DUSTY KNOTS IN SUPERNOVA REMNANTS

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Dusty knots are known to exist within supernova remnants (SNRs). The dust in these knots could be sufficiently heated by the X-ray emitting plasma to radiate in the far-infrared (FIR) wavelengths. We have searched the IRAS Point Source Catalogue for FIR sources associated with 117 SNRs from the catalogue of van den Bergh. We selected IRAS sources with definite flux densities at 60 µm or 100 µm and the flux density increasing with wavelength beyond 25 µm. For each SNR, background source density was determined in an area surrounding the SNR and the number of excess sources within the SNR area (with 10% radial extension) was determined. The results are shown in Table 1. We have significant excess for the total sample. A few sources also show excess on an individual basis as shown in the table.

In our sample we have 58 SNRs which have well defined peripheries. For these, as can be seen from the table, the significance of the excess increases in the shell areas of SNRs. In Fig. 1, we plot the excess of FIR sources against the SNR distance. The excess increases with decreasing distance. This shows that the FIR sources are associated with SNRs since with decreasing distance more sources will have fluxes above IRAS threshold.

In Fig. 2-4, we show positions of IRAS sources superposed on radio/X-ray maps of a few SNRs. The preponderance of FIR sources in the shell region can be clearly seen. In case of Pup A, two of the brightest sources coincide with the bright NE and northern X-ray knots. The brightness of these knots in X-ray and FIR are comparable. In Cas A, the IRAS source is coincident with a fast moving knot. It is possible that in a large number of SNRs, the associated FIR sources are dusty knots heated by the hot plasma. The other possibility is that they may be protostars triggered by supernova shocks.

A detailed study of these sources will help in understanding the interaction of dust with hot plasma and also serve as a probe for small scale structure of the ISM.

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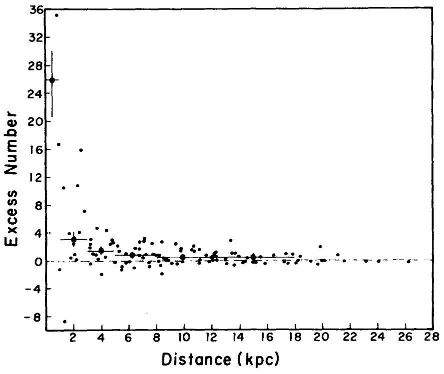

Fig. 1

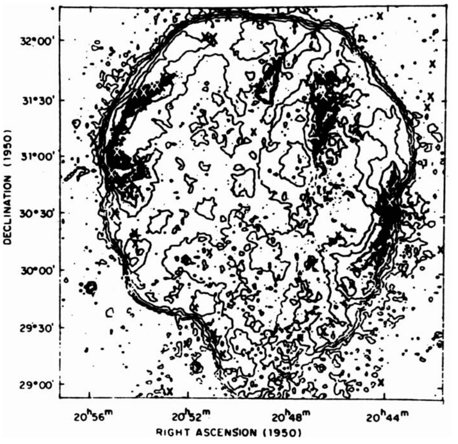

Fig. 2 Cygnus Loop
X-ray map; X IRAS Source

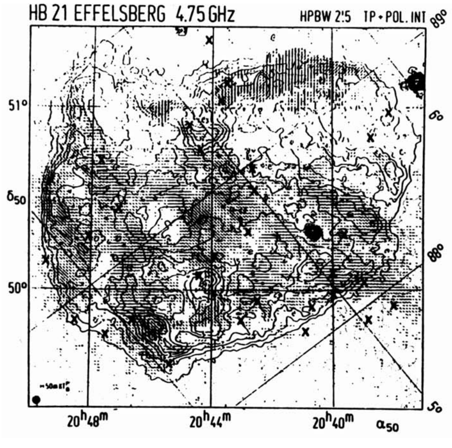

Fig. 3

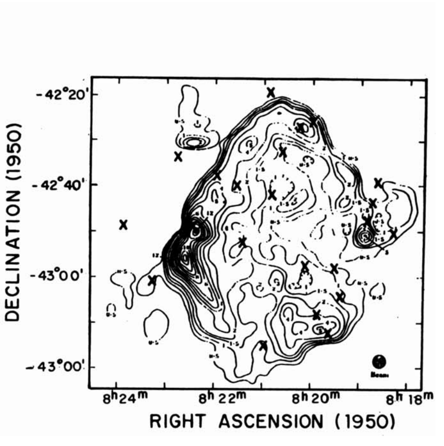

Fig. 4 Pup A (408 MHz)

Object	No. of IRAS Sources		
	Observed	Expected	Excess
Cygnus loop	51	15.9	35.1 ± 7.2
IC 443	14	6.9	7.1 ± 3.8
Pup A	20	4.1	15.9 ± 4.5
W 28	22	11.2	10.8 ± 4.7
HB 21	28	17.6	10.4 ± 5.3
S 147	63	45.3	17.7 ± 9
111 SNRs	347	283.8	63.2 ± 18.6
58 SNRs*	222	172	50 ± 15
Shells† of 58 SNRs	109	55	54 ± 11

* SNRs with well defined peripheries

† $0.85 < R/\theta < 1.05$

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