Observational Astronomy / Basic observatory instructions

For every lab, we will meet in Meyer 224, and all go together to the roof if we are having an outdoor lab (which won't be decided until the last minute). DO NOT BE LATE. YOU WILL MISS LAB AND GET NO CREDIT.

On the roof, it will be cold. DRESS WARMLY. REALLY WARMLY. You will be able to take extra clothing off if it is unnecessary, but you won't be able to put on extra clothing you didn't bring, so err on the side of warmth! This isn't like skiing or hiking or even walking in the cold — you will be standing stock still for a couple of hours. So dress WARMLY.

Do not leave the roof without handing in your lab and telling an instructor.

For the labs using telescopes (all outdoor ones except the first), we will begin lab by moving the telescopes outside. Make sure they are evenly spaced across the roof, and that each one has a view of Polaris to the North. If you are using an equatorial telescope, check that the batteries to its motor are working. Make sure to get eyepieces from the lab room. Some useful tools are also available in the lab room: binoculars, flashlights, and some sky atlases, for example.

Below we give some basic information about the telescopes.

Optics. The telescopes for this lab have apertures of 8 to 10 inches diameter, which allows them to collect much more light than the human eye (about 500 times more) so that we can see much fainter objects. The optics are quite complicated. At the front is a transparent plate, and in the center a small secondary mirror pointing inwards. The main optical component is a converging mirror at the other end of the telescope. The light from a distant star passes through the glass plate, bounces off the primary mirror, comes back up the tube, is reflected back down the tube by the secondary and passes through a hole in the primary mirror to the eyepiece. There is a knob on the back of the telescope that focuses the optics. Once set up, this does not need to be adjusted unless you change the eyepiece.

Magnification. When you look through the eyepiece the view is magnified. The magnification is given by the formula $m = f_o/f_e$ where f_e is the focal length of the eyepiece and f_o is the focal length of the objective or primary optical component. f_e is usually written on the eyepieces in mm. f_o for our telescopes is about 2000 mm. So for a 25 mm eyepiece the magnification is $2000/25 = 80$. We have a variety of eyepieces available in the lab room. Please take these from the lab room at the beginning of each lab and return them at the end.

Finder. Attached to the side of the telescope is a small finder telescope – it acts a bit like the sights on a rifle. It has a magnification of 6, and sees about 5°of the sky – much more than through the main eyepiece. When you look though the finder there is a cross hair, that should be aligned so that a star on the cross hair appears in the eyepiece. Thus one way to observe a star is to line up

the telescope roughly in the direction of the star; then line up the star in the finder. It should then appear in the main eyepiece.

Control. The telescopes come in two varieties. The "equatorial" telescopes have two moving axes that correspond to the sky coordinates RA and Dec. Each axis has a scale which enables you to dial in and point at a star of known coordinates. The Dec circle is marked in degrees; the RA circle in hours, with smaller 5 min ticks. To move over large angles: release the axis brake; move the telescope; then reset the break gently – not tightly. For precision setting, there are control knobs for each axis that move the telescope over small angles. The "alt-az" telescopes have axes that correspond to altitude and azimuth; these telescopes are easier to control, but do not naturally track the coordinates of the sky the way equatorials do.