

Does the Wolf-Rayet binary CQ Cep undergo sporadic mass transfer events?

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Stellar wind mass-loss in binary systems carries away angular momentum causing a monotonic increase in the orbital period, $\dot{P} > 0$. Despite possessing a significant stellar wind, the eclipsing Wolf-Rayet binary system CQ Cep does not show the expected monotonic period increase, in fact, it is sometimes reported to display the opposite behavior. The objective of this paper is to perform a new analysis of the rate of period change \dot{P} and determine the conditions under which Roche Lobe overflow (RLO) mass-transfer combined with wind mass loss can explain the discrepant behavior. The historic records of times of light curve minima were reviewed and compared with the theoretical values of \dot{P} for cases in which both wind mass-loss and RLO occur simultaneously. The observational data indicate that \dot{P} alternates between positive and negative values on a timescale of years. The negative values ($\dot{P} \sim -0.6$ to -8.5 s/yr) are significantly larger in absolute value than the positive ones ($\dot{P} \sim +0.2$ to $+1.2$ s/yr). We find that a plausible scenario for CQ Cep is one in which the O star undergoes intense but sporadic RLO events that lead to accretion onto the WR star, at which times $\dot{P} < 0$. At other times, $\dot{P} > 0$ when the WR wind, and possibly material swept up from the O star, carries angular momentum away from the system. A scenario in which the WR star is the mass donor cannot be excluded, but requires that either the WR wind mass-loss rate undergoes large sporadic enhancements or that an additional process that removes angular momentum from the system be present.

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Comments:

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