RADIO OBSERVATIONS OF SMALL DIAMETER SOURCES IN THE DIRECTION OF OLD SUPERNOVA REMNANTS

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Radio observations with high sensitivity have shown that lots of more or less compact structures can be found in the field of extended and old supernova remnants (SNRs). These small diameter sources have been subject to many recent observations. The aim of these studies is to infer a possible physical association of these sources with the SNR shell. The interest in this link is based on various aspects, instabilities of shocked interstellar matter, star formation, etc.

Unfortunately, it is difficult to ascertain any suggested association. Besides others, one possible criterium, sometimes used, is the similarity of the radio spectral indices of both, the SNR shell and the small diameter sources. This comparison seems to be suitable, if the radio spectrum of the SNR is not straight but shows a break. Small diameter sources in the field of those SNRs may be considered as candidates for an association, if they also have a bent radio spectrum similar to that of the SNR.

We have tested this method with the Effelsberg 100-m telescope for the SNRs HB9 and S147, which are known to have bent radio spectra. In case of HB9 only one source ($\alpha_{50} = 4^h55^m51^s$, $\delta_{50} = 45°48'12''$) with a bent radio spectrum could be detected. However, at low frequencies the spectral index of this source is probably smaller than that of HB9. Too few flux values are known for this small diameter source, thus firm conclusions cannot be drawn.

In case of S147 two neighboring sources have been identified, which have the same spectral slope at high frequencies. The integrated spectrum of these sources is known between 179 MHz and 10.69 GHz and resembles that of S147 quite well (Figure 1).

The two sources have been described by Fürst et al. (1982). An association is very probable. However, for a confirmation it is absolutely necessary to obtain the true sizes of the small diameter sources by interferometric observations. In addition, 21 cm absorption line measurements may reveal their galactic or extragalactic nature.

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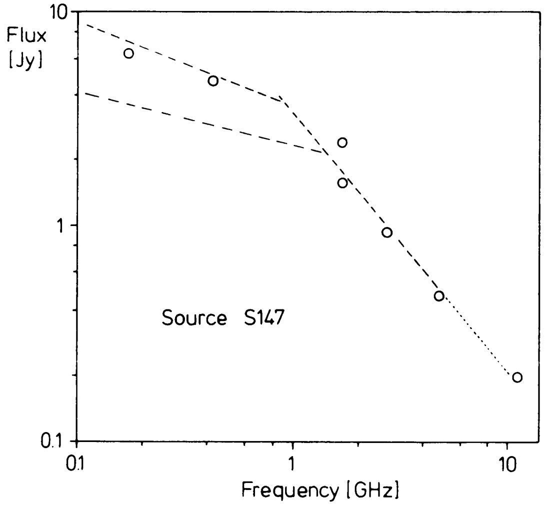

Fig. 1. The integrated flux (o) of two neighboring small diameter sources in the field of S147. For comparison we have plotted the slope of the radio spectrum of S147. At low frequencies the two dashed lines reflect the uncertainty of the spectrum of S147.

If the association is true, some interesting conclusions can be drawn. If equipartition magnetic field is assumed, the application of the synchrotron theory on the high frequency part of the spectrum leads to $B \approx 180\ \mu Gs$. Assuming isotropic compression of interstellar matter ($B \approx 3\ \mu Gs$, $n_o = 0.5\ cm^{-3}$) as the origin of the sources, the number density of the compressed small diameter objects is $n \approx 200\ cm^{-3}$.

There is still no clear explanation of the break in the radio spectra of SNRs. However, the frequency of the break depends certainly on the compression rate. Because of the very similar radio spectra of S147 and the two small diameter sources, the compression of the SNR radio shell should be similar. Therefore, the radio filaments of S147 are very probably rather dense. It is interesting to examine the association of the sources also by applying the other methods mentioned above.

REFERENCE

Fürst, E., Reich, W., Beck, R., Hirth, W., Angerhofer, P.: 1982, Astron. Astrophys., in press