Observation Log

NAME ______________________

SCHOOL ______________________

Introduction

As part of Unit 16B, you will be making day and night time observations of astronomical objects such as the Sun, the Moon, the Planets, and various constellations and the stars in them.

This log will allow you to keep all your observations and notes in one place. All digitally taken images should be backed up on line and a hard copy printed out and inserted into this booklet.

For Unit 16B, three documents will need to be submitted: a report on telescopes including an analysis of your observations; a zipped folder containing all your digital images (jpgs, FITS etc.) and this log.

As mentioned you will be observing the skies at night for your Unit 16B assessment and therefore several observation nights have been scheduled and will be on days when the school is open till late. Attendance is mandatory in order to pass the observation aspect of the unit. Recording observations outside of school hours will also be required therefore it is essential that you are organised. Observations of the sun will be done in school hours and we do NOT recommend you observe the Sun from home.

The first section of the log has useful information and instructions on how to construct an astrolabe and solar viewer. The second section has space for you to record your observations. If you require more space, you can attach more pages to the log with a treasury tag.

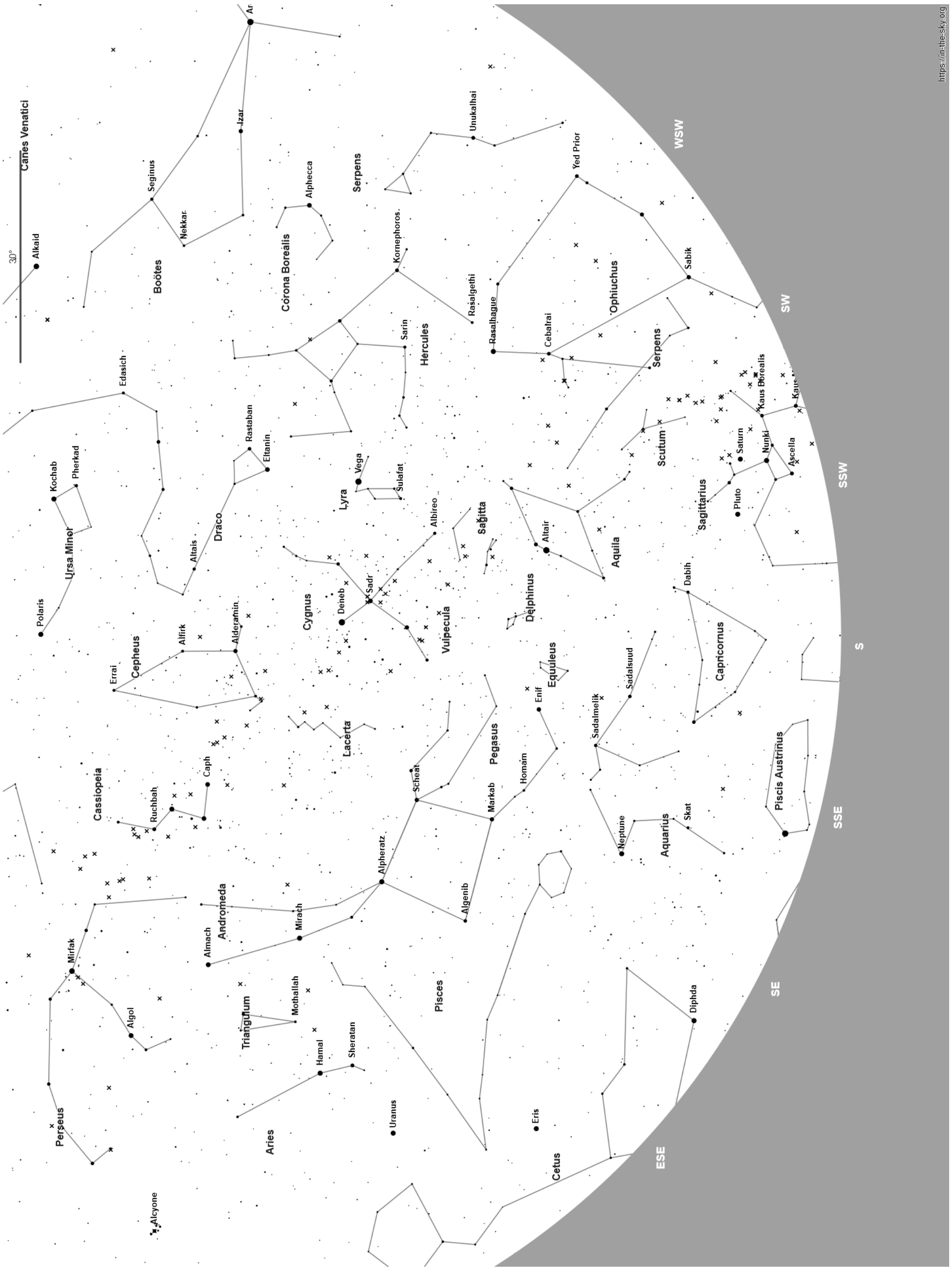
Useful Websites:

Astronomy Picture of the Day - https://apod.nasa.gov/apod/astropix.html
In-The-Sky.org Sky Maps - https://in-the-sky.org//skymap.php?skin=1
Heavens Above Satellite Predictions - https://www.heavens-above.com/
Las Cumbres Observatory - https://lco.global/
National Schools' Observatory - https://www.schoolsobservatory.org/
Daily SOHO Images - https://sohowww.nascom.nasa.gov/data/synoptic/sunspots_earth/
NASA Photojournal - https://photojournal.jpl.nasa.gov/
Stellarium Planetarium Software (online) - https://stellarium-web.org/
JS9 The online version of SAOImageDS9 - https://js9.si.edu/

Created by Dimitrios Theodorakis © GNU General Public License v3.0 astroDimitrios.github.io

Starmaps

Nottingham 180° South
2019/11/21



You can make your own star map like this one by visiting: In-The-Sky.org Sky Maps - https://in-the-sky.org//skymap.php. Make sure you choose the correct date and time. Slide the 'Field of View' slider to 180 degrees then drag the image until the S (South) marker is at the bottom edge. Below the image in the 'Show' box select the Ecliptic, Galactic Plane, and Show Scalebar. Change the colour scheme to one of the printer friendly options. At least double the width and height of the image and 'Export as PNG'. If exporting as a png fails, 'Export as SVG' then open it with your web browser and print from there. Print your map A3 size so it's easier to plot your observations. Repeat for the N (North) direction.

Creating RGB Images

You have each been given a student account on the National Schools Observatory which gives you access to a 2 m research grade telescope (the Liverpool Telescope) in Tenerife. There will also be opportunities to remotely control 2 m telescopes in Hawaii and Australia through the Las Cumbres Observatory network. The image files that you will get from these telescopes are called FITS files. FITS stands for Flexible Interchangeable Transport System and is the standard file format for astronomical images.

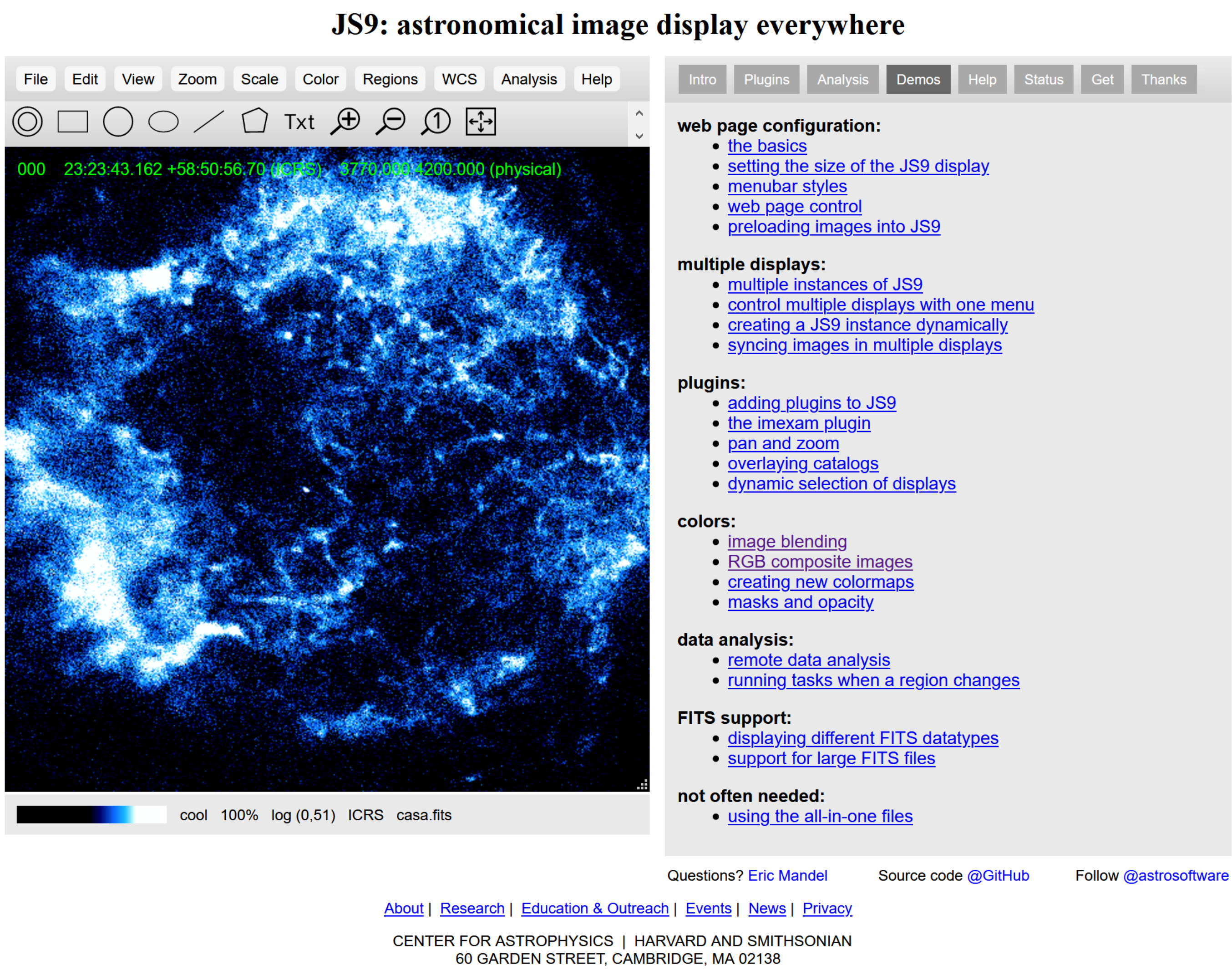
You can use the desktop software SAOImageDS9 which is free to download to open your images, colour them, then save them as pngs or jpgs. If you can't download the software, there is an online version called JS9 which you can see in the image below.

The cameras on the telescopes are black and white. To get a colour image you need three grayscale images taken through different colour filters (one red, one green, and one blue). To combine three FITS files into a single colour image you can follow the tutorial here for DS9:

http://ds9.si.edu/doc/user/rgb/index.html

or here for JS9:

https://js9.si.edu/js9/demos/js9rgb.html



Astronomical Calendar

There are many astronimal calendars online but I find http://www.seasky.org/astronomy/astronomy-calendar-2020.html to be the best. Some notable events for this academic year include:

September 11 - Neptune at Opposition.

October 1 - Mercury at Greatest Eastern Elongation.

October 13 - Mars at Opposition.

October 31 - Uranus at Opposition.

December 13-14 - Geminids Meteor Shower Peak.

2021

January 2-3 - Quadrantids Meteor Shower Peak.

March 20 - Venus at Greatest Western Elongation.

June 10 - Annular Solar Eclipse.

Be sure to check out seasky.org for the full list.

October 13 - Mars at Opposition. The red planet will be at its closest approach to Earth and its face will be fully illuminated by the Sun. It will be brighter than any other time of the year and will be visible all night long. This is the best time to view and photograph Mars. A medium-sized telescope will allow you to see some of the dark details on the planet's orange surface.

October 16 - New Moon. The Moon will located on the same side of the Earth as the Sun and will not be visible in the night sky. This phase occurs at 19:32 UTC. This is the best time of the month to observe faint objects such as galaxies and star clusters because there is no moonlight to interfere.

October 21, 22 - Orionids Meteor Shower. The Orionids is an average shower producing up to 20 meteors per hour at its peak. It is produced by dust grains left behind by comet Halley, which has been known and observed since ancient times. The shower runs annually from October 2 to November 7. It peaks this year on the night of the 21st and the morning of of the 22nd. The waxing crescent moon will set before midnight leaving dark skies for what should be a good show. Best viewing will be from a dark location after midnight. Meteors will radiate from the constellation Orion, but can appear anywhere in the sky.

How to make a Solar Viewer

A solar viewer lets you project an image of the Sun onto a piece of paper for safe viewing. The results will not be as good as using a dedicated solar telescope but it is the safest and easiest way to observe the surface of the Sun.

WARNING: Never look directly at the Sun without protection and proper filters.

To make a solar viewer, take a piece of card and poke a small round and smooth hole in it using a compass or needle. You can then use your solar viewer as shown in the image below.

Your results will be better if you make a large hole in the card and stick aluminium foil over the hole. Then poke a small hole through the foil using a needle.

How to make an Astrolabe

Using your astrolabe you can measure the inclination of astronomical objects. This is how high above the horizon in degrees the object is.

1) Cut out the next page and glue it onto a piece of thick card. Then cut around the template.

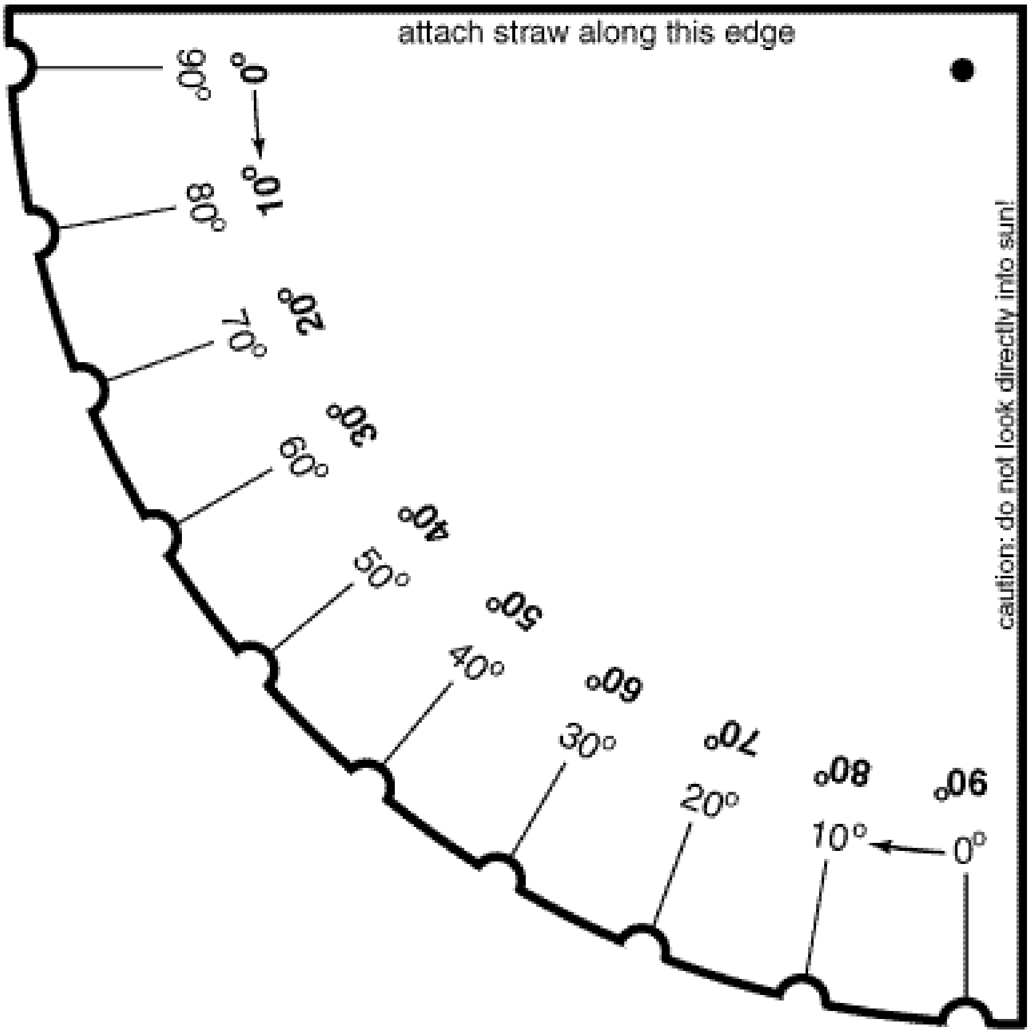
2) Take a straw and cellotatpe it to the top edge of the astrolabe.

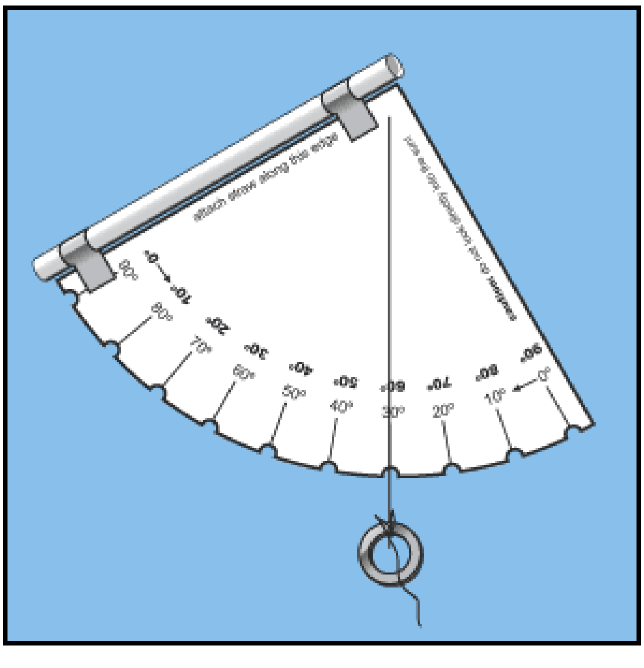
3) Poke a hole where the black dot is. Put a piece of string through the hole. Tie a knot on one side and to the other side tie a small weight or a piece of plasticine to act as a weight.

To use your astrolabe, look through the straw and locate an object. Hold the astrolabe steady and read off the angle that the string crosses as it hangs under gravity. It is best if you work in pairs to record your measurements.

NOTE: For your safety, never use your astrolabe on the Sun!!! You can measure the inclination of the Sun by locating it with your hand. Place your hand at the end of the straw and move the astrolabe until a bright dot appears on your hand.

Your finished astrolabe should look like the image below from At Home Astronomy. The template is also from At Home Astronomy (cse.ssl.berkeley.edu/AtHomeAstronomy/activity_07.html).





Definitions

Find the definitions for the following words/astronomical terms and write them in the space below.

Right Ascension and Declination

Altitude and Azimuth

Prograde Motion

Retrograde Motion

Ecliptic Plane

Equatorial Plane

Solar Plane

Definitions

Find the definitions for the following words/astronomical terms and write them in the space below.

Apparent Magnitude

Absolute Magnitude

Resolution

Magnification

Aperture

Focal Length

Lens Power

Ray Diagrams

You are going to draw some ray diagrams to measure the focal lengths of converging and diverging lenses, and concave and convex mirrors. These are vital components in all telescopes and a great deal of care goes into making flawless optics with very precise focal lengths.

On this page write a general method for measuring the focal lengths of the lenses and mirrors. Use the next four pages to draw your ray diagrams.

Method:

Ray Diagram – Converging Lens

Ray Diagram – Diverging Lens

Ray Diagram – Convex Mirror

Ray Diagram – Concave Mirror

Observation Log

Use this page to log your observations!

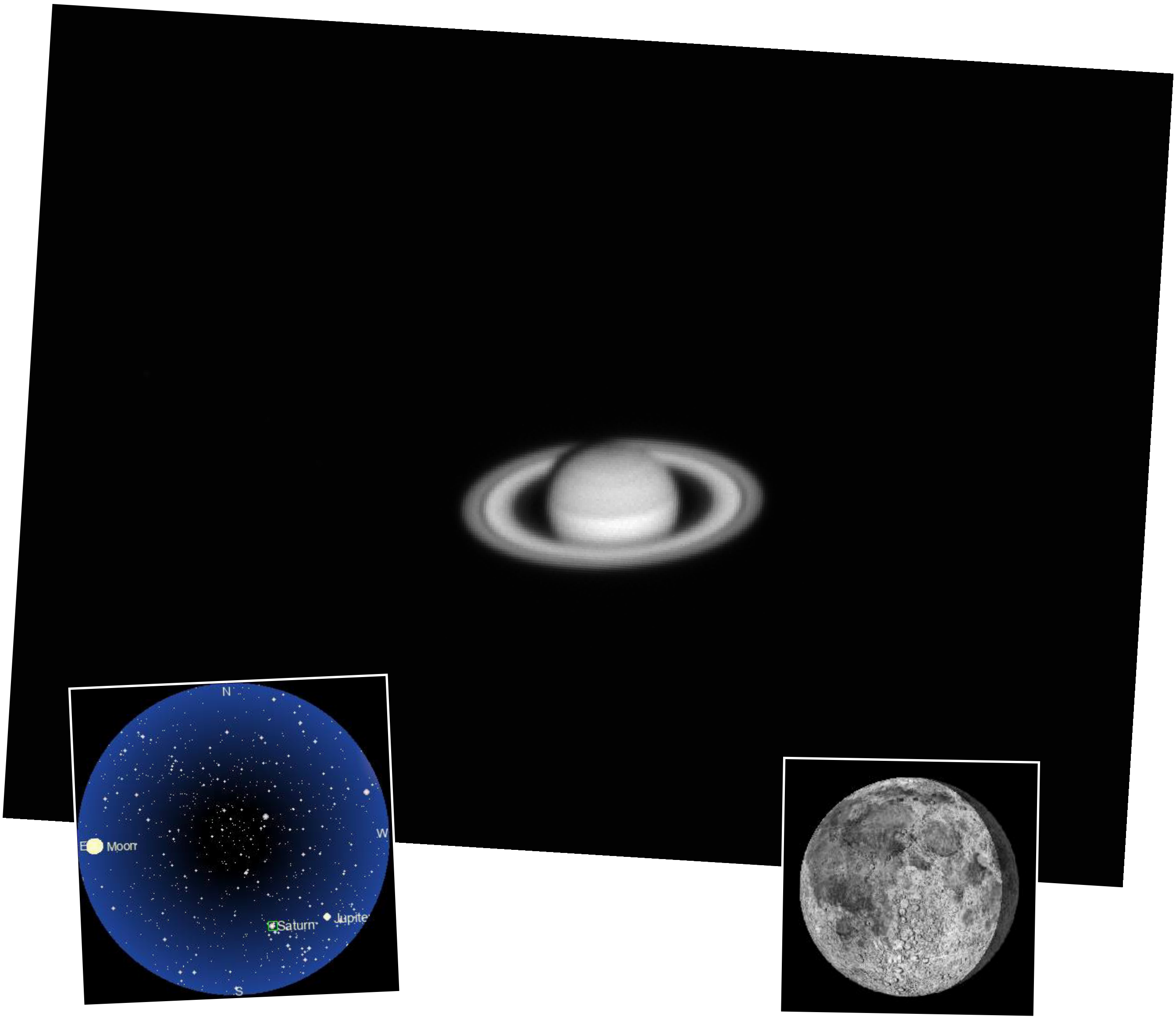
Date: 16/9/2019
Location: Tenerife (Liverpool Telescope)
Weather Conditions: Clear
Fellow Astronomers: Max
Moon Phase: Waning gibbous

Objects Observed:

Saturn!

EXAMPLE

Results:
(This could be a star map, a photo, a drawing, or something else!)



Notes:

The Liverpool Telescope is awesome and free for UK schools to use!
Visit - www.schoolsobservatory.org

Sky Mapping

Date: ____________________

Location: ____________________

Weather Conditions: ____________

Fellow Astronomers: ____________

Moon Phase: ________________

Use this page to log your observations!

Objects Observed:

Results:

(This could be a star map, a photo, a drawing, or something else!)

Notes:

Constellation 1

Use this page to log your observations!

Date: ______________________________

Location: ___________________________

Weather Conditions: _________________

Fellow Astronomers: _________________

Moon Phase: ________________________

Objects Observed:

Results:

(This could be a star map, a photo, a drawing, or something else!)

Notes:

Constellation 2

Use this page to log your observations!

Date: ______________________
Location: ______________________
Weather Conditions: ____________
Fellow Astronomers: ____________
Moon Phase: ________________

Objects Observed:

Results:
(This could be a star map, a photo, a drawing, or something else!)

Notes:

Constellation 3

Date: ______________________________

Location: ___________________________

Weather Conditions: _________________

Fellow Astronomers: _________________

Moon Phase: ________________________

Use this page to log your observations!

Objects Observed:

Results:

(This could be a star map, a photo, a drawing, or something else!)

Notes:

Polaris

Date: ____________________
Location: ____________________
Weather Conditions: ____________
Fellow Astronomers: ____________
Moon Phase: ________________

Use this page to log your observations!

Objects Observed:

Results:
(This could be a star map, a photo, a drawing, or something else!)

Notes:

Moon

Date: ______________________
Location: ______________________
Weather Conditions: ______________
Fellow Astronomers: ______________
Moon Phase: ____________________

Use this page to log your observations!

Objects Observed:

Results:
(This could be a star map, a photo, a drawing, or something else!)

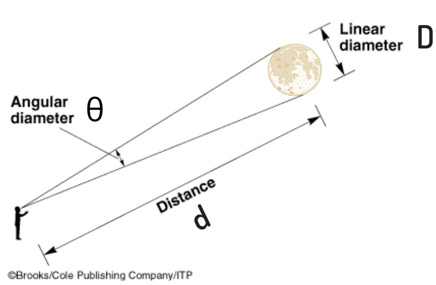
Distance to the Moon

To calculate the distance to the moon you need to work out the resolution of the image (note this won't work if the full disk of the moon isn't visible in your image).

resolution [arcsec / pixel] = pixel size [micrometre] / focal length [mm] × 206.25

You'll need to look up the pixel size for your camera and the focal length of the telescope. If you used a smartphone then you should also times your result by the focal length of your smartphone's camera.

The distance to the moon can then be found using trigonometry:



$d = D/\tan(\theta)$ where θ = resolution × diameter of the moon in pixels

D is the diameter of the moon which is approximately 3474.2 km.
Before taking the tangent of θ convert it to degrees using, $1'' = 0.00027\dot{7}^\circ$

My image resolution:

My calculated distance:

Actual distance:

You need to make an annotated version of your moon image. You can do this with the coding activity AstPy-7 Lunar Surface at astroDimitrios.github.io. Print out your photos from that activity and stick them in below.

Solar Projection

Date: ________________________
Location: ________________________
Weather Conditions: ________________
Fellow Astronomers: ________________
Moon Phase: ____________________

Use this page to log your observations!

Objects Observed:

Results:
(This could be a star map, a photo, a drawing, or something else!)

Notes:

Sun with Telescope

Date: ____________________
Location: ____________________
Weather Conditions: ____________
Fellow Astronomers: ____________
Moon Phase: ________________

Use this page to log your observations!

Objects Observed:

Results:
(This could be a star map, a photo, a drawing, or something else!)

Notes:

Extra

Date: ______________________

Location: ______________________

Weather Conditions: ______________

Fellow Astronomers: ______________

Moon Phase: ____________________

Use this page to log your observations!

Objects Observed:

Results:

(This could be a star map, a photo, a drawing, or something else!)

Notes:

Extra

Use this page to log your observations!

Date: ______________________________

Location: ___________________________

Weather Conditions: _________________

Fellow Astronomers: _________________

Moon Phase: _________________________

Objects Observed:

Results:
(This could be a star map, a photo, a drawing, or something else!)

Notes:

Extra

Date: ______________________

Location: ______________________

Weather Conditions: ______________________

Fellow Astronomers: ______________________

Moon Phase: ______________________

Use this page to log your observations!

Objects Observed:

Results:

(This could be a star map, a photo, a drawing, or something else!)

Notes:

Extra

Date: ____________________
Location: ____________________
Weather Conditions: ____________________
Fellow Astronomers: ____________________
Moon Phase: ____________________

Use this page to log your observations!

Objects Observed:

Results:
(This could be a star map, a photo, a drawing, or something else!)

Notes:

Extra

Date: ______________________

Location: ______________________

Weather Conditions: ______________

Fellow Astronomers: ______________

Moon Phase: __________________

Use this page to log your observations!

Objects Observed:

Results:
(This could be a star map, a photo, a drawing, or something else!)

Notes:

Extra

Date: ______________________________

Location: ___________________________

Weather Conditions: _________________

Fellow Astronomers: _________________

Moon Phase: _______________________

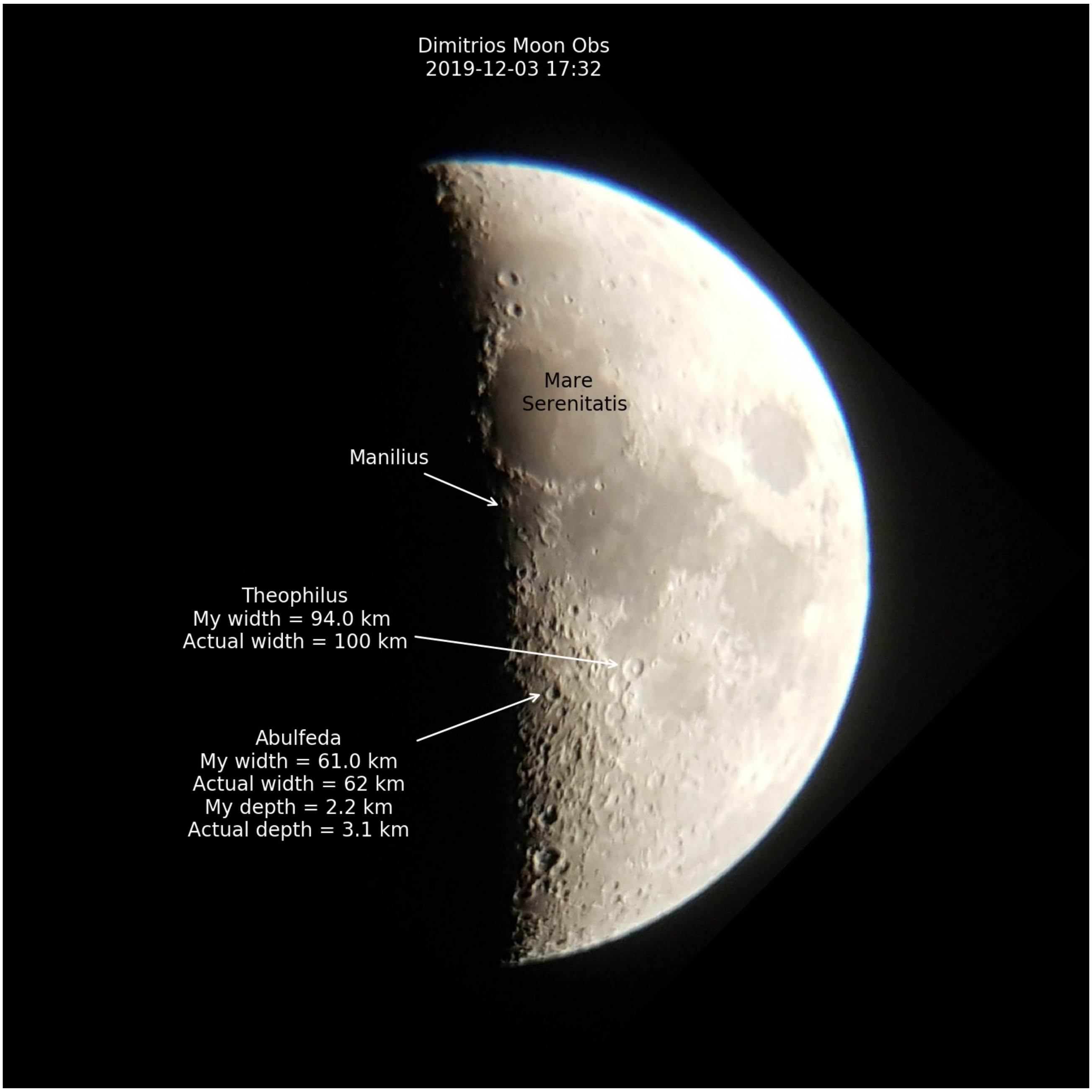
Use this page to log your observations!

Objects Observed:

Results:

(This could be a star map, a photo, a drawing, or something else!)

Notes:



Front, back, and example photos by Dimitrios Theodorakis © GNU General Public License v3.0 astroDimitrios.github.io