

# According To Dynamical Time Period, Calculate The Diurnal And Direct Motion Of Celestial Sphere's Objects

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**Abstract:** Amateur observational astronomy is the unlimited hobby of learning about the universe and observing as the base of astronomy. It can be divided into five major types of amateur observing as observing with your unaided eyes [naked eye] without optical aids, Observing with binoculars, observing with telescopes, observing with cameras that use film and electronic technologies & Astronomy spectroscopy. Each kind of observing is based on learning how to use different types of observing equipment. Sky is a natural laboratory for every amateur astronomer in the world. But the sky that our students can observe is not impressive. In the 21<sup>st</sup> century images are of outstanding importance, the appearance of the sky is awful. From many cities it is not possible to look at the sky, but when we find a space between the buildings to see the sky, the light pollution reduces the full numbers of visible stars to a few. However if could go through the barriers of observation astronomy, it becomes as part of our life. Then we can look at the sky to rediscover the stories of our ancestors & Promote positive feelings towards astronomy and towards science in general. Thus amateur astronomers can help people to discover and taste the adventure of a new knowledge by means of simple observations using the naked eye, binoculars, amateur telescopes or public observatories & Impress upon humanity the beauty of natural phenomena also you can be step forward for keep something so wonderful.

## Introduction

Amateur observation as observing with your naked eye is the first stage of entering the observation astronomy. The coordinate system which corresponding to above observation is relative to the observer & it's easy to build up compatibility data base of CSO. Thus this practical research activity observer could be able to simply calculation of motion of CSO which are tend to exhibit apparent magnitude as more than +5 [Refer the discussion] due to the dynamical time period. This method is more accurate for stars, planets & their satellites

The following observation were obtained,

- The time taken for the CSO to be observed, till it sets at the horizon.
- The time took for CSO to be observed, appears at the horizon.
- The time taken for the CSO to be observed till it appears at the horizon on the next day.
- The time taken for the CSO to set at the horizon and appear on the horizon on the next day.

## Method

- Select the suitable sexton for the experiment. (It should have 1/4 of a circle from 0° - 90°)
- To measure the intensity of the Object,
  1. Make sure there is a vernier scale attached to the main scale
  2. A tripod for the sexton, so that sexton can be placed horizontally on the ground.
- Identify the celestial objects.
- Measure the angle to the celestial sphere at different periods or at equal time interval.
- Use the data observed to make calculation at the appropriate time intervals. Use the calculated value to calculate the celestial objects motions in angles per minutes.

## Measurement & Calculation

- Observation Start time as tstart
- Observation Start Latitude as xStart
- Observation close time as tend
- Observation close Latitude as xend
- Periods for calculated as d

$$t_{start}=t_1, x_{Start}=x_1, t_{end}=t_5, x_{end}=x_5$$

Observation	Latitude	Time
O1	X1	T1
O2	X2	T2
O3	X3	T3
O4	X4	T4
O5	X5	T5
O.EX	X.EX	T.EX

Chart No:01/Data Index & Measurement

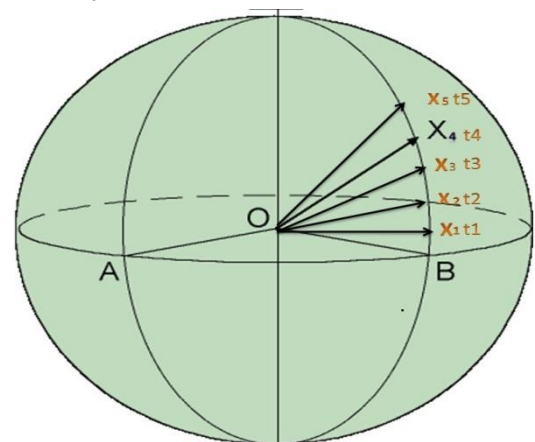


Fig: 01: Terrestrial Latitudes & Longitudes system

### Chart No: 02| Data Index & Measurement

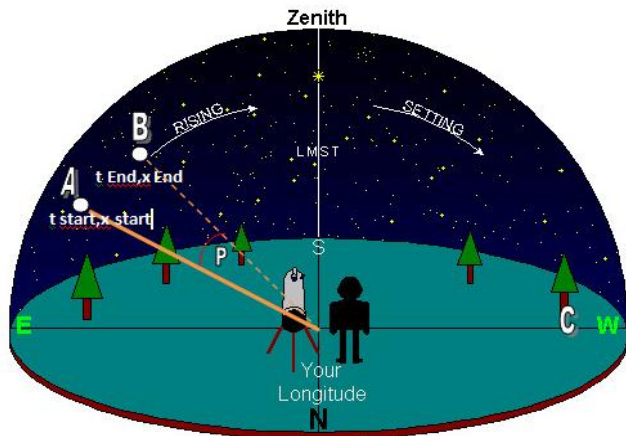
Total time average for complete the one latitude:

$$\frac{[tA/xA + tB/xB + tC/xC + tD/xD]}{d} = C/d$$

$$1^0 = C/d$$

- ❖ The time taken for the CSO to be Start of observed , till it sets at the horizon = TOA<sub>1</sub>

$$TOA_1 = t_{start} + [C/d]_x [XEA_1]$$

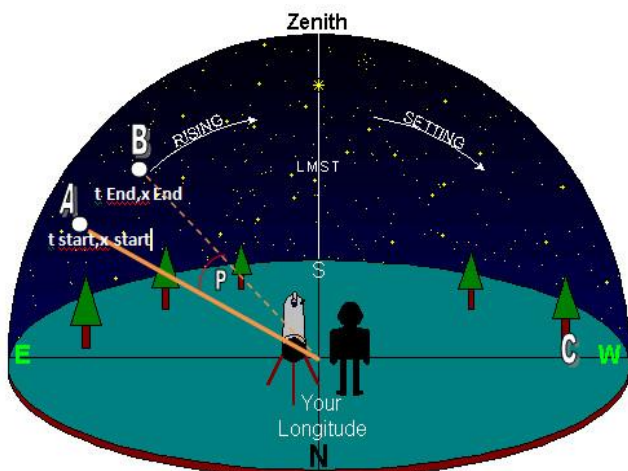


Your LMST - Local Mean Siderial Time - on your Meridian.

$$A-C = xEA_1 = [180^0 - x_{start}]$$

- ❖ The time taken for the CSO to be Start of observed , till it sets at the horizon = TOA<sub>2</sub>

$$TOA_2 = t_{end} + [C/d]_x [XEA_2]$$



Your LMST - Local Mean Siderial Time - on your Meridian.

$$B-C = xEA_1 = [180^0 - x_{end}]$$

According to TOA<sub>1</sub> and TOA<sub>2</sub> observation data

$$x_{end} - x_{start} = P \mid XEA_1 - XEA_2 = P$$

$$x_{end} - x_{start} = XEA_1 - XEA_2$$

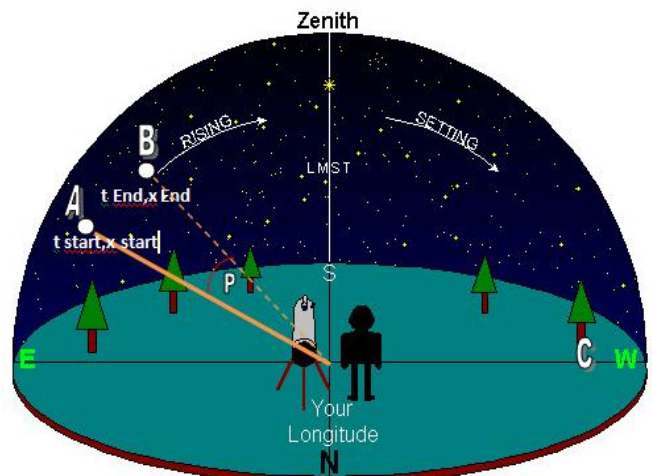
Time period	Latitude period	Time taken to absolute latitude
t2 - t1 = tA	X2 - x1 = xA	tA/xA
t3 - t2 = tB	X3 - x2 = xB	tB/xB
t4 - t3 = tC	X4 - x3 = xc	tC/xC
t5 - t4 = tD	X5 - x4 = xD	tD/xD

$$X[end-start] = XEA[A_1-A_2]$$

$$TOA_1 = TOA_2$$

- ❖ The time took for CSO to be observed<sub>1</sub> appears at the horizon.

$$TOB = t_{start} - [C/d]_x [x_{start}/60]$$



Your LMST - Local Mean Siderial Time - on your Meridian.

- ❖ The taken for the CSO to be observed, till it appears at the horizon on the next day

$$TOC_1 = t_{start} - [C/d]_x [XEB/60]$$

- ❖ The time taken for the CSO to set at the horizon and appear on the horizon on the next day.

$$TOC_2 = TOA + [C/d]_x [XEC/60]$$

### DISCUSSION

All calculation of this research activity is relative to location of observer according to terrestrial coordinate system

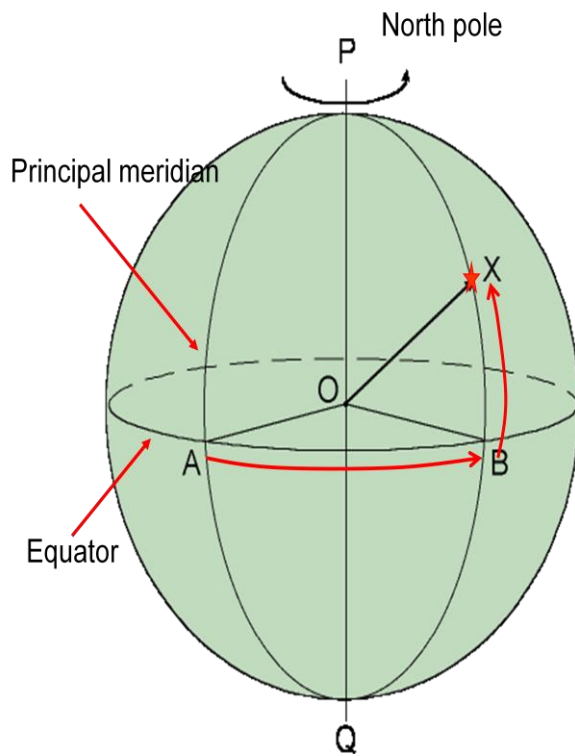


Fig No: 02 Terrestrial coordinate system

1. Any semi great circle terminate by P and Q is a meridian  
2. Latitude is measured from equator  
3. Longitude is measured from principal meridian  
4. The longitude line passing through Greenwich is called the Principal meridian

For the highest accurate result, maximum measurement has to be taken for the each every calculation & You can apply this calculation on any celestial Sphere's objects that are going to riseing [east to zenith]  $t_1 < t_2 < t_3 < t_4$ ,  $X_1 < X_2 < X_3 < X_4$  or setting [zenith to west]  $t_1 < t_2 < t_3 < t_4$ ,  $X_1 > X_2 > X_3 > X_4$ .

### Apparent Magnitude

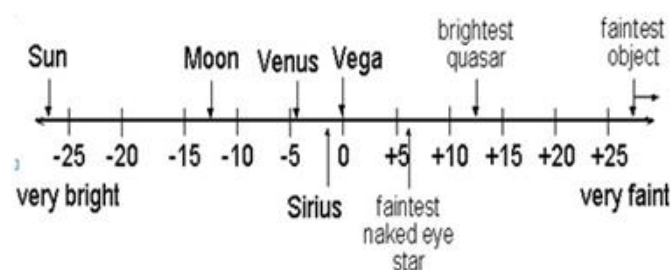


Fig No: 03: Apparent brightnesses of objects in the magnitude system

The apparent brightness of a star observed from the Earth is called the **apparent magnitude**. The apparent magnitude is a measure of the star's flux received by us. Here are some example apparent magnitudes: Sun = -26.7, Moon = -12.6, Venus = -4.4, Sirius = -1.4, Vega = 0.00, faintest naked eye star = +6.5, brightest quasar = +12.8, faintest object = +30 to +31

### Simply use hand measurement of angular deviation

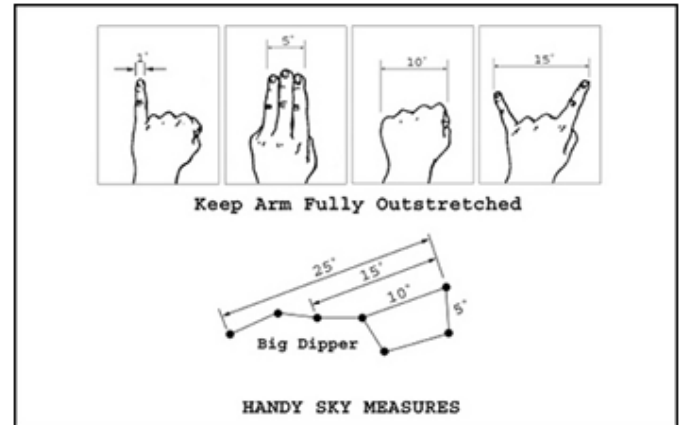


Fig No: 04: Handy Sky measures

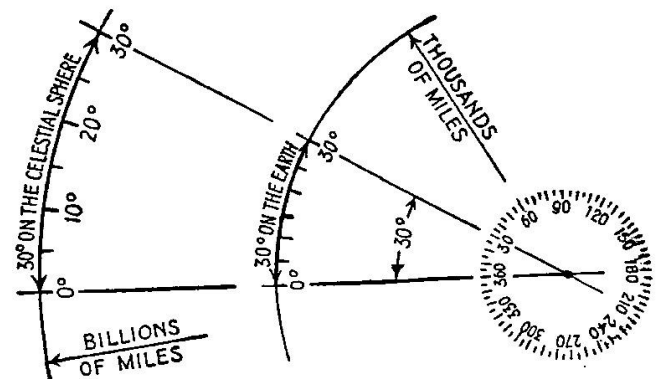


Fig No: 05: An angle measured by degrees of arc

### Error of Atmospheric refraction

Atmospheric refraction is the deviation of light or other electromagnetic wave from a straight line as it passes through the atmosphere due to the variation in air density as a function of altitude. This refraction is due to the velocity of light through air decreasing (the index of refraction increases) with increased density. Atmospheric refraction near the ground produces mirages and can make distant objects appear to shimmer or ripple, elevated or lowered, stretched or shortened with no mirage involved. The term also applies to the refraction of sound.

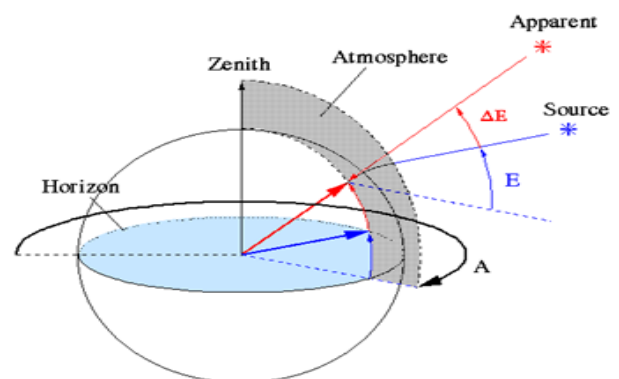


Fig No: 06: Error of Atmospheric refraction

### Calculating refraction

Bennett (1982) developed a simple empirical formula for calculating refraction from the apparent altitude, using the algorithm of Garfinkel (1967) as the reference; if  $h_a$  is the apparent altitude in degrees, refraction  $R$  in arc minutes is given by

$$R = \cot \left( h_a + \frac{7.31}{h_a + 4.4} \right) ;$$

The formula is accurate to within 0.07' for the altitude range 0°–90° (Meeus 1991, 102). Sæmundsson (1986) developed a formula for determining refraction from true altitude; if  $h$  is the true altitude in degrees, refraction  $R$  in arc minutes is given by

$$R = 1.02 \cot \left( h + \frac{10.3}{h + 5.11} \right) ;$$

The formula is consistent with Bennett's to within 0.1'. Both formulas assume an atmospheric pressure of 101.0 kPa and a temperature of 10 °C; for different pressure  $P$  and temperature  $T$ , refraction calculated from these formulas is multiplied by

$$\frac{P}{101} \frac{283}{273 + T}$$

(Meeus 1991, 103). Refraction increases approximately 1% for every 0.9 kPa increase in pressure, and decreases approximately 1% for every 0.9 kPa decreases in pressure. Similarly, refraction increases approximately 1% for every 3 °C decrease in temperature, and decreases approximately 1% for every 3 °C increase in temperature.

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