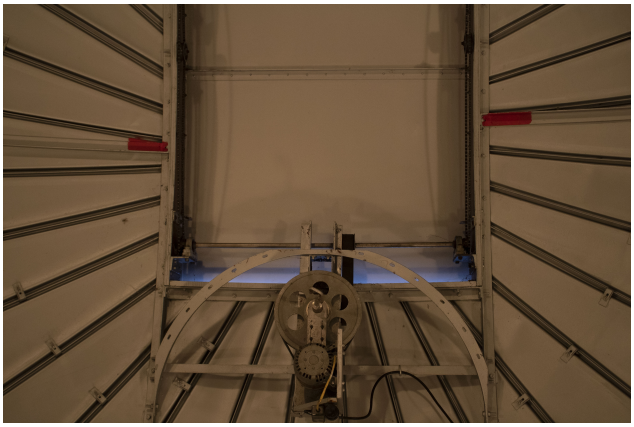

Figure 2: The red markers on the dome. **Do not open the hatch past these!**

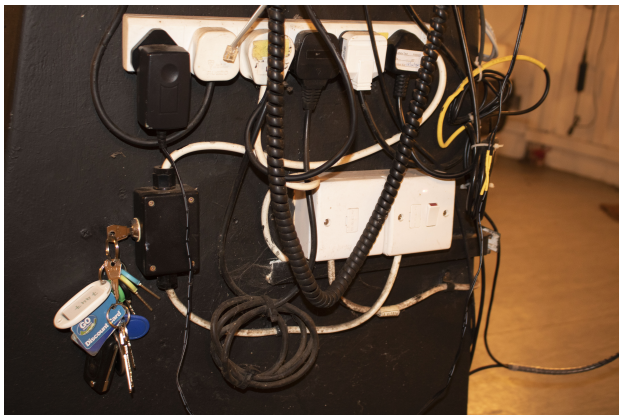

Figure 3: The key-switch can be seen on the left. Don't forget to also turn on the white switch on the right

Figure 4: This is the back of the EQ mount, the RA and DEC led's will be flashing when you first turn the scope on. Listen for 2 different toned beeps and the led's to stop flashing. This means the mount has checked its balance and it is okay

Figure 5: These are the fan controls for the telescope. They should be set as shown when in use

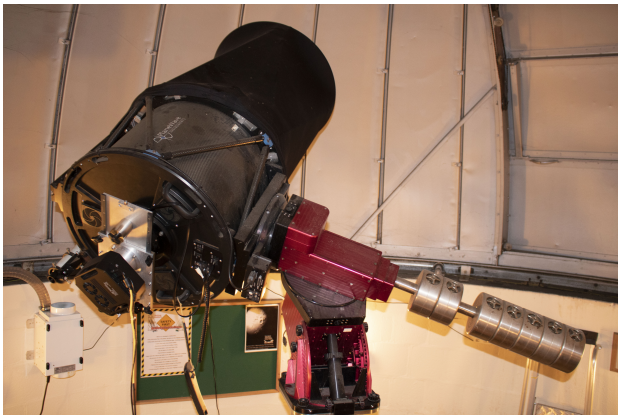

Figure 6: This is what the "Home" position of the telescope will look like

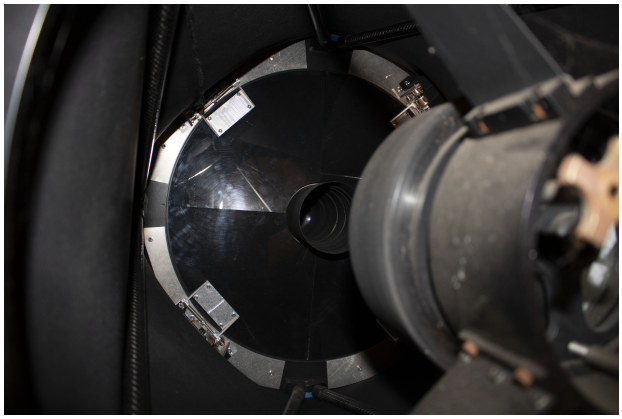

Figure 7: This is the inside of the telescope. The petals are the black acrylic sheets that cover the primary mirror

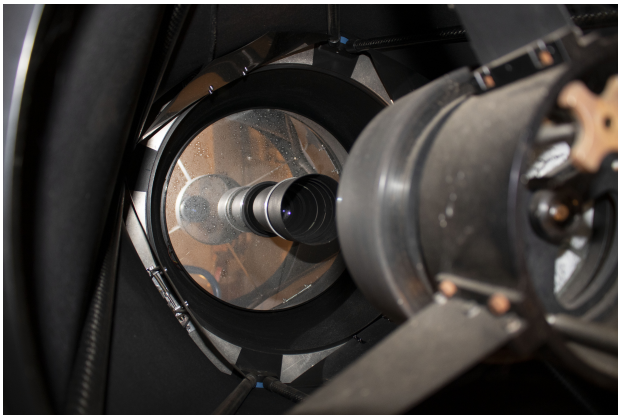

Figure 8: This is after the petals have opened - the mirror looks a lot dustier than it is due to the flash on my DSLR

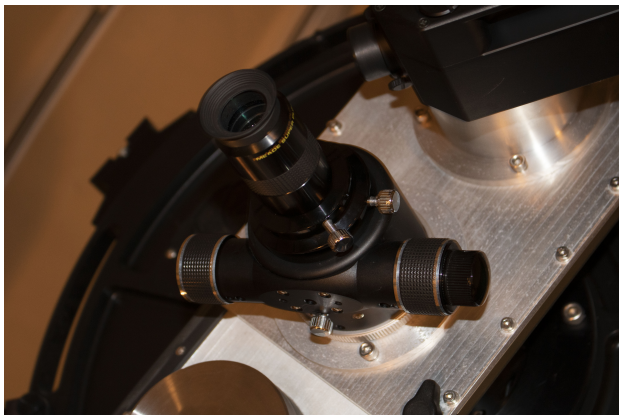

Figure 9: This is a 1.25” eyepiece fitted

Figure 10: This is a 2” eyepiece fitted, you will need to remove the 2” to 1.25” reducer

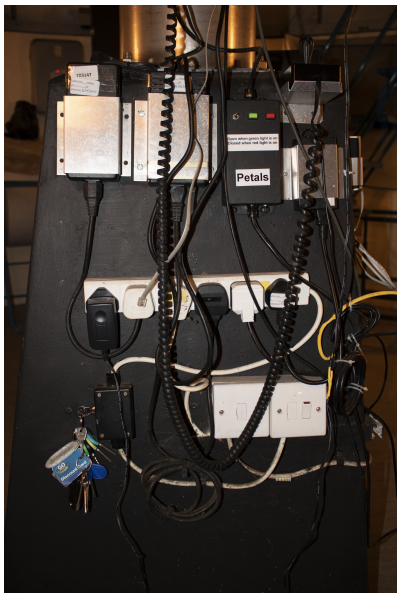

Figure 11: A full view of the pier, this also shows the indicator on the dome control box in the top left

Figure 12: This is the controls for the dome. The two direction buttons are at the top, stop is the 3rd one down. The speed control is the metal shaft at the bottom of the controller

Figure 13: The keypad illuminated, do not press any of the buttons on this as it is used for the CCD

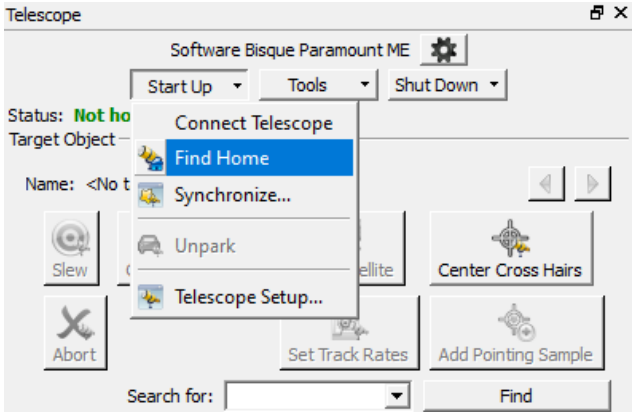

Figure 14: This is the "Start Up" drop down menu, found under the "Telescope" tab at the side

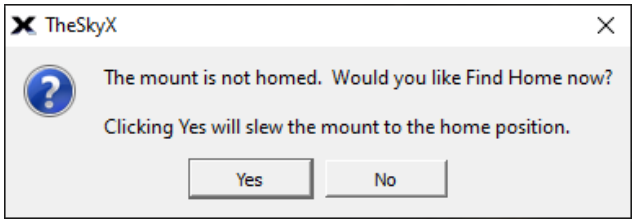

Figure 15: When connecting the mount this popup will appear if the mount is not yet homed. After confirming the mount will slew to the home position

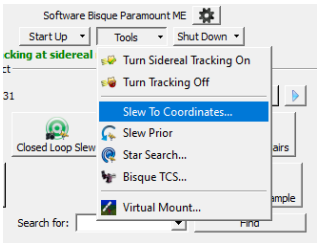

Figure 16: This is the "Tools" drop down

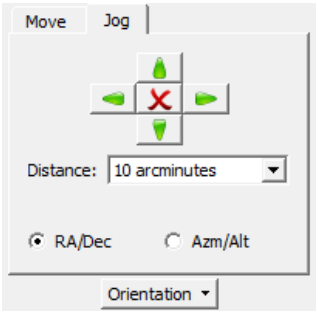

Figure 17: You can use these job controls to move the mount by a specific angle to center your object

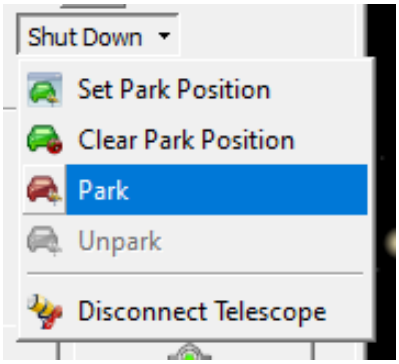

Figure 18

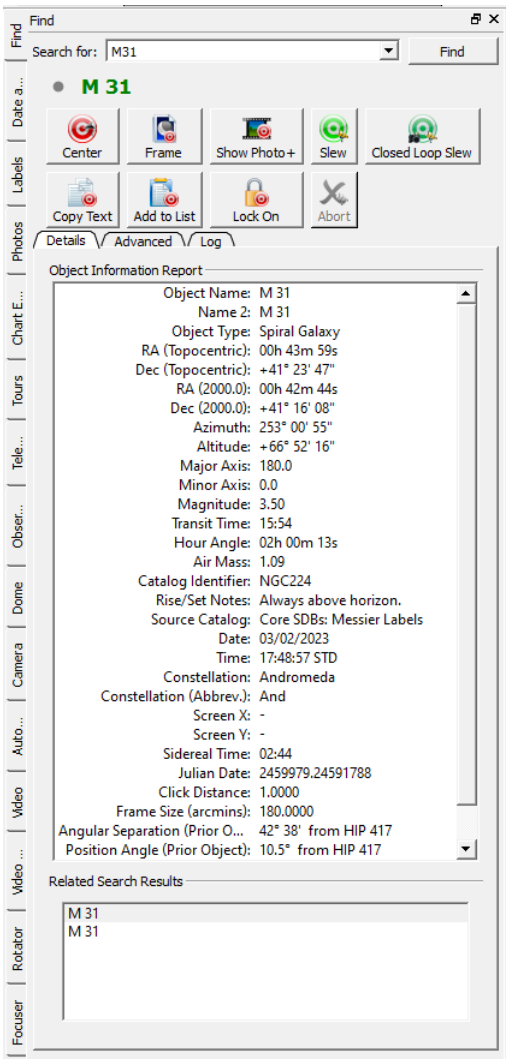

Figure 19: This is the "Find" tab. You can use this to select your target along. Once you have done that press the slew button and confirm the slew

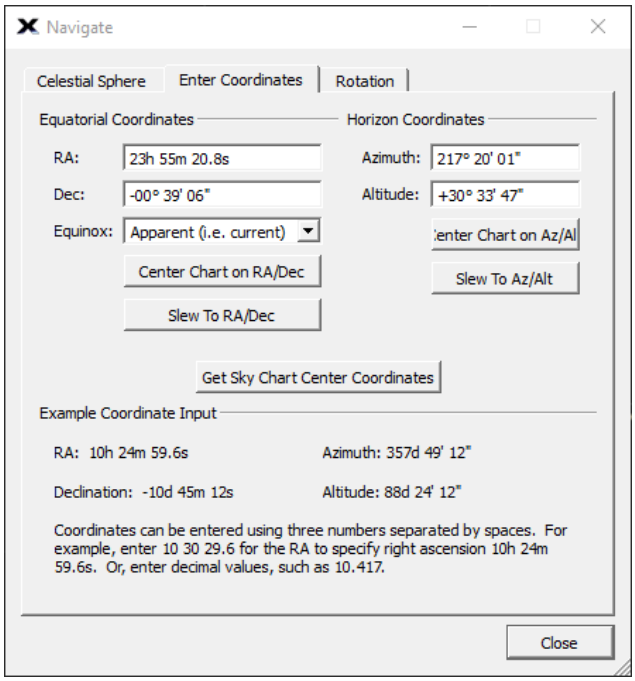

Figure 20: If your target is not in the database then you can manually enter the RA and DEC values. Make sure you set the correct equinox, it is usually J2000