THE SECONDARY PERIOD OF TU COMAE BERENICES

by

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Abstract

Photographic observations between 1928 and 1975 have been analyzed to derive a secular decrease of period. A secondary period of about 40 days in the times of maxima is reported.

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TU Comae Berenices is an RR Lyrae star ($12^{m}.7$ - $14^{m}.1$) with a published period of 0.46181 days. Research done several years ago at the Astronomical Observatory in Cluj, Romania, by Vasile Ureche (1965) showed evidence of light-curve variations with a period of approximately 75 days.

During the summer of 1971, Pamela Bonnell at the Maria Mitchell Observatory reworked the variable because it had shown some divergence from its published period. Combining 102 photographic plates taken at the Maria Mitchell Observatory from May, 1964, to June, 1971, with 349 of Ureche's observations from May, 1959, to June, 1963, led to a final period of 0.46182 days, a difference of $0^{d}.00096$ from the then published period of 0.46086 days. However, due to the large dispersion of the data, variations of the amplitude and shape of the light curve were not apparent (Bonnell 1971).

This summer, at the Maria Mitchell Observatory, I again worked on TU Comae, concentrating my efforts on the changing period of the star. In addition to the observations mentioned, 52 plates taken from May, 1972, through June, 1975, at the Maria Mitchell Observatory were used to update the previous observations; and 76 observations obtained from a publication by Grönstrand (1939) taken from January, 1928, to April, 1938, were also added.

Using the period of 0.4618182 days determined by Bonnell, and plotting the magnitude of each observation against its phase in groups of 1000 Julian Days, I noted a discrepancy for the phase of maximum between the first group of earlier points, and the later groups of points. This discrepancy was corrected by adding a kn^2 term of 1.64×10^{-9} to the phases computed with a primary reciprocal period of 2.165354.

Despite the correction, which brought the maxima into phase with each other, an unusual amount of scatter was still evident. This scatter was apparently produced by the presence of two distinct light curves within each of two groups of points. The two distinct curves seemed to indicate a secondary beat period of approximately 40 days. Another correction was therefore applied for the secondary period phenomenon and this brought the two curves together. A slight change in the primary period to 0.4618523 days gave an excellent reduction of the scatter for the largest set of data points, and a moderate reduction for the other groups of data points.

In summary, the results indicate a secondary period of approximately 40 days, with a shift in the phase of maxima, but no noticeable change in the size or shape of the light curve.

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SOME CHARACTERISTICS OF VARIABLE STARS APPEARING IN INFRARED SKY SURVEYS

by

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ABSTRACT

Variable and suspected variable stars are relatively numerous in infrared sky surveys carried out at wavelengths of 2.2, 4, 11, and 20 microns. Most of these variables are of Mira, semi-regular, and slowly varying irregular types with late (i.e., cool) spectral classes and with giant or supergiant characteristics. Eclipsing variables are represented, but most of them are of long period with ζ Aurigae or VV Cephei characteristics. Orbital data for these and a number of other spectroscopic binaries indicate that they are more massive than the average star. Other variables represent an assortment of the remaining types, and they appear to represent the brightest members of those classes or to be especially peculiar.

It is suggested that the observed infrared variability of Mira stars, typically with amplitudes of 0.5 to 1.0 magnitude and approximately in phase with the visual light curve, results primarily from changes in the temperature of circumstellar dust rings or shells as a consequence of variations in the heating by activity centers in the star's atmosphere not too dissimilar from the sun's plage areas characterized by sunspots, flares, etc. The aspect angle at which we view these presumably rotating stars may also be important, since the activity centers will be nearer their equators than to their poles, and perhaps may be the cause of differences in light curve and spectroscopic characteristics separating certain of the semiregular variables from the Mira stars.

The assistance of the AAVSO provided in the form of preliminary visual light curves for a number of long period variables is acknowledged with appreciation.