

REVISION AND REFINEMENT
OF THE ELEMENTS OF EE COMAE BERENICES

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Abstract

The elements of the RR Lyrae variable EE Comae Berenices are revised.

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The variability of EE Comae Berenices (RRab) was discovered at Lick Observatory in a survey of RR Lyrae stars near the north galactic pole (Kinman et al. 1966). This study included 43 plates taken of EE Com with the 20-inch astrograph in early 1962, as well as three more plates taken two years later. The period was determined with a period-search program using the method of Lafler and Kinman (1965), based on the minimization of scatter in the light curve. The derived elements were:

$$JD_{\max} = 2437736.776 + 0.53956 E.$$

The present paper shows this period to be in error by one cycle in two years, a result of the grouping of the original observations.

In a study of RR Lyrae metallicities conducted 15 years later (Butler et al. 1979), EE Com was again observed from Mt. Hamilton. The elements published by Kinman et al. predicted maximum light one-half cycle off the observed maximum. This difference led to a period revision by the increment of one-half cycle per 15 years. Since the sign of the correction was not apparent, two revised periods were given:

$$P = 0.539586 \text{ day and } P = 0.539533 \text{ day.}$$

In the summer of 1982, the finding chart and sequence star magnitudes of Kinman et al. were used in making estimates of EE Com's brightness on 110 plates taken at Maria Mitchell Observatory since 1972. Attempts at plotting a light curve with these data using the revised elements of Butler et al. were unsuccessful, suggesting that the revision itself was incorrect. While the elements of Kinman et al. were thought to predict a phase of maximum for EE Com that drifted from that observed by only one-half cycle in the 15-year interval between Lick observations, a drift of $\pm 1.5, 2.5, 3.5, \dots$ cycles now seemed more likely.

A mean light curve was traced from the original Lick data (Kinman et al. 1966) and overlaid on light curves made from 11 seasons of Maria Mitchell observations. The estimated phases of maximum for each season were then plotted in an O-C diagram to which a linear fit was made by the method of least squares. The slope and intercept of this line implied new elements of which the period was found to differ in the fourth decimal place from those published.

A different path of inquiry led to the re-use of the Lafler and Kinman period-search program on the original 46 data points published by Kinman et al. While the best light curve fit was found for the period published, the period of 0.53995 day exhibited a very good fit as well. This period predicted the phase observed in the second Lick study through a correction in the old period of -7.5 cycles in the

15-year interval (one cycle in two years). In addition, the period agrees with the period found by the period-search program to best fit all 10 years of data taken at Maria Mitchell Observatory.

Refinement of the period was achieved through repetition of the above procedure; new elements from the O-C diagram were used in plotting light curves which generated new O-C diagrams. The refined elements are:

$$\text{JD}_{\text{max}} = 2441657.384 + 0.5399556 \text{ E.} \\ \pm 0.005 \quad \pm 0.0000008$$

The revision of EE Com's elements affects the determination of its metallicity (Butler *et al.* 1979) by changing the calculated phase at which its two spectra were taken. The periods revised in their study were used to eliminate one of the spectra from metallicity estimates because it was taken near maximum light when spectral features are strongly phase dependent (Preston 1959). The newly revised elements show that both spectra were taken near maximum light and therefore should not have been used in metallicity estimates. Even so, the inclusion of EE Com's overestimated metallicity does not affect the study's primary conclusion: RR Lyrae metallicity is not dependent on distance above the galactic plane.

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