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A RECONSIDERATION OF THE ORBITAL PERIOD OF AZ Cas

Ashbrook (1956) found that the cool supergiant AZ Cas was an eclipsing variable with a period of about 9.3 years. From magnitudes estimated on Harvard patrol plates covering the eclipses between 1901 and 1947 he derived the ephemeris :
Min = JD 2432484 + 3406 E.

Larsson-Leander (1959) noted that his photoelectric coverage of the 3rd and 4th contacts during the 1957 eclipse occurred about 6 days earlier than predicted from Ashbrook's ephemeris. In a discussion of the eclipse times Bonnell and Herczeg (1976) have concluded that the period should be revised to 3402^d. However, their ephemeris predicted the 3rd and 4th contact of the 1975 eclipse to occur on 1975 Nov. 17 and 27 ± 1^d, respectively. Florkowski's (1975) photoelectric coverage of the eclipse shows the 4th contact occurred on 1975 Dec. 8, suggesting that P = 3402^d is too short. On the other hand, 1st and 2nd contacts as given by Florkowski (1975 Aug. 2-3) and Tempesti (1975) (1975 Aug. 11) occurred 10 days too early to satisfy Ashbrook's ephemeris. Using all of these data we have derived periods based on comparing times of 1st, 2nd, 3rd and 4th contacts to be 3403 ± 1.2, 3402 ± 1.8, 3406 ± 0.7 and 3405 ± 1.4, respectively. Each figure is derived from between three and five eclipses between 1901 and 1975, but because of incomplete coverage not all the periods are determined from the same eclipses. From all of these data we derive an ephemeris:

$$\text{Min} = \text{JD } 2432481 + 3404 (\pm 1^{\text{d}}) \text{ E.}$$

We note that there is good evidence that in the last two eclipses for which we have observations (1957 and 1975) the duration of the eclipse was longer by ~9 and ~20 days than the mean duration

($\sim 86^d$) of the eclipses observed by Ashbrook. This change in eclipse duration does not extrapolate back through Ashbrook's observations, however. The effect is to make the periods derived from 1st and 2nd contacts shorter than the mean, and similarly those periods determined from 3rd and 4th contacts somewhat longer. The mean value should be unaffected. The increased duration of the minimum may have caused Bonnell and Herczeg to suggest an abrupt period change after the 1947 eclipse.

The same value of the period (3404^d) was also derived by a slightly different method, using the deviations of times of mid-eclipse from the values predicted by Ashbrook's ephemeris. This method is not quite as sensitive since the whole of totality was not usually observed and one must assume something about the eclipse duration, which appears to be variable. Presumably the variation in eclipse duration may be due to a change in radius of the primary star. Spectroscopic data on AZ Cas are discussed in full elsewhere (Cowley, Hutchings, and Popper 1977).

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A.P. COWLEY and J.B. HUTCHINGS
Dominion Astrophysical Observatory
Victoria, Canada

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