

Chapter 3

The program star: δ -Scorpii

3.1 INTRODUCTION

δ -Scorpii (HD143275, HR5953, 7Sco) is among the brightest stars in the sky with a magnitude of $v = 2.3$ and it has been considered to be a typical B0.3IV star. The star was first classified as a Be star when it was discovered to show an emission profile on the wings of an absorption core of a spectrum taken in 1990 (Cote and van Kerkwijk, 1993). Prior to 1990, the spectra were reported to have no evidence of emission lines (Heasley, 1983) and thus, it was considered as a normal B type star (Settlebak, 1985).

3.2 THE MULTIPLICITY OF δ -SCORPII

Through observations using speckle interferometric techniques, δ -Scorpii (hereafter δ -Sco) is known as a binary system with a highly eccentric orbit with a period of about 10.6 years (Bedding, 1993; Hartkopf et al., 1996). This star has been known as a binary system from as early as 1901, following observations by Innes during a lunar occultation. van Hoof et al. (1963) and Levato et al. (1987) have published evidence that δ -Sco is a single-lined spectroscopic binary with a period of about a month and an amplitude of ~ 7 km/s but the separation of such a binary cannot be resolved with a 4 m telescope; thus, the detection of the secondary was not expected with optical interferometric observation (Bedding, 1993).

The more distant companion of the δ -Sco system was detected via a speckle interferometry technique with a separation of $0''.18$ (Labeyrie et al., 1974). Recent work on the binarity of the star discovered that the mass of the primary is $12.4 \pm 0.8 M_{\odot}$ (Tycner et al., 2011) and the mass for the secondary star was adopted from Tango et al. (2009) at $8 M_{\odot}$ with a spectral type of B2.

3.3 THE PERIASTRON PASSAGE OF δ -SCO

The star has gone through several episodes of periastron passage, i.e., in 1990 and 2000. The last periastron passage was observed between July 2000 and March 2001 (Miroshnichenko et al., 2001). The orbital period for the last periastron has been measured to be 10.817 years (Tycner et al., 2011) with high eccentricity of 0.94 (Tango et al., 2009). This high eccentricity creates a moment of a periastron passage where both stars are at their smallest separation. The binary orbit of the δ -Sco system for the 2000 periastron is shown in Figure 3.1.

The study of this star in the near infrared and optical regions during the last periastron passage identified the appearance of emission lines, at the lines reported as pure absorption lines as late as April 1998, which coincided with the close periastron passage (Miroshnichenko et al., 2001; Banerjee et al., 2001). Following recent work, the expectation was that the stars were separated by 6.14 ± 0.07 mas (milliarcsecond) or 14 stellar radii during the 2011 periastron (Tycner et al., 2011).

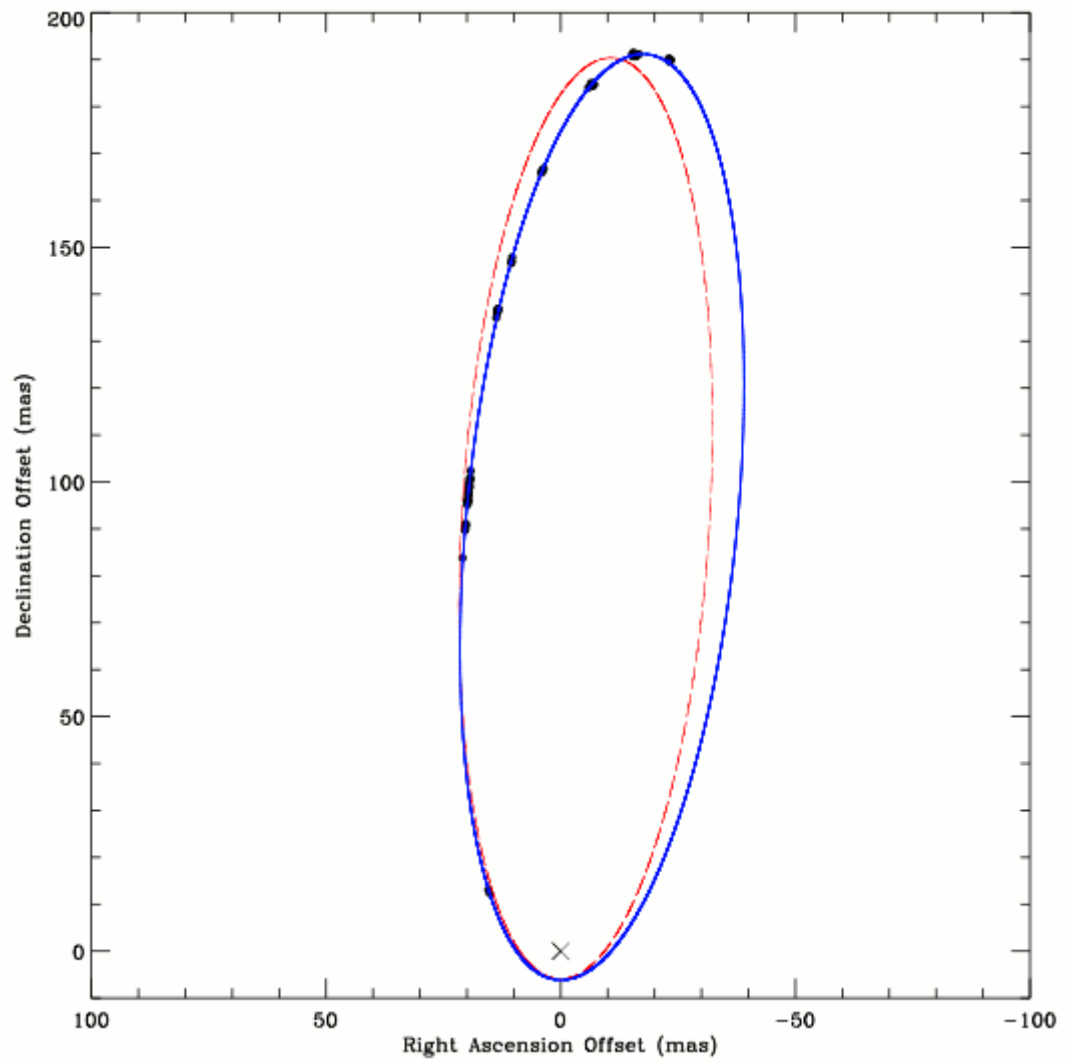


Figure 3.1 – Binary orbit of δ -Sco system for periastron in 2000. The solid line represents work by Tycner (2011), whereas the dashed line is based on Tango et al. (2009). The primary location is marked with an X. (Tycner, 2011).