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PERIOD CHANGES IN AC HERCULIS

AC Herculis is a well-known RV Tauri star. Its period is 75.01 days according to the 4th edition of the GCVS, while in the 3rd edition it was 75.4619 days. O-C diagrams were published by Zakharov (1953) and Erleksova (1971), both showing period changes. Neither of these diagrams used all of the available minimum observations, so it was considered worthwhile to have another look at the period variations.

In addition to the times of primary minima found in the literature, published photoelectric observations were also examined, and, whenever possible, the times of minima were estimated from them. Because there are few photoelectric observations in the 80's, the observations of the French (AFOEV) and Hungarian (Pleione) amateurs were also used for minimum determination. The O-C values were calculated using the elements

$$\text{Min.} = 2410010.24 + 75^{d}.4255 \cdot E \ .$$

This formula was received by changing the period and epoch until a least-squares solution gave a satisfactory approximation of the O-C=0 line. The resulting O-C diagram is plotted in Figure 1. The references for the minima, for photoelectric observations and for amateur observations are below the Figure 1.

The O-C diagram of AC Herculis is very interesting. It clearly shows a wave, with a period of 9323.3 days. This period is in reasonable agreement with the value of 9400 days mentioned in the GCVS (3rd ed.). A wave is also

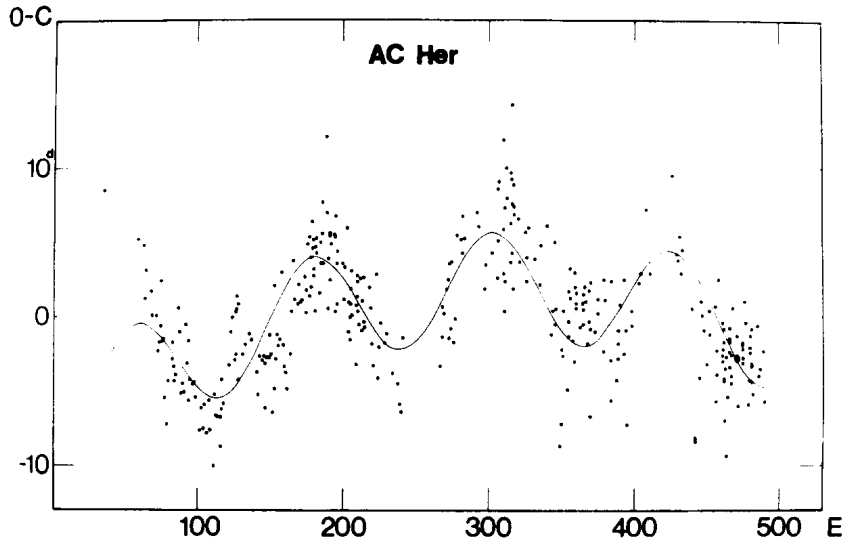

Figure 1: The O-C diagram of AC Herculis. References: AFOEV (1985-87), Beyer (1930), Blasberg (1972), Cardelli (1985), Colacevich and Masani (1941), Dawson (1979), Domke and Pohl (1953), DuPuy (1973), Dziewulski and Brzeska (1958), Eggen (1961,1986), Erleksova (1971), Erleksova et al. (1986), Hagedorn (1950), Huth (1964), Lause (1930,1931,1933,1934), Leiner (1924), Loreta (1941,1942), Magalashvili and Kumsishvili (1972), Matzek (1977), Mizser and Szánthó (1988), Model (1942,1964), Nakagiri and Yamashita (1979), Parenago (1938), Pettit (1948), Preston et al. (1963), Rosino (1951), Santangelo (1987), Satanova (1958), Szafraniec (1961), Tsessevich (1952), Waterfield (1927), Zakharov (1928,1953).

present in the diagram of Zakharov (1953), though his period is much shorter. Erleksova (1971) used straight lines to fit the diagram.

Removing this wave, there are two possibilities. The residuals may be fitted with either another wave with a period of about 33000 days, or with a parabola. As the difference between the last and first minima is only 34000 days, the second option is the more likely one. This parabola indicates a continuous decrease of the period. Figure 1 shows the fit using the wave and the parabola. The equation of the wave is

$$O-C=0.244+3.690\cdot\sin(0.05096\cdot E+5.015),$$

while the equation of the parabola after removing the wave is

$$O-C=-7.639+6.023\cdot10^{-2}\cdot E-9.658\cdot10^{-5}\cdot E.$$

According to Jura (1986), RV Tauri stars are in the post-red giant phase, evolving to the blue in the HRD. A continuously decreasing period is certainly not in contradiction with this picture. The cause of the wave is, however, rather uncertain. It is clearly not the result of a binary companion (though AC Herculis may have one), because the amplitude of the wave is too large. If the star has two frequencies which are close to each other, that might cause a wave in the O-C diagram. The photoelectric observations, unfortunately, are too few to give some support to this idea.

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E. ZSOLDOS

Konkoly Observatory
Budapest, P.O. Box 67
1525 Hungary

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