# MONITORING SN1987A AT 45 MHZ

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ABSTRACT. Encouraged by a theoretical model we are monitoring supernova 1987A at 45 MHz in an attempt to detect its scintillation. So far the result is negative, but the program will continue.

## 1. Introduction

There are no low-frequency observations (<400 MHz) of radio supernovae. Prompted by the interest to observe SN1987A with the University of Chile's 45-MHz transit array we have computed the light curves of the four best-studied supernovae using the model by Weiler *et al.* (1986). The calculations were made for 45 MHz assuming the objects to be at the distance of the LMC (55 kpc). The supernovae are 1981k, 1983n, 1980k and 1979c. The results show that had these objects occurred in the LMC, their flux density would first have exceeded 20 Jy (the estimated sensitivity of the instrument) after 1.2, 1.3, 6.4 and 17.4 years, respectively, since the explosion. Assuming that 1987A would behave like any of the first three objects we began in 1988 a monitoring program.

## 2. Observations

The observations have been made with the University of Chile's transit array. This is made up of 528 full-wavelength dipoles connected to a Butler matrix which produces several beams along the meridian. These beams, of which only the four central ones are used, have a resolution of 4°6 ($\alpha$) x 2°4 ($\delta$) with a maximum effective area of 9650 $m^2$ (May *et al.* (1984)). To the best of our knowledge this is the only low-frequency telescope operating in the Southern Hemisphere at this time.

It is expected that when the 45 MHz radiation gets through, 1987A will produce a small signal increase above the combined galactic background plus the LMC radiation. Detecting this small signal increase would be difficult. For example, the wide antenna beam and the high source declination would make the crossing of the beam quite long. We believe that a more suitable method is to detect the source scintillation since 1987A has a small angular size and the observing frequency is low.

The method consists of pointing one of the antenna beams to 1987A declination (ON signal) while another points simultaneously to the sky (OFF signal). A similar procedure is followed with the radio source 0410-75 which is used as a control source; of the strong scintillating sources this is the closest to 1987A. The presence or absence of 1987A is judged by comparing the power



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spectra of the four time signals, assuming that the conditions that produced the scintillation in the control source have not changed by the time 1987A transits. We make fast-sampling recordings 146 minutes long, spanning the transits of both sources, and from them we obtain spectra between 0.05 and 4 Hz.

## 3. Discussion

Good data were obtained for a few days in December 1989 and January 1990. The spectrum of 0410-75 is typical of scintillating radio sources exhibiting a fast drop from 0.05 to 4 Hz. The OFF source (sky background) spectra of 0410-75 and of 1987A show components with small amplitude and a slow decline towards high frequencies. The spectrum of 1987A (ON source) is similar to that of the sky background. We conclude, therefore, that we have not detected 1987A in these data.

The possibility of detection was based on the applicability of Weiler *et al.*'s model, which, while we believe it is the most comprehensive radio model, it is not complete (for example, it does not take into account synchrotron self-absorption). The model also assumes values for several parameters that might be different for 1987A. When the program began in 1988 the feasibility of detection was based on the assumption that 1987A would behave like 1981k, 1983n, or 1980k, of types II (?), I(SL) and II(L), respectively. Subsequent studies of the object in a wide range of the electromagnetic spectrum have shown it to be an atypical supernova. While this may work against the possibility of detection, it may also work in its favor. From these considerations and because, a) the uniqueness of the event, b) the possibility of detecting it will increase with time, and c) the advantageous location of our telescope, we intend to continue the monitoring program.

## 4. Acknowledgments

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