

HCN, THE FIRST STRONG MASER IN CARBON-RICH STARS

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ABSTRACT. Maser emission has been observed at the frequency of the (0,2,0) $J = 1 - 0$ line of HCN (89088 MHz, energy 2050 K above the ground state) in 7 C-rich circumstellar envelopes: CIT 6, S Cep, IRC+50096, IRC+30374, FX Ser, AFGL 2513 and IRAS 17581-1744. This is the second molecule showing strong maser emission in millimeter lines, and the first strong maser ever observed in a C-rich circumstellar envelope. The emission is particularly strong (70 Jy) in CIT 6 because of its proximity (Guilloteau, Omont, and Lucas 1987). The masers in the stars have luminosities and linewidths (FWHM about 1 km/s) similar to CIT 6; they are also blueshifted by a few km/s with respect to the velocity of the star given by the central velocity of the ground-state HCN emission (Lucas, Guilloteau, and Omont 1987). These properties are somewhat similar to those of SiO masers in O-rich stars, although the intensities of HCN masers are weaker.

85 C-rich circumstellar envelopes were searched for HCN maser emission. Strong maser emission seems confined to envelopes with intermediate mass-loss rates between 10^{-6} and $10^{-5} M_{\odot}/\text{yr}$ which have very similar infrared properties. HCN maser emission is present in about 20% of C-stars in this particular subclass.

Time variations occur on scales of months in HCN masers, since one maser (IRC+50096) had disappeared 80 days after its detection. The maser emission is strongly linearly polarized in CIT 6 (Goldsmith *et al.* 1987). No emission was detected in CIT 6 from the $J = 3-2$ transitions of different vibrationally excited states of HCN.

The existence of HCN maser emission, especially in CIT 6, could be related to the particular activity and structure in the vicinity of the photosphere of these extreme AGB stars.

REFERENCES

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