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# Millimeter-Wave Continuum Around NGC 7538-IRS1, IRS2, and IRS3

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Millimeter-wave continuum sources in NGC 7538 region were observed with the NRO 45-m telescope and Nobeyama Millimeter Array. NRO 45-m telescope observations showed that the compact region which includes IRS1, IRS2, and IRS3 has a strong millimeter-wave intensity excess, cf. figures 1, and 2. This region was also studied with NMA at 49 and 98 GHz, and the results are shown in figures 3, and 4 respectively. The obtained millimeter-wave spectrum, open circles in figure 5, was analyzed and compared with other reference data. It has been proposed from this analysis that new compact quasi-spherical and homogeneous HII sources, branch (B) in figure 5, may exist in the IRS1 region, in addition to the VLA ultra-compact HII regions, branch (A) in figure 5, (Campbell 1984; Turner and Matthews 1984). It is suggested that the new sources have a small size, of the order of $10^{15}$cm, and a high electron density of $\sim 10^{7}$ cm$^{-3}$; they are still optically thick, even in the 100-GHz range. This gives an HII evolution time as short as 100 yr. These small but intense HII emission sources in the IRS1 may well be identified by cocoon stars predicted by Davidson and Harwit (1967). To investgate the evolution of the HII regions in the cocoon, an intensity monitoring observation, as well as a source expansion check, of NGC 7538-IRS1 at around 49 GHz in about 10 yr has been proposed. The total flux density of the extended dust emission around the IRS1 (Werner et al. 1979) was estimated by the 45-m dish observation, dotted circle D in figure 5, to be about 0.6 Jy at 90 GHz, giving a somewhat steeper intensity spectrum than $\nu^{3}$, $\nu$ the radio frequency.

We tried, to find separate single sources, a spectral decomposition of a composite spectrum of compact HII source which is spatially not resolved yet. Observed results of NGC 7538 main, IRS2, and IRS3 are given in figure 6 by dotted circles (A1), open circles, and arrows (upper limits), respectively with other reference data. H an F (dotted circles) in the figure are for NGC 7538 compact by the 45-m telescope observation. A full report on this work has been appeared in Special Issue of the Publ. Astron. Soc. Japan, Vol.44, 421-433, 1992.

References

Campbell, B. 1984, Astrophys.J.Letters, 282, L27.
Davidson, K., and Harwit, M. 1967, Astrophys.J., 95, 1185.
Turner, B.E., and Matthews, H.E. 1984, Astrophys.J., 277, 164.

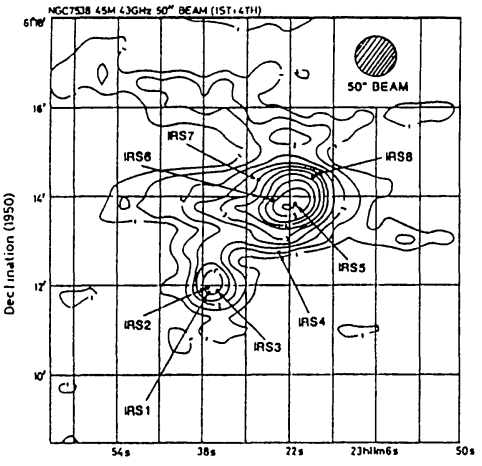


Figure 1. Right Ascension (1950)

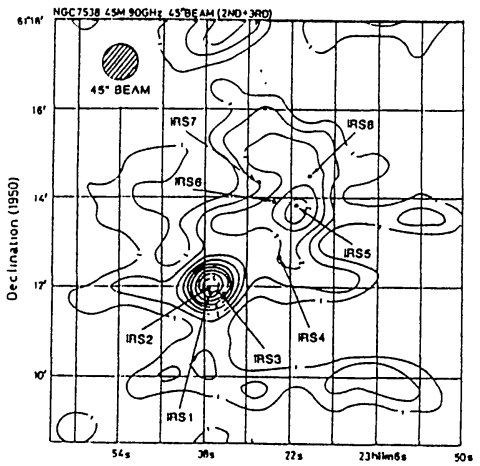


Figure 2. Right Ascension (1950)

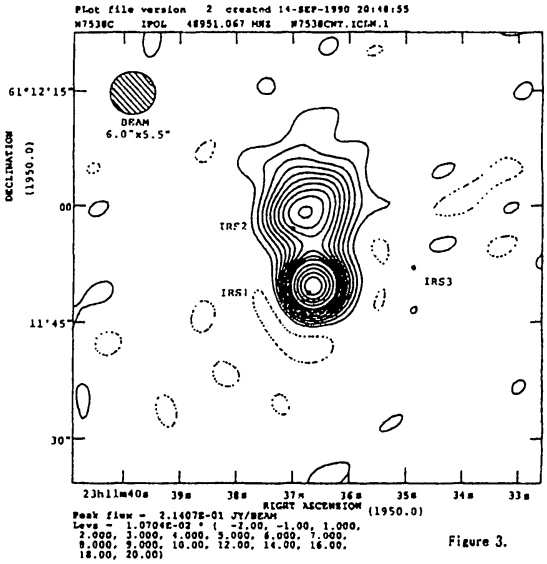


Figure 3.

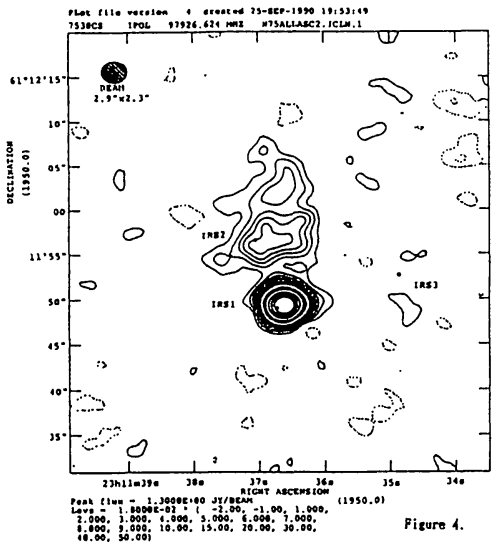


Figure 4.

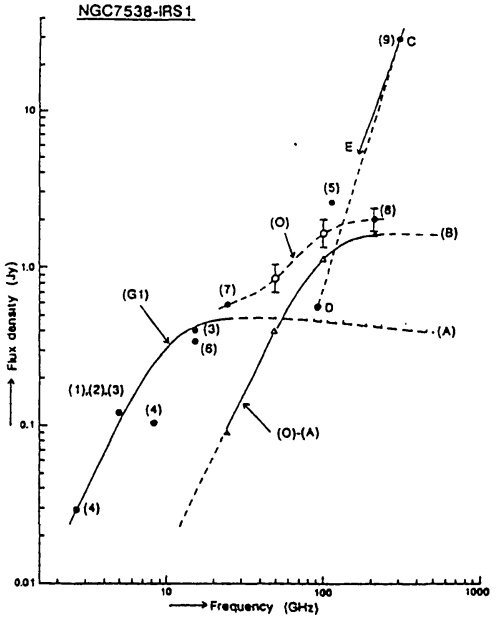


Figure 5. Continuum spectra of the radio sources in NGC7538 IRS1

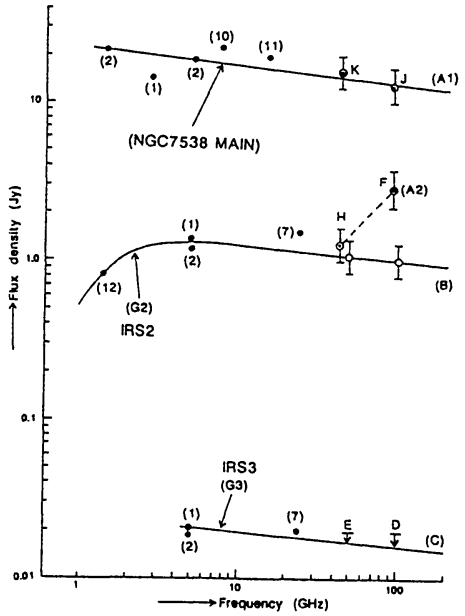


Figure 6. Continuum spectra of the sources in NGC7538 region