# CHAPTER 1

# Introduction

The points of light in the night-time sky, that we call stars, can be divided into two categories. There are the truly single stars, like the Sun, and also pairs of stars. The pairs of stars consist of two components moving in bound orbits about their common centre of mass. They are called binary stars and there are about 50% of all stars in the sky. The binary systems is important because of the information they can provide from their motions. The motion of binary system include orbital and rotational components, which can be detected through the variation in their spectral line. Mass ratio and gravitational interaction between stars can be determined directly from their motion. Astronomer distinguish the binary stars into many types depend on the physical characteristic of the components of stars which RS Canum Venaticorum variable is one of them.

The RS CVn type binaries represent a class of close detach active binaries that rotate synchronously due to tidal forces. These systems consist of a massive primary component (mostly G-K) and a secondary subgiant or dwarf (G-M) star. They show optical variability which is characterized by a large amplitude and interpreted as rotational modulated effect of cool spots on their surfaces. Because of low luminosity of the secondary component, it frequently cannot be observed. The primary component as brighter and more active than the secondary and they appear as a single-line binary.



EI Eri (HD 26337, HIP 19431 or SAO 130994) is a chromospherically active G5 IV single-lined spectroscopic binary with a period of 1.94722 days in a position α = $04^h$ $09^m$ $40^s$ and δ = -07°53’34”. It was identified as RS CVn-type, owing to fact that it is a close binary star with active chromosphere due to the rotationally modulated effect of cool spots on their surfaces.

The strong Ca II H and K emission of EI Eridani with V≈7.0 mag, spectral type

G5 IV and having active Ca II H & K emission has been first detected by Bidelman and MacConnell (1973)[1]. In 1982 Fekel [3] confirmed this result and reported rotationally broadened absorption feature indicating a $v \sin(i)$ = 40-50 km/s and discovered its light variability and consequently to classify the star as a RS CVn binary by Fekel et al. (1982) [3]. In 1986 Fekel[4] computed an orbit for this single-lined spectroscopic binary and report that their new spectroscopic data are fitted with an orbital period of 1.9472 days, while Hall et al. (1987)[8] found a rotation period of 1.945 days from UBV photometry and conclude that the G5 IV component in HD 26337 rotates synchronously.

Strassmeier[16] reported seasonal changes of the photometric period of 0.043 days within three seasons in 1989. Rodono & Cutispoto (1992)[12] suggested a possible cycle period of about 10 years. Strassmeier et al. (1997)[14] summarized the first 16 years of photometric data and found a possible 11±1 years cycle of the mean brightness while Olah & Strassmeier[10] refined this to be 12.2 years in 2002. Recent observation in a new radial velocity to improve the orbital solution and reveal a long-term variations of the Barycentric velocity were presented by Washuettl et al. (2008)[18].

The goal of this research is to study and analyze the binary system including to present a new result of a new spectroscopic study of RS CVn-type binary EI Eridani (HD 26337) with Least-Squares Deconvolution technique. The high resolution echelle-spectra of EI Eridani were acquired during October 2004 to February 2006 with HERCULES echelle-spectrograph of the 1-m telescope at Mt John University observatory, New Zealand by Dr. Siramas Komonjinda.