Astronomy Exercise 1

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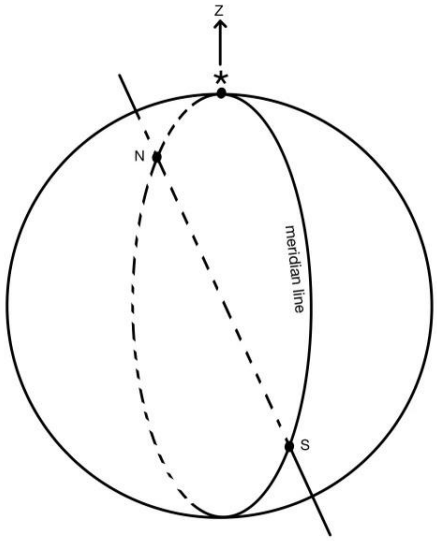
October 2023

1. Coordinate system

a) Define **zenith**, **nadir**, the **celestial north** and **south poles**, and the **meridian line**. Draw the meridian plane of an observer, including the position of the observer (*), the zenith (Z), the meridian line, and the north (N) and south (S) poles.

- **zenith**: Point which is directly over the observer on a celestial sphere
- **nadir**: Point which is directly under the observer on a celestial sphere
- **celestial north pole**: Northern point of the Earth's rotation axis
- **celestial south pole**: Southern point of the Earth's rotation axis
- **meridian line**: Great circle that passes through the celestial poles



b) An observer located in the Earth's Northern Hemisphere observers the top

and bottom culminations of circumpolar star. Measuring $h_i = 20^\circ\ 22'\ 32.4''$; $A_i = 180^\circ$ for the hight and Azimuth of the bottom culmination and $h_s = 50^\circ\ 23'\ 08.2''$; $A_s = 180^\circ$ for the upper culmination. What is the observer's latitude ϕ?

First of all we convert the measured hights:

$$\begin{aligned}
h_i &= 20^\circ\ 22'\ 32.4'' \\
&= 20^\circ + \frac{22^\circ}{60} + \frac{32.4^\circ}{3600} \\
&\approx 20^\circ + 0.36666667^\circ + 0.009^\circ \\
&= 20.37566667^\circ \\
h_s &= 50^\circ\ 23'\ 08.2'' \\
&= 50^\circ + \frac{23^\circ}{60} + \frac{08.2^\circ}{3600} \\
&\approx 50^\circ + 0.38333333^\circ + 0.00227778^\circ \\
&= 50.3856111^\circ
\end{aligned}$$

c) Determine the maximum height in the sky that the globular cluster ωCen (declination $\delta = -47^\circ\ 29'$) reaches when observed from the Inter-American Observatory of Cerro Tololo, Chile (latitude $\phi = -30^\circ\ 10'\ 20.9''$)