Rotational and Cyclical Variability in γ Cassiopeia

Myron A. Smith^1, Gregory W. Henry^2, and Ethan Vishniac^3

^{1}Catholic University of America and Space Telescope Science Institute, 3700 San Martin Dr., Baltimore, MD 21218 USA, msmith@stsci.edu, ^{2}Center of Excellence in Information Systems, Tennessee State Univ., Nashville TN, USA, henry@schwab.tsuniv.edu, ^{3}Department of Physics, Johns Hopkins Univ., Baltimore, MD 21218, ethan@pha.jhu.edu

γ\,Cas is an unusual classical Be star for which the optical-band and hard X-ray fluxes vary on a variety of timescales. We report results of a 9 year monitoring effort on this star with a robotic ground-based (APT) telescope in the B, V filter system as well as simultaneous observations in 2004 November with this instrument and the {\it Rossi X-ray Timing Explorer (RXTE)} satellite. Our observations disclosed no correlated optical response to the rapid X-ray flares in this star, nor did the star show any sustained flux changes any time during two monitored nights in either wavelength regime. Consistent with an earlier study by Robinson et al. (2002), optical light curves obtained in our new APT program revealed that γ Cas undergoes $\sim$3\%-amplitude cycles with lengths of 50--91 days. Our observations in 2004 showed a similar optical cycle. Over the nine days we monitored the star with the {\it RXTE}, the X-ray flux varied in phase with its optical cycle and with an amplitude predicted from the data in Robinson et al. In general, the amplitude of the V magnitude cycles are 30--40\% larger than the corresponding B amplitude, suggesting that the production site of the cycles is circumstellar. The cycle lengths constantly change and can damp or grow on timescales as short as 13 days. We have also discovered a coherent period of 1.21581${\pm 0.00004}$ days in all our data, which appears consistent only with rotation. The full amplitude of this variation is 0.0060 in both filters, and, surprisingly, its waveform is almost sawtooth in shape. This variation is likely to originate on the star's surface. This circumstance hints at the existence of a strong magnetic field with a complex topology and a possible heterogeneous surface distribution of metals.

Reference: The Astrophysical Journal
Status: Manuscript has been accepted

Weblink:

Comments:

Email: msmith@stsci.edu