

Rotational and Cyclical Variability in γ Cassiopeiae. II. Fifteen Seasons

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The B0.5IVe star γ Cas is of great interest because it is the prototype of a small group of classical Be stars having hard X-ray emission of unknown origin. We discuss results from ongoing B and V observations of the γ Cas star-disk system acquired with an Automated Photometric Telescope during the observing seasons 1997--2011. In an earlier study Smith, Henry, Vishniac showed that light variations in γ Cas are dominated by a series of comparatively prominent cycles with amplitudes of 0.02--0.03 mag and lengths of 2--3 months, superimposed on a 1.21-day periodic signal some five times smaller, which they attributed to rotation. The cycle lengths clustered around 70 days, with a total range of 50--91 days. Changes in both cycle length and amplitude were observed from year to year. These authors also found the V-band cycles to be 30--40% larger than the B-band cycles. In the present study we find a continuation of these variability patterns and that the distribution of the $\Delta(B)/\Delta(V)$ amplitude ratios in the long cycles to be bimodal. During the 2010 observing season, γ Cas underwent a mass loss event ("outburst"), as evidenced by the brightening and reddening seen in our new photometry. This episode coincided with a waning of the amplitude in the ongoing cycle. The Be outburst ended the following year, and the light-curve amplitude returned to pre-outburst levels. This behavior reinforces the interpretation that cycles arise from a global disk instability. We have determined a more precise value of the rotation period, 1.215767 ± 0.00001 days, using the longer 15-season dataset and combining solutions from the V and B band light curves. Remarkably, we also find that both the amplitude and the asymmetry of the rotational waveform changed over the years. We review arguments for this modulation arising from transits of a surface magnetic disturbance. Finally, to a limit of 5 mmag, we find no evidence for any photometric variation corresponding to the γ Cas binary period, 203.55 days, or to the first few harmonics.

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