

Exercises accompanying lecture 2: coordinates & time

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1 Location and Observability

Your favorite star is η Carinae, a very high mass star that is in a late stage of its evolution, and may be the next observable Supernova in our galaxy. You can hardly wait to check out its Wikipedia entry! Its coordinates (equatorial system, equinox 2000.0) are:

$$\alpha = 10^{\text{h}}45^{\text{m}}03.591^{\text{s}}$$

$$\delta = -59^{\circ}41'04.26''$$

- 1) During what time of year (\sim season) can this object be observed from Königstuhl Observatory (Heidelberg, Germany, geographical coordinates: $49^{\circ}24'02''$ N, $08^{\circ}43'41''$ E)?
- 2) We want to observe this source from La Silla Observatory (Chile, geographical coordinates: $29^{\circ}15'15''$ S, $70^{\circ}44'22''$ W) but we haven't figured out whether to go in February or in August. Which of these would be best? Hint: calculate the approximate LST for the beginning and end of the night on each date, respectively, using the attached observer's calendars, in the middle of both months (i.e. on the 15th). Let us define the beginning and end of a night as the moment of "astronomical twilight" (this is the time when the sun is 18° below the horizon, which is the working definition of "completely dark").

- 3) Say, at some night, we want to observe η Car three hours before the source culminates (i.e. reaches its highest point in the sky). In what direction with respect to the ground (i.e. azimuth A and elevation h , where $h = 1 - z$ and z is the zenith distance), should we point our telescope? Use the nautical triangle and the trigonometric relationships (slide 16-18).

2 Time

- 4) In which coordinate system will the conversion formula of JD to HJD have the simplest form? How does the conversion formula read?
- 5) (Qualitatively) draw an analemmic curve as it would be obtained by taking a photograph every morning at the same time, from a location in the Southern hemisphere (e.g. South America).