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AC HER FROM 1988 TO 1990

abstract

Visual photometry by GEOS observers of AC Her for three years are presented. The purpose of this study is to monitor the light curve and to control the period.

Introduction

RV Tauri stars comprise a small but interesting class of pulsating semiregular variables.

Membership in this class is defined by satisfaction of the following criteria:

- 1 - light curves with alternating deep and shallow minima
- 2 - periods of 30-150 days between successive deep minima
- 3 - spectral types of F,G or K, barring peculiarities at certain phases

The stars appear very luminous and occur both in the general field and in a few globular clusters; to date none have been found in open clusters.

The RV Tauri class is not homogeneous. Its members display a plethora of spectral and photometric peculiarities. Among the former are a discontinuous variation of radial velocity with phase, periodic doubling of low-excitation absorption lines of metals, Balmer emission during rising light and the superposition of band of titanium oxide with an otherwise normal G or K spectrum around minimum light.

The photometric peculiarities include long-term variations (time scale of months or years) in the level of mean light and simultaneous infrared and ultraviolet excesses.

Characteristics

AC Herculis is a bright and well know RV Tauri variable star, located at

$$\alpha=18^{\text{h}} 30^{\text{m}} 16^{\text{s}}, 1 \quad \delta=21^{\circ} 52' 01'' \quad (2000, 0)$$

The GCVS gives the following data:

Max at j.d. 2435097.8+75.01E

range between magnitude 6.85 and 9.0

spectra are respectly F2p-Ib and K4-E

AC Her is a "Carbon Star". The C is present in atomic (CI and CII) and molecular forms (CH, CN), above all in the circumstellar structure.

The high dusts presence in the stellar envelope is a reason of strong infrared excess, higher than an usual F-K star.

The presence of CH and CN in the atmosphere of AC Her causes the radiation's absorption at the more high frequencies, that appear so reddened.

CH and CN have a strong opacity, which at the temperature of 500° K, shell's temperature, condense in grains of dust, as far as 25 solar radii distance.

After the max, appear strong lines of H in absorption, and the G-band of CH is present with an unusual intensity for a F star.

All the lines at $\lambda < 4000$ Angstrom are weak, while the CN band after the minimum is intense, as the Ca at $\lambda = 4226$ A.

The brightness, as a function of time, for the RV Tauri is expressed by the formula

$$M = A_p \sin(2\pi T/P) + A_s \sin(4\pi T/P + \phi) \quad (1)$$

where A_p and A_s are respectively the amplitude of peaks for the two fundamental periods, obtained after the power spectrum analysis.

The theoretical light curve is expressed by a sinusoidal law, with deep and shallow minima.

The absolute magnitude for the RV Tauri is expressed by the formula

$$\langle M_v \rangle = -5.3 + 0.021P^d \quad (2)$$

The period P is expressed in days.

For AC Her the (2) gives a value equal to -3.5 .

The Data

I've collected the AC Her visuals observations of many GEOS members, obtaining a good light curve cover for all the three years, from 1988 to 1990.

The observations (points) are fitted with the OAHF (continued line) developed by Gaspani.

Using the Melsp (developed by Gaspani) on the light curve assembled for all the three seasons, I've obtained the fundamental period at 76.92 days ($\nu = 0.013$) and the semiperiod at 37.73 days ($\nu = 0.0265$).

The derived period is longer than the given in GCVS, as we can deduct watching the O-C diagram (expressed in days).

Conclusion

The light curve of AC Her is sinusoidal and regular, total absence of strange behaviour; but the period is linearly and continuously increasing.

A new monitoring is necessary in the future to determine the O-C behaviour.

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bibliography

- 1 - Dawson-Astroph. J. Supp. Series 41
- 2 - DuPuy-Astroph. J. 185
- 3 - Gehrz-Astroph. J. 178
- 4 - Gehrz and Woolf-Astroph. J. 161 L213/217

list of observations

for the 1988 I've collected the observations of:

- 1 - DDL 57 estimates
- 2 - BGN 54 estimates
- 3 - VBR 51 estimates
- 4 - CHC 45 estimates
- 5 - CBO 4 estimates

for the 1989 I've collected the observations of:

- 1 - CHC 78 estimates
- 2 - BGN 47 estimates
- 3 - DDL 20 estimates

for the 1990 I've collected the observations of:

- 1 - DDL 102 estimates
- 2 - CHC 75 estimates
- 3 - CBO 47 estimates
- 4 - BGN 14 estimates







