Intro to AstroSoc's Telescopes

AstroSoc's favourite piece of equipment is the lovely white Dobsonian (image 1) mounted 6" Newtonian-reflector. It's not necessarily the best, but its great advantage is that we can easily take it wherever we go – as long as there is someone strong around to lug it up whichever incredibly steep hill we decide to climb. Now you might think a 6" telescope would not be heavy, but then again most believe that the description of 6-inches refers to its length. In fact it means that the telescope's primary mirror is 6-inches in diameter, the actual telescope tube is over 7" in diameter and about 42" in length (about 1.18m). To add to that the Dobsonian mounting for the telescope tube is basically a large heavy wooden box.

Image 1

So what is a primary mirror? The diagram below (image 2) is of a Newtonian-reflector telescope, the term reflector refers to the fact that the telescope gathers light using a combination of mirrors – rather than the traditional seafarer's telescope's use of lenses. The primary mirror focuses all the light that enters the telescope onto a (flat) secondary mirror, which then in turn directs the light into the eyepiece.

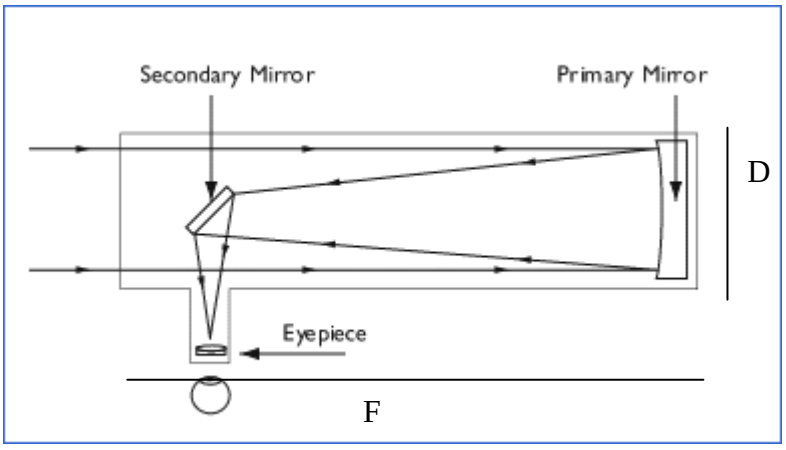

Image 2

The F shown on the diagram is the measurement of the Focal Length of the telescope, and the D marks out the diameter of the primary mirror (which is parabolic in shape). The Focal Length is important in calculating the magnification of the telescope. The diameter tells you how much light a particular telescope can gather, and hence gives and indication of how bright an object appears in the telescope. This is important for viewing deep sky objects such as galaxies, because they are very dim.

In general a high magnification is not necessarily important, in fact for viewing the majority of astronomical objects telescope with short focal lengths are preferred. This is because apart form planets (and the moon) most objects in the sky are actually quite large. These are best seen at around 30x magnification, because the higher the magnification, the dimmer the objects appear through the eyepiece.


Image 3

Arguably our finest telescope is the ancient refracting telescope (the Grubb – image 3) located in a shed on the roof of Poynting Physics Building. It is actually two telescopes attached to the same equatorial mounting. The two telescopes are a 5.5" and 4.5" in diameter and so are quite powerful. These are not the original telescopes for this mounting; the original is located in the course one laboratory of Physics and is considerably larger. The Grubb was originally located at the current location of the Guild of Students when it was the main telescope of the University. Although this telescope is permanently attached to the Physics roof and hence can not escape the light-polluted sky of Birmingham, it quite often produces superior views of the planets than the Dobsonian at a dark site. Also the twin telescopes on the roof have a drive system which follows the motion of the stars across the sky. This means that you do not have to keep readjusting the telescope's arm, and the more adventurous can even have a go at taking long exposure photographs of the night' sky – either through the sky or via piggy-back.

Refracting telescopes are traditional Earth-based type of telescope, where the light travels into the telescope through a large lens in the front opening of the tube, and is then focused onto an eyepiece at the other end of the tube (see image 4). The major difference between terrestrial telescopes and the astronomical telescopes is that the images in the later appear upside down. This at first seems very strange, but objects in space seem pretty much the same either way around, so it is not a problem. The reason why this is so, is because to produce an image in the eyepiece that is the correct way up requires an extra lens to be placed within the telescope. With each lens placed within the telescope less light that enters the telescope actually arrives at the eye, so you receive a dimmer image, which is more of a problem to astronomers than an upside-down image. Reflecting telescope like our Dobsonian also produces images the wrong way up, for the same reason.

Again refracting telescopes are referred to by the diameter of their objective lens (like a reflectors primary mirror). Generally they are smaller than reflecting telescopes, due to the extra cost of lens over mirrors, but a 4" lens is more effective at light gathering than a 6" mirror, and hence is a better telescope. The magnification is again partially determined by the focal length of the telescope. Eyepieces are used to vary the magnification; each eyepiece has a number printed on it – that is its focal length in millimetres. Short focal length eyepieces such as 6mm and 9mm are high magnification eyepieces which are best used for observing planets and the moon. Longer focal length eyepieces such as 27mm are used for observing larger and dimmer objects in the sky such as nebulae. Fairly bright, large objects in the sky such as globular clusters can be comfortably observed at higher magnification, using eyepieces of say 12mm.

Image 4