Joseph Sanderson, Michel Fich, 2024

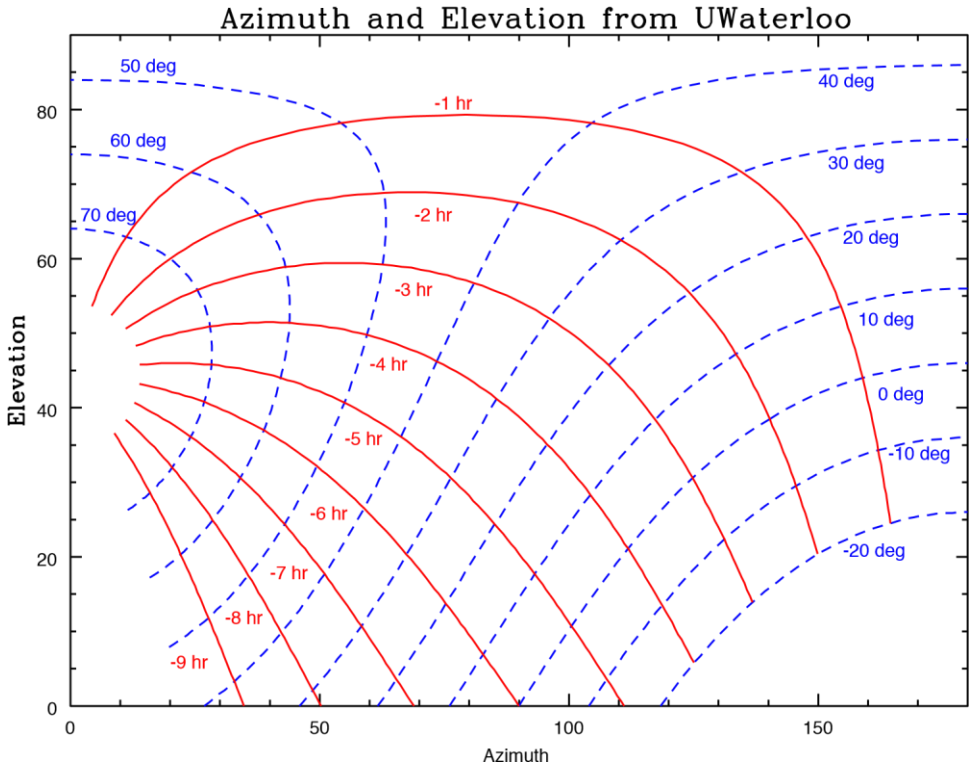
SCIENCE 238 Assignment #1

(Requires course material up to and including Module 1e)

Answers should be given with an appropriate number of digits of accuracy. There is a discussion of significant figures in Module 0. **Marks will be deducted for inappropriate presentation of answers (i.e. too many digits) on all assignments.**

1) How much of the Moon's surface is visible (i.e. lit by the Sun and in view from the Earth) when the Moon is exactly half way between Full Moon and Last Quarter? (Marks: 3) *Hint: drawing a figure can be very useful.*

2) The figure below shows the positions of objects in the sky as seen from Waterloo in "natural" coordinates of Azimuth (0 degrees is to the North, 90 degrees is East, 180 degrees is South) and Elevation (0 degrees is the horizon and 90 degrees is directly overhead). This is just half of the sky but the other half (from Azimuth of 180 to 360 is a perfect mirror reflection of this). Note that Elevation of 0 is the position where an object rises above the horizon (the Elevation of 0 on the reflected figure shows the position at setting).



The blue lines show the Declinations of the objects and the red lines mark the time in hours, where 0 hours is "noon" for object, or the time (in Sidereal Time) where the object is at its highest Elevation – note that 0 hours is not marked as the plot "blows

(Marks: 10 out of 60 Assignment Marks for Term)

up" (e.g. at a Declination that is the same at Waterloo's latitude to object is directly overhead at Elevation of 90 degrees, but at **all** or **any** Azimuth… Azimuth is poorly defined for such objects at that time). Use this plot to answer the following questions:

(a) On June 21 the Sun is at a Declination of 23.5 degrees. Estimate the time of sunrise in Waterloo (e.g. how many hours before noon is the Sun at Elevation = 0. (b) How long is the day in Waterloo on June 21?

(c) What is the time of sunrise on September 21 when the Declination of the sun is 0?

(d) On Dec 21 the Sun is at a Declination of -23.5 degrees. Estimate the time of sunrise on that date and the length of the day.
(Marks: 4)

3) What is the angular diameter (in arcseconds) of a comet nucleus that has a radius of 15.0 km and is located at a distance of 3.00 Astronomical Units. (1 A.U. is defined to be 1.496×10^{11} *meters.*) (Marks: 3)

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