

Why Observe Double Stars?

- ▣ Observing double stars will improve your observing skills.
- ▣ You will learn how to discern position angle.
- ▣ You will learn more about these fascinating objects.

Facts about Double Stars

- In observational astronomy, a double star is a pair of stars that appear close to each other in the sky as seen from Earth when viewed through an optical telescope. This can happen either because the pair forms a binary star, i.e. a binary system of stars in mutual orbit, gravitationally bound to each other, or because it is an *optical double*, a chance alignment of two stars in the sky that lie at different distances.
- Binary stars are important to stellar astronomers as knowledge of their motions allows direct calculation of stellar mass and other stellar parameters.



Facts about Double Stars

- Mizar, in Ursa Major, was observed to be double by Giovanni Battista Riccioli in 1650. The identification of other doubles soon followed: Robert Hooke discovered one of the first double-star systems, Gamma Arietis, in 1664, while the bright southern star Acrux, in the Southern Cross, was discovered to be double by Fontenay in 1685. Since that time, the search has been carried out thoroughly and the entire sky has been examined for double stars down to a limiting apparent magnitude of about 9.0. At least 1 in 18 stars brighter than 9.0 magnitude in the northern half of the sky are known to be double stars visible with a 36-inch telescope



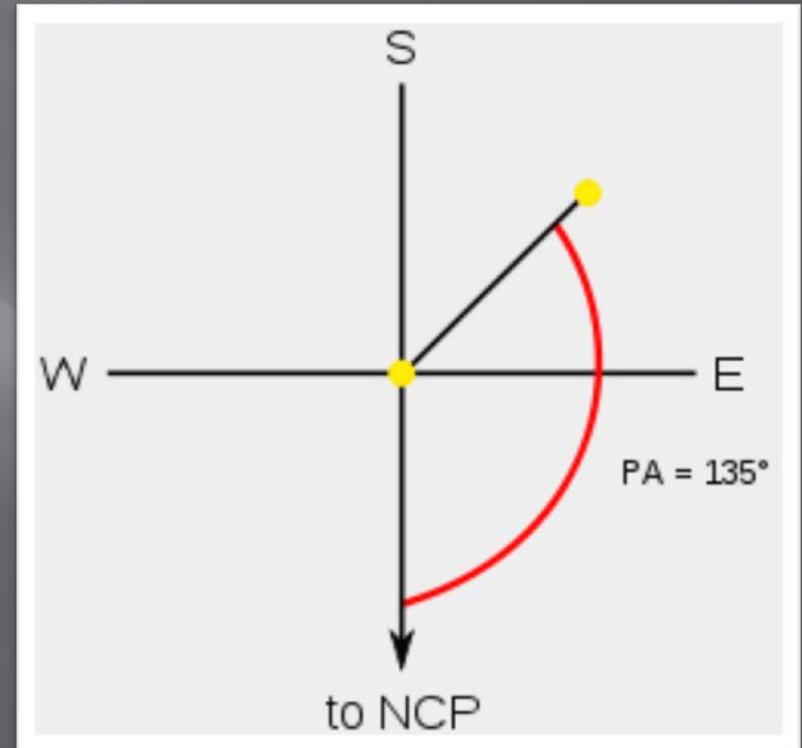
Facts about Double Stars

- Friedrich Georg Wilhelm von Struve's name is best known for his observations of double stars, which he carried on for many years. Although double stars had been studied earlier by William Herschel and John Herschel and Sir James South, Struve outdid any previous efforts. He discovered a very large number of double stars and in 1827 published his double star catalogue *Catalogus novus stellarum duplicium*.
- Since most double stars are true binary stars rather than mere optical doubles (as William Herschel had been the first to discover), they orbit around one another's barycenter and slowly change position over the years. Thus Struve made micrometric measurements of 2714 double stars from 1824 to 1837 and published these in his work *Stellarum duplicium et multiplicium mensurae micrometricae*.



Facts about Double Stars

- Observation of visual double stars by visual measurement will yield the *separation*, or angular distance, between the two component stars in the sky and the *position angle*. The position angle specifies the direction in which the stars are separated and is defined as the bearing from the brighter component to the fainter, where north is 0° . In the measures of a visual binary, the position angle will change progressively and the separation between the two stars will oscillate between maximum and minimum values. Plotting the measures in the plane will produce an ellipse. This is the *apparent orbit*, the projection of the orbit of the two stars onto the celestial sphere; the true orbit can be computed from it. Although it is expected that the majority of catalogued visual doubles are visual binaries, orbits have been computed for only a few thousand of the over 100,000 known visual double stars



AL Double Star Program

- ▣ The purpose of the Double Star Program is to introduce observers to 100 of the finest double and multiple stars in the heavens. You don't need a large, expensive apochromatic refractor to view the objects on this list since a small refractor, Newtonian reflector, or Schmidt-Cassegrain will do just fine. All objects on this list were originally observed with a three-inch refractor using between 75X and 150X. Again, this program is meant to allow you to enjoy a different aspect of our wonderful hobby, and not to test your equipment.



AL Double Star Program

- Double star observing can be very forgiving. You don't need the darkest skies, the clearest skies, or even a moonless night to observe many of these objects. Some can be observed from your backyard under moderate light pollution, some can be observed under less than transparent skies, and some can even be observed with the moon up. However, as usual in astronomy, the best results can be obtained under optimum conditions. The point is, always try for the best conditions, but if you don't have them, don't worry about it. You can still enjoy this program.



AL Double Star Program

- To qualify for the AL's Double Star Certificate and pin, observe the 100 selected objects on the list.
- Any telescope may be used, but one I also encourage you to look at the stars with varying powers as some of these doubles are very close and require substantial power to get a clean separation of the stars. (Gamma Virginis, for instance, is currently separated by under an arc second and is expected to close to around 0.3 arc seconds around 2007. It may require more power and not everyone will be able to split it. Just do the best you can and report what you see.)



AL Double Star Program

- To record your observations, you should include: object, date, time, power, seeing, instrument, and a drawing of the double or multiple system.
- Yes, I said a drawing of the double star. Now, before you panic, how hard is it to draw two dots in the box provided, with the size of the dot indicating magnitude, and the distance between the dots representing separation?
- **Please show North and either East or West in your drawing.** A part of this exercise is to teach celestial directions so the position angles of the stars will be judged by your denotation of the directions. I have given you a line for a description, but this is optional and not required. I have included this so that if you are inspired by any one double star, you can write your thoughts or feelings down for later reference.

