SEARCH FOR CO (1-0) EMISSION IN R CrB WITH LARGE INFRARED EXCESSES

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The IRAS observations of hydrogen deficient stars, like R CrB stars, have revealed the presence of extended cool dust shells (≈30-200 K BB) around them in addition to the hotter dust shells (≈600-900 K BB) close to the star (Rao and Nandy 1986; Walker 1986; Gillet *et al.* 1986). In the case of R CrB and SU Tau the cool dust shells have been interpreted as the remnant of the (hydrogen rich) envelope ejected when the star was a red giant for the first time (Rao and Nandy 1986; Gillet *et al.* 1986). With an assumed gas to dust ratio of ≈250 (Gillet *et al.* 1986) the total mass of the cool dust shell around R CrB has been estimated to be in the range of 0.1 to 4.8 $M_\odot$, depending on the nature of the dust particles involved. Such a large amount of gas is expected to show substantial CO emission. With a view to estimate the amount of cool gas and the mass loss rates which might give clues to the evolutionary status of these objects, we have started a programme to observe southern R CrB and other hydrogen deficient stars in the CO (1-0) and (2-1) lines; here we present the results obtained for a few objects.

The CO J = 1-0 (115 GHz) observations were obtained simultaneously in the low and high resolution modes with the 15-m SEST telescope at La Silla, Chile (Booth *et al.* 1989) during May 1990. The HPBW at 115 GHz is 44 arc-sec and the main beam efficiency η_{mb} is 0.71. We have looked at five objects with integration times ranging from 1.2 to 3.2 hours. We could not positively detect any source in the CO (1-0) line. V605 Aql, which is the central star of the planetary nebula A58 (44" x 34") (Seitter 1987; Rao *et al.* 1986), shows a signal at 2.6σ level at the position of the LSR velocity of 138.5 kms^{-1} which is in agreement with

the velocity derived from the emission lines originating from the outer nebula (The inner hydrogen deficient nebula is supposed to differ in velocity from the outer planetary nebula by 60 kms^{-1}). If this probable detection is real, then it implies that the molecular gas is associated with the PN. A rough estimate gives a value ≃0.06 for the ratio of the mass of molecular gas to ionized gas.

V348 Sgr is classified as a cool Wolf-Rayet star of WC 10/11 group in addition to being an R CrB star. A few other members of this group, like CPD-56°8032, He 2-113, IRAS 21282+50 etc., show strong CO(1-0) emissions.

UW Cen is similar to R CrB in many respects (and has even higher 100μ flux density). If the extent of the dust shell is the same as that of R CrB (≃20 arc-min) as estimated by Gillet *et al.* (1986), then at the estimated distance of UW Cen the entire dust shell should be within the beam size of SEST, and hence it is expected to show substantial CO emission, which is not observed. It might imply that CO gas in the cool dust shells gets dissociated by the radiation field around the star, or the gas to dust ratio is very low. Observations of CO (1-0) line for other R CrB stars would be useful in this regard.

Observations

Star	CO J=1-0 T_{mb}Peak(K)	Estimated distance(kpc)	IRAS Flux density (Jy) 12μ	25μ	60μ	100μ
V605 Aql	0.024	3.5	4.9	31	47	21
V348 Sgr	<0.012	4.7±2	5.5	2.78	2.52	<13.02
UW Cen	<0.022	5.5	7.81	5.57	8.46	5.38
DY Cen	<0.030	4	1.05	0.84	<0.49	<2.21

References

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