UPDATED PERIODS FOR CG AND GY COMAE BERENICES

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Abstract

Updated linear elements for CG Comae Berenices from 1964 to 1990 are:

$$JD_{max} = 2444056.457 + 0.4683231\ E.$$

A parabolic ephemeris is derived for GY Comae Berenices from 1957 to 1990:

$$JD_{max} = 2444086.364 + 0.53446796\ E + 3.2 \times 10^{-10}\ E^2.$$

1. CG Comae Berenices

CG Com, an RR Lyrae variable of type RRab, was discovered during a sky survey with the Lick 20-inch astrograph in 1966 (Kinman *et al.* 1966). The elements were later refined (Butler *et al.* 1979) to:

$$JD_{max} = 2437370.645 + 0.4683235\ E. \quad (1)$$

In this study, data from more recent epochs are studied for possible period changes.

Magnitudes were estimated from over 200 photographic plates from the Maria Mitchell Observatory (MMO) collection for the years 1964 to 1990. The minimum magnitude of CG Com is approximately 16.9, which is at or below the limit of the plates. The star brightens by nearly two magnitudes in the course of a cycle. Magnitude estimates of the variable were accomplished visually using five comparison stars. Magnitudes for the comparison sequence were obtained using a Cuffey iris photometer, with six stars from the Lick RR2 field for calibration (Kinman *et al.* 1966).

Photographic light curves were plotted against phase in groups of twenty data points, and a mean curve was derived for the entire data set using an MMO procedure which sorts the data into bins according to phase and calculates an average magnitude and average phase for each bin. A non-linear least-squares method was used with the mean curve to calculate the phase shifts for each subset of the data (Belserene 1986).

The resulting O-C diagram, Figure 1, was fit to linear and parabolic functions using least-squares. Both functions are found to satisfy the data, but the line is preferable. The probability that the parabolic term is due to real effects in the data is only 74%, according to the F-test (Pringle 1975). The period has therefore exhibited no significant changes since 1964. The light curve for the data set is illustrated in Figure 2. The parabolic elements are:

$$JD_{max} = \underset{\pm 0.004}{2444056.460} + \underset{\pm 0.0000005}{0.4683230}\ E - \underset{\pm 1.0 \times 10^{-10}}{1.3 \times 10^{-10}}\ E^2. \quad (2)$$

The preferred elements, derived from the linear fit, are:

$$JD_{max} = 2444056.457 \pm 0.003 + 0.4683231 \pm 0.0000005\ E. \quad (3)$$

Both ephemerides are consistent with the data of Butler *et al.* (1979).

2. GY Comae Berenices

GY Com is an RR Lyrae variable discovered by D. Hoffleit at the Maria Mitchell Observatory (1975). The elements were initially determined to be:

$$JD_{max} = 2440377.654 + 0.534476\ E, \quad (4)$$

with some suspicion that the period might be spurious.

Over 300 photographic plates of the Maria Mitchell Observatory collection, which spanned 1964 to 1990, were examined to gather magnitude data. To confirm the previously published results on GY Com, a period search for the years 1964 to 1974 was conducted using a date-compensated discrete Fourier transform (Ferraz-Mello 1981). The method found the elements:

$$JD_{max} = 2438550.882 + 0.534465\ E, \quad (5)$$

thereby confirming that the published elements were not spurious. This new ephemeris was then used to form light curves of magnitude vs. phase, in two-year groups for 1964 to 1990. A mean curve was determined and used to calculate the O-C value for each set of data, as described above for CG Com.

The O-C analysis using least-squares determined the linear elements:

$$JD_{max} = 2444086.372 \pm 0.003 + 0.53446775 \pm 0.00000067\ E. \quad (6)$$

However, a parabolic function gives a better description of the O-C diagram with a probability of about 95%, according to the F-Test (Pringle 1975). This function yields the revised elements of:

$$JD_{max} = 2444086.364 \pm 0.004 + 0.53446796 \pm 0.00000056\ E + 3.2 \times 10^{-10} \pm 1.4 \times 10^{-10}\ E^2. \quad (7)$$

The rate of change of the period is $+0.44 \times 10^{-6}$ day per year. Figure 3 shows the best-fit line and parabola on the O-C diagram. The light curve has scatter which seems to be beyond that normally encountered with this type of data. Further study would be worthwhile to see whether there is more than one period in the data.

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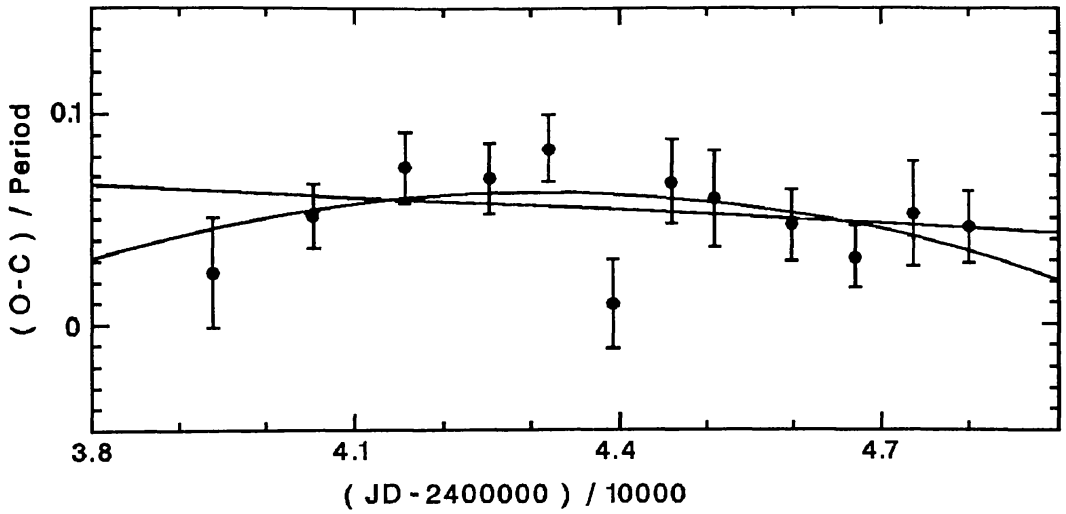

Figure 1. The O-C diagram for CG Com for the years 1964 to 1990, using C as defined by equation (1). Included are the least-squares line and parabola. The parabola is not significantly better than the line.

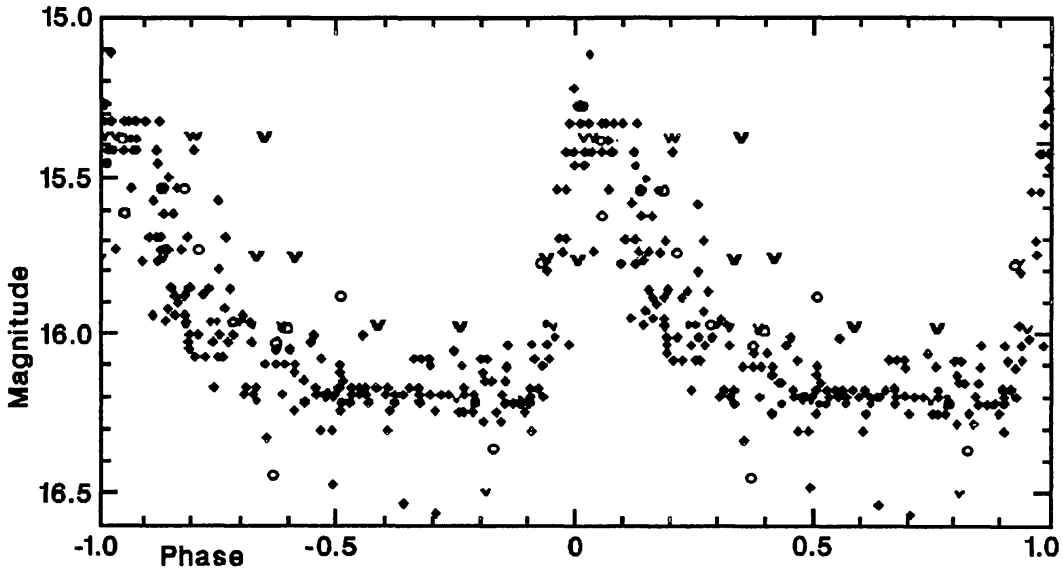

Figure 2. The light curve for CG Com, for the entire data set used in the O-C analysis (1964-1990). Open circles mark uncertain points, and arrows are brighter limits. Elements are those of equation (1).

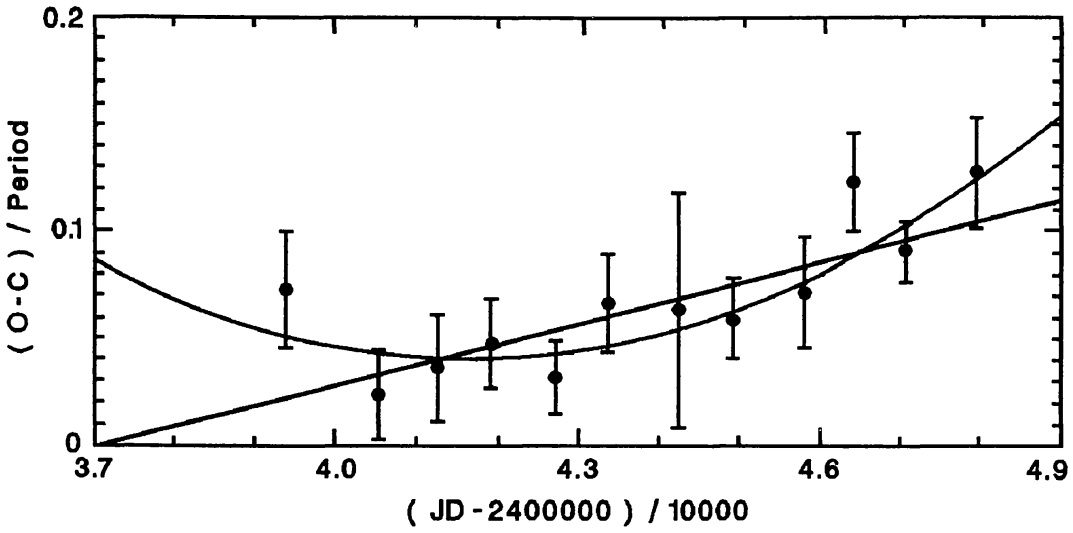

Figure 3. The O-C diagram for GY Com, for the years 1964 to 1990, including the least-squares line and parabola. C is defined by equation (5). The parabola is preferred.