

# Double and Multiple Stars

Double and multiple stellar systems present many striking colour and magnitude contrasts, and many amateurs derive a great deal of satisfaction from merely seeking out and examining different systems. However, close binaries are excellent objects for testing both a telescope's resolution and an observer's acuity of eyesight, so this aspect also presents a considerable challenge.

Generally resolution is dependent upon the aperture of the equipment being used, but refractors usually resolve closer pairs than reflectors of the same aperture. (Under certain specific circumstances the optical characteristics of the reflector may make the resolution of a particular double system slightly easier, but this is rare.) Some interesting systems are listed in the table, with a note on some which are suitable for telescopic resolution tests. Many more objects are listed in some of the works given in the bibliography.

For the purposes of resolution tests, apparent doubles – i.e. those where the stars merely happen to lie on the same line of sight, and where the separation remains constant apart from any proper motion – are better objects than the true binaries, where the stars are in orbit about one another. Strictly speaking, both individuals in a binary system orbit their common centre of mass, but it is usual to regard one – usually the brighter and more massive – as being stationary and orbited by its companion. (Similar considerations apply, of course, to multiple systems.)

The study of true binaries is rather neglected by both amateur and professional astronomers, but it remains very worthwhile, partly because of this neglect. Very frequently the separations of the components of binaries and multiples are quite inaccurately quoted in textbooks, largely because

many years have elapsed since the last measurements were made. The orbital motion of the stars may have converted 'easy' systems into very difficult objects, and vice versa. Even a single measurement is therefore of interest, but a series on a single object, perhaps continued over years, is of great value. If a proper orbit can be defined the orbital period and also the relative masses of the components can be found.

Generally refractors are favoured for this work, with large aperture and long focal length being great advantages. Although professional astronomers may employ very sophisticated techniques, such as photography and speckle interferometry as described on page 232–4, amateurs use one of the many forms of visual micrometer, the bifilar type being one of the best and perhaps the most readily understood and used. The measurements required are those of position angle (PA) and separation. Because of the problems encountered, most especially with close binaries and those with very unequal magnitude components, it is usual for a set of PA and separation estimates to be made at any one time, the most probable values being then derived mathematically. From these the apparent orbits may be plotted, either by continuing a series of observations over a period of years, or by combining modern measurements with those of earlier observers. The calculations required for deriving the full orbital elements and relative masses of the components are fairly complex, and are usually only applied to observations of a sufficiently high accuracy. However such studies are of great importance in the investigation of stellar characteristics and there are indications that this is now being recognized, and that more amateurs are turning to the measurement of double and multiple stars as a primary interest.

Right and centre right:

*Measurement of position angle is always made from north through east (anti-clockwise in most normal telescopes).*

*Separation is the angle between the two components of the double.*

Far right:

*A number of measurements made over a period of years – in some cases over many decades – can show the relative orbit of the secondary star and reveal the position of perihelion (p).*



Opposite:

*Double stars are conventionally shown on charts by a bar through the centre of the star. Some well known examples are shown on this chart.*

*By a strange chance, Gemini (the Twins) contains many double stars, including the brightest stars Castor (top) and Pollux (left).*