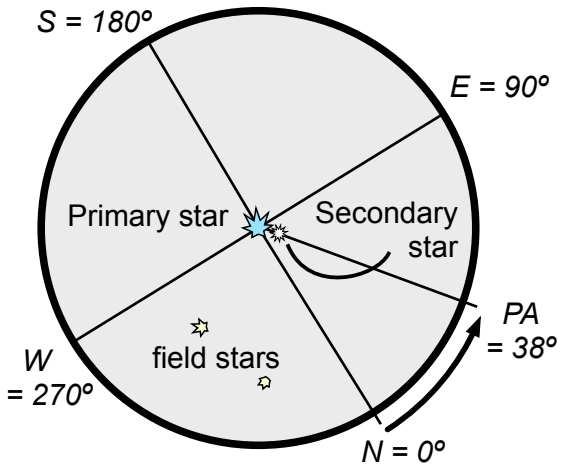
Observing Double Stars

An estimated 50% – 85% of stars are members of a binary or a multiple star system. For a few of these, their stellar components can be separated - or "split" – using a small telescope.



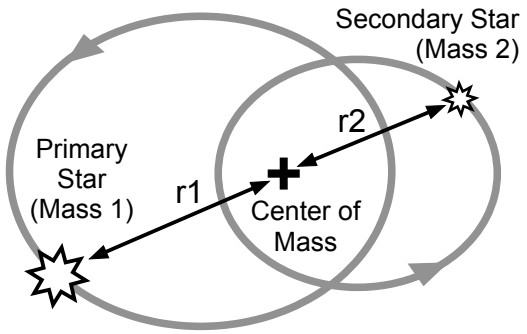
Telescopic View

Factors to consider when observing:

• **The magnitude of each component.** If the magnitude difference is large, the components need to be widely separated to be seen.
• **Their angular separation, r.** Very close binaries are separated by a few seconds of arc and require high magnification and good seeing. Widely separated binaries can be over 1 minute of arc apart and many of these can be split in binoculars.
• **The position angle, PA:** The angle in degrees from North made by the Secondary relative to the Primary in the N-E-S-W direction.
• **The color of each component.** Many are white, while others are red, blue, and yellow.

Precisely estimating these factors is very difficult when done visually. Measuring the star system on images is much more reliable.

Optical Double: A chance alignment of stars appearing near each other, but they are actually no where near each other in three dimensional space.
Visual Binary: Gravitationally bound stars, each seen orbiting their center of gravity.
Spectroscopic Binary: Two stars that can not be seen visually, but the spectrum of the system indicates that it consists of two stars orbiting very closely to each other.



M1 x r1 = M2 x r2
r = r1 + r2

Face on View

**Tilted,
nearly Edge on View**

Tilted & Rotated View

Orbital Orientation:

Because binary stars orbit their center of mass (COM) in elliptical orbits, they constantly change the distance between them (r). It takes years to notice a significant change in separation, though.

The COM is at the focus that they share. The primary (brighter) star lies on one side of that focus and the secondary (dimmer) star always lies on the opposite side.

If tracked for what often turns out to be many tens or even hundreds of years, their orbits can be determined. Our viewing angle from Earth distorts the true orbital ellipses into a tilted and rotated representation.

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