

VARIATIONS IN THE PERIOD AND LIGHT-CURVE OF THE SHORT-PERIOD ECLIPSING BINARY VW CEPHEI

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In this paper an analysis of variations in the period and the light-curve of the eclipsing binary VW Cephei has been made, based on more than 13 800 photo-electric observations made from 1957 till 1960. The individual observations have been published in *Bulletin of the Astronomical Institutes of the Netherlands Supplement Series*. It was found that on top of the long-term variation in the period there exists a second and smaller variation in the residuals of the observed minimum times. While the long-term variation has a period of about thirty years and an amplitude in the variation of the observed minimum times of about 0.03 day, the period of the smaller variation is about two years

and its amplitude 0.001 day. It is demonstrated that this second variation is strongly correlated with variations in the light-curve, in particular with the differences in brightness between the two maxima. The conclusion is therefore reached that the smaller variations in the observed minimum times originated from distortions of the light-curve rather than from dynamical causes. Finally, in an attempt to explain these distortions in the light-curve, a model is discussed in which a ring-like envelope with variable density surrounds the eclipsing system, giving rise to more or less absorption at certain phases.

1. Introduction

In an investigation on period variations of a number of short-period eclipsing binaries (KWEE, 1958), there appeared some indications that on top of the large-scale variations in the period, which are quite common for this kind of variables, period fluctuations over relatively short time intervals exist. Because of the small number of accurate epochs for each of these variables, however, the existence of these phenomena could only be demonstrated by a comparison between the internal deviations of the observed epochs and their expected standard errors. In order to investigate these period fluctuations more closely, an elaborate programme was set up to study one of these variables extensively during a long interval of time. The system VW Cephei has been chosen because of its brightness, its favourable position and its short period. With a declination of about $+75^\circ$ the star never sets for the Leiden Observatory and even in lower culmination the zenith distance is still only 53° . Its period of about 400 minutes makes it quite possible to observe a complete cycle of the light-variation during one night, except in the summer months when the nights are shorter than seven hours.

After discovery by SCHILT (1926) the variable VW Cephei has been studied by various observers. PRAGER (1934) and SCHNELLER (1957) have accumulated extensive lists of references. Variations in the period have been studied over a long interval of time. In a more recent investigation, SCHMIDT and SCHRICK (1955) showed that these variations correspond well with an orbital movement of the eclipsing system around a third body. Furthermore, they noticed variations in the light-curve over relatively short intervals of time.

New photo-electric observations have been made at the Leiden Observatory. They were made through an orange colour filter and covered the period from October 1957 till May 1959. All these observations, amounting to a total of 4949, have been described and listed in a separate paper (KWEE, 1966a). In making these observations much effort has been made to obtain a complete and uninterrupted cycle of the light-variation in one night. At the end we succeeded in getting half a dozen of such completely covered light-curves, each containing 200 or 250 individual observations.

From September till November 1959, an international campaign has been organized on VW Cephei. One of the aims of this campaign was to investigate rapid variations in the light-curve. In total 8454 photo-