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SETI OBSERVATIONAL PROGRAM IN ARGENTINA†

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Abstract—Due to the scarce SETI research in the Southern Hemisphere, we decided to begin an observation of a series of southern stars at 21 cm and 18 cm, using the facilities of the Instituto Argentino de Radioastronomía (IAR). One of the two 30 m radiotelescopes was used since October 1986, for a search of narrow frequency (2.2 kHz resolution) band signal in the direction of nearby stars. We have selected for this plan 78 stars between $-40°$ and $-90°$ of declination and distances less than 50 l.y. In this paper we present the first results of this program at HI and OH line. We describe a 320 h parasitic program at OH line using the data of Comet Halley observations. Following a suggestion of Dr I. Almár we began in November 1987, a series of observations around the SETI Ellipsoid originated in the SN1987A at 18 cm. We describe the observations around the stars HD21899 and HD100623, following a suggestion of Alexei Arkhipov. We have initiated‡ contacts with *The Planetary Society* to expand our SETI activities. It is our hope that at the time of this Symposium we can announce the details of this agreement, which could include the construction of a 8.4 million channel ultranarrowband spectrum analyzer, designed by Professor Paul Horowitz of Harvard University.

1. OBSERVATIONS

Since October 1986, we decided to begin a search for extraterrestrial intelligence signals (SETI), using the facilities of the Instituto Argentino de Radioastronomía (IAR). It is interesting to note that SETI activities are very scarce in the southern hemisphere. We know only four searches made in Australia by Kellerman [1], Cohen *et al.* [2], Cole and Ekers [3] and Kuiper and Gulkis [4].

In this paper we report the negative results of a search for narrow band signals in the direction of southern stars, primarily chosen on the basis of their distances ($d \leqslant 50$ l.y.) and positions ($-40° \geqslant \delta \geqslant -90°$). These stars were selected mainly from the catologue of Wooley *et al.* [5]. The 21 cm observations around 34 stars were described in a previous paper by the same authors [6].

During 1988 we began a series of observations of the same stars that were selected for the 21 cm program. The receiver consisted of a single channel GaAs Field Effect Transistor (FET) radio frequency amplifier at the front end. The system temperature at the receiver was 93 K against cold sky. The spectrometer consisted of a bank of 74 filters, with a total frequency coverage of 180 kHz and a resolution of 2.2 kHz. The observations were done in the frequency switching mode, while tracking the stars. The mimimum integration time was 60 s and we observed at least 3 min on each frequency range, spending more than an hour per star to cover a frequency interval of ± 5 MHz around the 1667.358 MHz OH line. The minimum detected total power after 3 minutes of integration is 3×10^{-23} W m^{-2}.

Until May 1988 we have observed 16 stars. The data obtained in the direction of these stars has not revealed the presence of any signal which might be attributed to an artificial source coming from the stars.

2. PARASITIC PROGRAM

A parasitic program was developed using the OH observations of Comet Halley by Bajaja *et al.* [7]. We inspected more than 320 h of observation using standard programs which search for high narrow signals in the profiles. No signal was presented at a level of 1×10^{-24} W m^{-2}. In this case the frequency coverage was 180 kHz and the velocity was referred to the nucleus of the comet.

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‡This agreement was announced on 8 October 1988 at *The Planetary Society Toronto SETI Conference*. The 8.4 million channel spectrum analyzer called META II, was built during 1989, at Harvard University by J. C. Olalde and E. Hurrell, under the supervision of Professor Paul Horowitz. META II was officially dedicated on 12 October 1990 and is in operation with the antenna 2 of the Instituto Argentino de Radioastronomía.

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3. SN1987A SETI ELLIPSOID

Following a suggestion of Professor I. Almár [8] we began a series of observations in the direction of the SETI Ellipsoid generated by SN1987A. The SETI Ellipsoid concept was developed independently by T. B. Tang [9] and P. V. Makovetskii [10]. They have proposed to observe only those stars situated on an ellipsoid having the Sun at one of the focus and supernova in the other. This concept allows us to relate direction with time. In February 1987, when the Magellanic supernova was first detected on Earth, a new SETI Ellipsoid was generated, namely a straight line joining the Earth to the supernova. This Ellipsoid will expand very slowly in width next year and we can cover it with only one antenna beam; and by the end of this century we will only need about seven beams.

We have observed in the direction of SN1987A at two different epochs during 1987/88 in the 1667.358 MHz OH line, covering a frequency range of ± 20 MHz, employing the same receiver that we used to observe in our target program. The minimum integration time was 1 min and we spent 5 min in each frequency range. No signal was present at a level of 1×10^{-23} W m^{-2}. We plan to observe SN1987A during several years in the 21 cm HI and 18 cm OH lines.

4. ARTIFICIAL ACTIVITY?

In 1986, Professor A. Arkhipov [11] proposed the association of four nearby solar type stars with continuum radio sources. He calculated the probability of accidental projection of the radio sources in vicinity of four such as 2×10^{-4}, and suggested that these stars are interesting objects for SETI programs. He attributed the excess in the radio spectrum of these objects to possible artificial intelligent activities around the stars. Two of these sources (HD21899/PKS0328-415 and HD100623/PKS1132-325) are situated in the southern sky. Recently Jean Heidmann [12] in an independent way discovered another similar radio source near a class G star.

During May 1988, we observed HD21899 and HD100623 at 1667.358 $\pm$ 5 MHz. The minimum integration time was 1 min and we spent 5 min in each frequency range. No signal was present at a level of 1×10^{-23} W m^{-2}.

5. NEAR FUTURE

By the end of this year a 1008 channel autocorrelator spectrometer will be in operation† on the IAR antenna I. This will allow us to obtain a spectral resolution of 39 Hz and we will continue with our target program.

We have initiated‡ contacts with *The Planetary Society* to expand our SETI activities. It is our hope that at the time of this meeting we can announce the details of this agreement, which would include the construction of a 8.4 million channel ultranarrow band analyzer (META), designed by Professor Paul Horowitz [13] of Harvard University.

The antenna 2 will be dedicated almost 12 h per day for at least 3 years to survey the southern sky at 21 cm covering 420 kHz at 0.05 Hz resolution.

†The spectrum analyzer is at IAR on basis of a long term loan agreement between the National Astronomy and Ionospheric Center and the Instituto Argentino de Radioastronomía.

‡See footnote on p. 211.

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