Molecular emission from GG Car's circumbinary disk

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The appearance of the B[e] phenomenon in evolved massive stars such as B[e] supergiants is still a mystery. While these stars are generally found to have disks that are cool and dense enough for efficient molecule and dust condensation, the origin of the disk material is still unclear. We aim at studying the kinematics and origin of the disk in the eccentric binary system GG,Car, whose primary component is proposed to be a B[e] supergiant. Based on medium- and high-resolution near-infrared spectra we analyzed the CO-band emission detected from GG,Car. The complete CO-band structure delivers information on the density and temperature of the emitting region, and the detectable element[][13]{CO} bands allow us to constrain the evolutionary phase. In addition, the kinematics of the CO gas can be extracted from the shape of the first element[][12]{CO} band head. We find that the CO gas is located in a ring surrounding the eccentric binary system, and its kinematics agrees with Keplerian rotation with a velocity, projected to the line of sight, of $80pm 1$,km,s^{-1}. The CO ring has a column density of $(5pm 3)times 10^{21}$,cm^{-2} and a temperature of $3200pm 500$,K. In addition, the material is chemically enriched in element[][13]{C}, which agrees with the primary component being slightly evolved off the main sequence. We discuss two possible scenarios for the origin of the circumbinary disk: (i) non-conservative Roche lobe overflow, and (ii) the possibility that the progenitor of the primary component could have been a classical Be star. Neither can be firmly excluded, but for Roche lobe overflow to occur, a combination of stellar and orbital parameter extrema would be required.

Reference: Astronomy and Astrophysics
Status: Manuscript has been accepted

Weblink: http://arxiv.org/abs/1211.5149

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