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Physical properties of the oEA star IV Cas

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Abstract

We present photometric and spectroscopic observing results of the oEA star IV Cas. Spectral types of the binary system are derived to be A3 ($T_{\rm eff}$ = 8500 K) for the primary component and G9 ($T_{\rm eff}$ = 5370 K) for the secondary. We detected two δ Scuti-type pulsation frequencies of f_1 = 32.6894 c/d (cycles per day) and f_2 = 36.6714 c/d, for the primary component.

Introduction

Mkrtichian et al. (2004) introduced the oEA (oscillating EA) stars as the (B)A-F spectral type mass-accreting main-sequence pulsating stars in semi-detached Algol-type eclipsing binary systems. The oEA stars are very interesting objects to show pulsations, eclipses and mass accretion. Furthermore, they are important from an asteroseismological point of view because we can get information of their pulsation modes through spatial filtration during the primary eclipse.

We had discovered δ Scuti-type pulsations of the semi-detached Algol-type eclipsing binary IV Cas and had classified it as a member of the oEA stars (Kim et al. 2005). In order to investigate its physical properties in detail, we carried out photometric and spectroscopic observations.

Results

We have obtained a high-resolution spectrum on 30th November 2005, using a high-resolution echelle spectrograph attached to the 1.8m telescope at Bohyunsan Optical Astronomy Observatory in Korea. The echelle spectrograph has a resolution of 1.5 Å/mm at 5000 Å. Fitting the observed spectrum with a synthetic one by the SPECTRUM code (Gray & Corbally 1994) gave us atmospheric parameters such as $T_{\rm eff}$ = 8500 K, log g = 4.0 and $v \sin i$ = 110 km/s for the primary component in the binary system. No emission features could be found in the spectral lines between 3500 Å and 9000 Å.

Photometric observations were performed in 17 nights between November 2004 and September 2006, at the dual sites of Sobaeksan Optical Astronomy Observatory (0.6 m telescope) in Korea and Mt. Lemmon Optical Astronomy Observatory (1.0 m telescope) in Arizona, USA. Figure 1 shows B and V phase diagrams of IV Cas. For the light curve analysis, we applied the latest version of the Wilson-Devinney code (Wilson & Devinney 1971) and obtained the mass ratio q = 0.404, orbital inclination i = 87.1° and effective temperature of the secondary component $T_{\rm eff}$ = 5370 K. An effective temperature for the primary component $T_{\rm eff}$ = 8500 K was assumed from the spectroscopic results.

We detected two δ Scuti-type pulsation frequencies of f_1 = 32.6894 c/d and f_2 = 36.6714 c/d from the multiple frequency analysis of the residuals which were calculated by subtracting the synthetic eclipsing light curve (solid lines in Fig. 1) from the data.

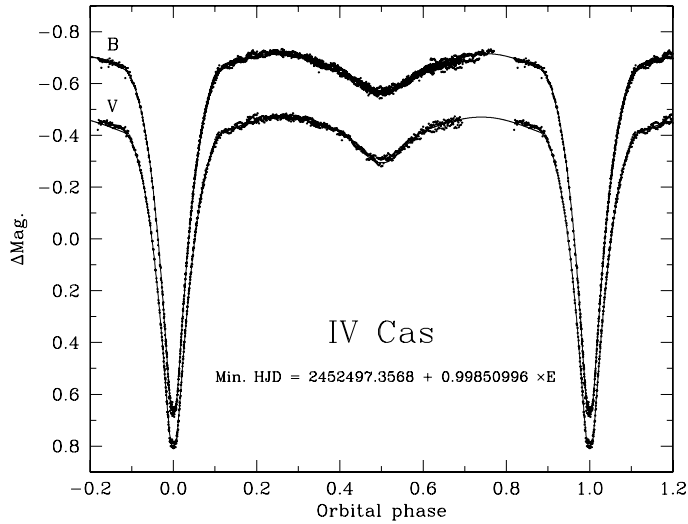

Figure 1: Phase diagram of IV Cas

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