The Night Sky
ASTR 101

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1 Objective

To be introduced to the essential objects of astronomy which are: planets, stars, galaxies, nebulae, and telescopes. This is achived through observation of the night sky.

2 Equipment

For this lab, we will be using two telescopes. The first of which will be used for deep-sky objects is the University of Victoria's 38 inch telescope. This telescope is found in the Bob Wright Centre in the dome on the roof. The telescope is computer controller for movement from one cellestial object to the next. The dome itself is operated sperately and needs to be rotated to compinsate for the telescope's direction. The second telescope we will be using is the Celestron C8 Cassegrain telescope which is operated by a GoTo mount and is placed on the rood top.

We will take this time to explain the parts of the Celestron C8, as it is the telescope of most interest in this lab. All parts of the C8 can be found labeled in Figure 1. First we have the main optical tube which is a Cassegrain reflecting telescope. The light entering the front of the tube and travels to the primary mirror. Here, the light is reflected to the secondary mirros which again reflects the light back to the rear of the telescope and into the eyepiece.
Resting on top of the primary optical tube is the finderscope. The finderscope is used to align the telescope easier because of its wider field of view. Plainly put, it is easier to get objects in the finderscope than the main optical tube because

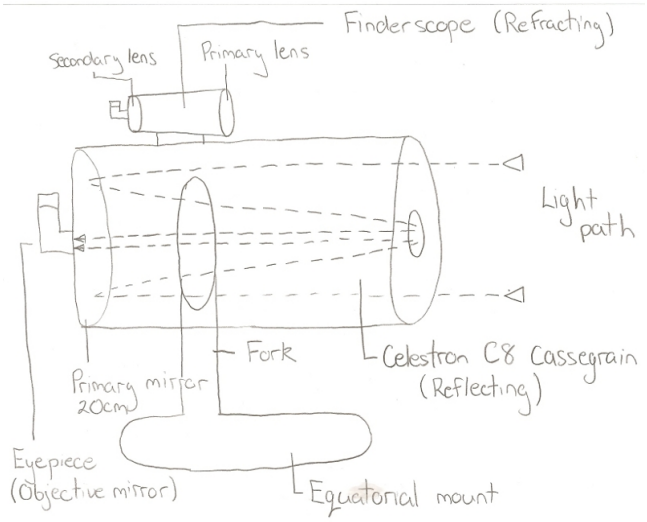

Figure 1: The Celestron C8 used in this lab.

its field of view is much wider while its magnification is lower. The finderscope is a refracting telescope as opposed to reflecting. It uses two lenses, the primary where the light enters and the secondary where the light passes out and into the eyepiece. Refracting telescopes use to be the main tool used for astronomy before Isaac Newton who created the first reflecting telescope in 1668 [1].
The telescope is proped up by what is called the fork and rests on top of an equatorial mount as opposed to the altazimuth mount.

The equations for calculating the telescope's brightness in contrast to a human eye as well as its magnification power can be found in Section 5 Calculations.

3 Procedure

3.1 The Constellations

While this section of the lab is labelled "The Constellations" what we will actually be looking at is the asterisms which are the basis for the constellations. Using the star map provided as well as being guided by the T.A, sketch three (3) new constellations that you learnt tonight. Describe the mythology associated with each of the constellations. Learn three stars and label them inside of the constellation sketches and be sure to note the date, time, and weather of the observations.

3.2 Deep-Sky Objects: Star Clusters, Bebulae, Galaxies

Here we will look at cellestial objects which are very dim and therefore harder to see with small telescopes. Using the University of Victoria's 38inch telescope, locate the 3 following deep-sky objects: M11, M15, and M57. Sketch each of these objects and be sure to note the time and date and weather conditions of each siting. Give a brief summary of what each of these objects are.

3.3 The Stars

Here we will observe some interesting stars as well as look at the closest galaxy to our own Milky Way. Using the provided Celestron C8 telescopes, locate the following three objects: Alberio, Mizar, and The Andromeda Galaxy. Sketch each one of these and provide a brief description of each. Be sure to note the time, date, and conditions for each observation.

4 Observations

4.1 The Constellations

The three asterisms observed in this part of the lab were: Cygnus, Andromeda, and Pegasus. Cygnus was observed at the time 21:00 on the night of 10/09/2012 under clear weather conditions at 48 degrees latitude and is located approximately in the upper eastern section of the sky. A sketch of Cygnus can be found in Figure 2. Cygnus, otherwise known as the Nothern Cross, is the Greek word for swan which is represents in the sky. Cygnus contains the star Denab which is part of the summer triangle. Cygnus also contains the famous Cygnus X-1 which is widely believe to be a black hole for its enormous X-ray source [2]. Cygnus in mythology, is identified with several legendary swans; one of which is when Zeus disguised himself as a swan to seduce Leda [3].

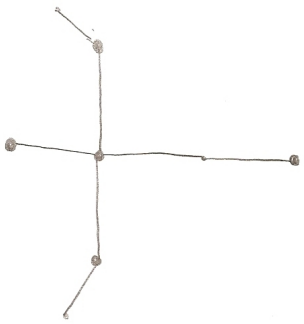

Figure 2: The asterism of Cygnus.

The asterism of Andromeda was observed at the time 21:05 of the night 10/09/2012 under clear weather conditions at 48 degrees latitude and is located approximately in the middle eastern section of the sky. A sketch of Andromeda can be found in Figure 3. Andromeda is involed in the mythological story of Perseus, Cepheus, and Cassiapeia in which Cassiopeia bragged that her daughter was more beautiful than the Nereids, sea nymphs blessed with beauty. After an attack by Poseidon to punish Cassiopeia, Andromeda's father, Cepheus, was told to sacrifice his daughter. Andromeda was later saved however by Perseus [4]. Andromeda contains the binary star known as Alpheratz and is the third brightest start in the asterism [5].

Figure 3: The asterism of Andromeda.

The asterism of Pegasus was observed at the time 21:08 of the night 10/09/2012 under clear weather conditions at 48 degrees latitude and is located approximately in the middle eastern section of the sky right next to Andromeda and under Cygnus. A sketch of Pegasus can be found in Figure 4. 51 Pegasi, a star in this constellation, was the first extrasolar Sun-like star found to have a planet orbiting it [6]. Pegasus is involed is many mythological stories including how he delivered Medusa's head to Polydectes after Perseus cut off her head.

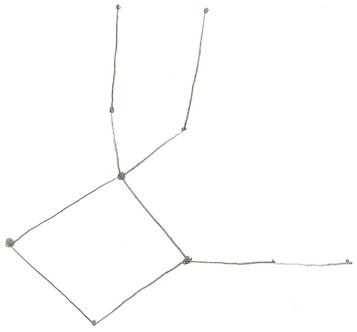

Figure 4: The asterism of Pegasus.

4.2 Deep-Sky Objects: Star Clusters, Nebulae, Galaxies

The three Messier objects observed were: M57, M15, and M11. M57, the Ring Nebula, was observed at 21:16 on the night 10/09/2012 under clear weather conditions at 48 degrees latitude. A sketch of M57 can be found in Figure 5. M57 appears in the constellation of Lyra and is an example of a planetary nebula, which is an emission of ionized gas expelled during a star's late life [7]. Planetary nebula may result from the death of intermediate and low mass stars [8].

Figure 5: The Messier 57 object.

M15, a globular cluster, was observed at 21:23 on the night 10/09/2012 under clear weather conditions at 48 degrees latitude. A sketch of M15 can be found in Figure 6. M15 can be described as a large gathering of star which the brighter are more often located towards the centre of the cluster while the dimmer appear towards the outer rim. M15 in particular is thought to have a black hole located at its centre [9].

Figure 6: The Messier 15 object.

M11, an open cluster, was observed at 21:30 on the night 10/09/2012 under

clear weather conditions at 48 degrees latitude. A sketch of M11 can be found in Figure 7. M11 can be described as a large cluster of stars, however, not all brightest stars appear at the centre of the cluster. Star appear to be randomly spread out inside of the cluster. It is believed that its more or less triangular shape is similar to that of a flock of flying ducks.

Figure 7: The Messier 11 object.

4.3 The Stars

The two stars observed were Mizar/Alcor and Alberio in addition to the Andromeda Galaxy being observed. The stars Mizar and Alcor were observed at 21:32 on the night 10/09/2012 under clear weather conditions at 48 degrees latitude. A sketch of the stars can be found in the Figure 8.

Figure 8: The stars Mizar and Alcor.

The star Alberio was observed at 21:40 on the night 10/09/2012 under clear weather conditions at 48 degrees latitude. A sketch of the star can be found in Figure 9. Alberio contains two stars. The left star shines a red colour while the right star shines blue. The star that shines blue must be hotter because blue is a more energetic end of the light spectrum which means that is must be generating more energy than the red one.

Figure 9: The stars of Alberio.

The Andromeda Galaxy was observed at 21:49 on the night 10/09/2012 under clear weather conditions at 48 degrees latitude. A sketch of the galaxy can be found in Figure 10. The Andromeda Galaxy can be described as an elliptical blur in the sky where its centre is more concentrated than the perimeters. The Andromeda Galaxy is actually the closet galaxy to our own Milky Way at about 2.5 million light-years from Earth [10]. The Andromeda Galaxy is also part of the Messier objects and is known as M31.

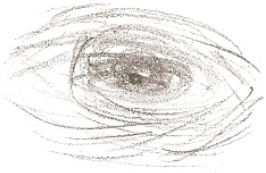

Figure 10: The Andromeda Galaxy. Also known as M31

5 Calculations

For the light gathering abilities of the Celestron C8 telescope, let us contrast it to that of the human eye. The pupil in the eye is used for gathering light and is on average about 1cm in diameter. The primary mirror of the C8 is also used for light gathering and has the diameter of 20cm. The equation for area of a circle is shown in Equation 1 below. We can use this to calculate the ratio of the telescope's primary mirror to that of the human eye in Equation 2.

$$A = \pi * r^2 \tag{1}$$

$$\frac{A_m}{A_e} = \frac{\pi * 10cm^2}{\pi * .5cm^2} = 400 \tag{2}$$

From Equation 2 above we see that the C8 has 400 times the light gathering ability as compared to the human eye. Now as for magnification, we look to Equation 3. We see here that the magnification is equal to the focal length (f) of the primary mirror divided by the focal length of the objective mirror.

$$m = \frac{f_p}{f_o} = \frac{2000mm}{40mm} = 50 \tag{3}$$

From Equation 3, we see that magnification is 50 times.

6 Evaluation

Overall, I liked the lab as a refresher to the night sky. I had lots of previous knowledge of the constellations and of some key Messier objects and what they were, however I was never able to view them through my own telescope. The most I took away was some of the mythology from the constellations as I had never researched it on my own.

References

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