SEARCH FOR STRONGLY POLARIZED RADIO EMISSION FROM E.T.I., AND AN OPTIMIST APPROACH TO THE GREAT SILENCE (FERMI'S PARADOX)

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ABSTRACT. A summary is made of a program to scan slowly a band of sky in search of strongly linearly polarized radio signals from E.T.I. communication relays. Despite this and numerous other observational searches, no signals have been found. An optimist approach to this great silence (Fermi's paradox) is developed.

1. SEARCH FOR STRONGLY POLARIZED RADIO EMISSION FROM E.T.I.

1.1 Introduction

In radio astronomy, only spectroscopy has been heavily used so far in SETI observations. A colleague (Martine Simard-Normandin) and I decided to use polarimetry instead, because there is no known process by which Nature can emit with a percentage of linear polarization above about 70%, and because Man's radio/TV signals can be highly polarized. The aim of this study is to locate potential communication relays in interstellar space near the center of our Galaxy, because this could be an ideal location for extraterrestrial purposes in telecommunications within our Galaxy.

1.2 Instrumentation and Observations

The 46-meter diameter radio telescope at the Algonquin Radio Observatory was used, along with a cooled parametric amplifier tuned near 10.6 GHz (λ2.8 cm wavelength). Figure 1 shows the telescope used.

The incoming signals from space enter the horn of the polarimeter (top left of Figure 2), and go through a rotating quarter-wave plate followed by a circular-to-linear converter and two orthogonal pick-ups for the linear polarization, before exiting (bottom right of Figure 2) in the appropriate waveguides. Observations are made by Dicke-switching at a rate of 103 Hz between the signals from these two waveguides, thus giving an output which is the difference between these two signals. Nature's thermal signals will be splitted roughly equally between these two waveguides, giving a zero output - which is

M. D. Papagiannis (ed.), The Search for Extraterrestrial Life: Recent Developments, 321–325.

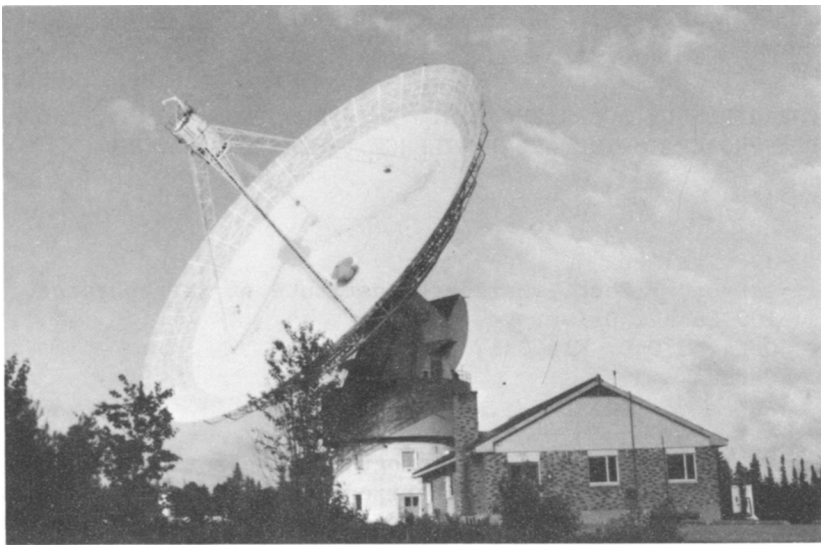

Figure 1. The 46-meter diameter telescope at the Algonquin Radio Observatory, near Lake Traverse, Ontario, Canada.

the beauty of the system!

A typical observing run lasts three consecutive days and yields entries in the log book for the receiver, the motion of the telescope, the weather, and other miscellanea. The system temperature averages about 165 K, and the average 3-db bandwidth is around 200 MHz.

The target is a band of sky along the central meridian of zero galactic longitude (across the galactic plane, going through the galactic center), because of the existence of strong radio signals emitted by Nature all along the galactic plane. The telescope is made to execute a long scan starting at -12.5° and ending at +12.5° of galactic latitude, at a fixed position in galactic longitude. Taking successive positions in galactic longitude allows the mapping of a band of sky.

1.3 Calibration and Data Reduction

Various calibration sources are used, for the instrumental polarization (by observing three unpolarized HII regions), and for the determination of the zero of the position angle scale of the polarimeter (by observing 2 quasars with 10% polarization). The instrumental degree of polarization averages about 0.9% daily, slowly changing in winter due to a small amount of snow on the telescope.

The calibration source for the total-intensity flux density is 3C123, with an adopted flux density of 7.7 Jy at a wavelength of 2.8 cm. For these total-intensity observations, Dicke-switching is performed between a cold load and one of the two orthogonal pick-ups in the main beam of the telescope.

On-line data reduction at Algonquin consists of a subtraction of

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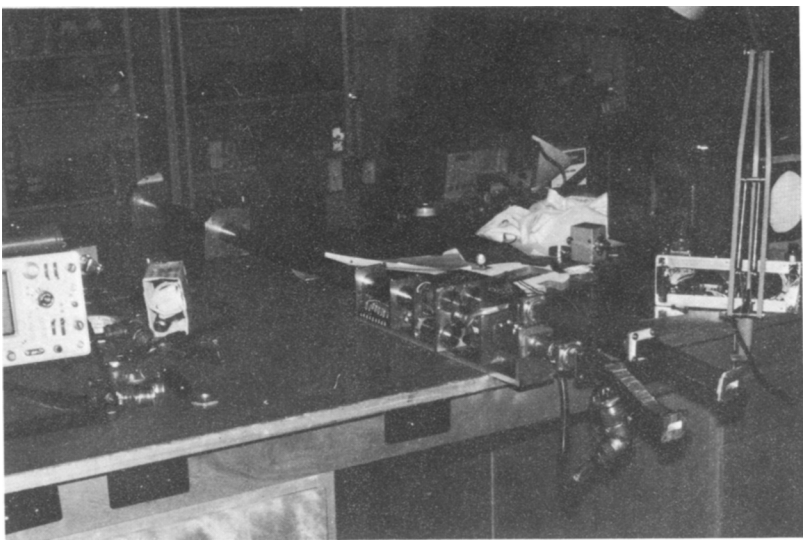

Figure 2. The polarimeter, operating at a wavelength of 2.8 cm. Signals from space enter the long tube from top left, and exit from the two waveguides at bottom right.

the amplitudes from the two orthogonal pick-ups, and its display on a chart record. Off-line data reduction consists in removing the effects of the telescope/receiver/polarimeter system on the signals.

1.4 Results

Nature's nonthermal radiation at the galactic center was observed with our polarimeter, as well as its appearance through the telescope side-lobes while crossing the galactic plane.

No time-constant source was found significantly above the r.m.s. noise of about 30 mJy after one searching pass, corresponding to a sensitivity of a few times 10^{-20} watt.meter^{-2} of polarized intensity. In scientific terms, this value implies a maximum transmitted power of a few times 10^{14} W.Hz^{-1} for a Communication Relay at the distance of the Galactic Center.

One time-dependent source was possibly found on the easternmost of the scans in galactic latitudes, about 5° south of the Galactic Center, very near the horizon at the Observatory. It was looked at four times in a three-hour period in March 1983, giving successive polarized intensity values of one Jy, less than 50 mJy, less than 50 mJy, and one Jy approximately. If it was a modulated TV signal, its amplitude would not disappear entirely with time - the fact that its amplitude disappeared entirely at times would suggest a radio frequency interference from a nearby airport or other earth causes.

Complete details of the full program to search for strongly polarized radio emission from E.T.I. will be published elsewhere (Vallée and Simard-Normandin, in preparation).

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2. AN OPTIMIST APPROACH TO THE GREAT SILENCE (FERMI'S PARADOX)

2.1 Introduction

On the observational side, close to fifty observational searches have been made in the quarter of a century that elapsed since the first research on E.T.I. in 1960. All have been met by a great silence. An optimist approach to this silence is developed briefly, as a game.

2.2 Postulates

The first postulate is that there is a single galactic-wide homogeneous civilization, making short visits on each planet where intelligence has newly arisen, to instruct a few inhabitants of the basic laws of the galactic civilization, and to incite them to propagate these basic laws to as large a following as possible. The great silence is imposed in this instruction/propagation period by the E.T.I.

The second postulate is that the large following that ensues will become in due time the representative on earth of this civilization, and will promote creativity as an exportable value of the mind.

2.3 Tests

A first test, the instruction test, pertains to the higher religions that have some identification with an E.T. presence. The actual definition used for such higher religions is that of Toynbee (1972, p.333-334). Table I shows that 5 church-like assemblies can meet this test.

A second test, the propagation test, pertains to whether the assembly is open to an individual outside of the civilization of the founder of the religion, following Toynbee (1972, p.335-336). Table I shows that only 3 assemblies (out of the previous 5 meeting the instruction test) could meet this test.

A third test, the representativity test, refers to whether there is a unified assembly government as opposed to a loosely knit assembly, following Toynbee (1972, p.333). Table I shows that only 1 assembly (out of the 5 meeting the instruction test) meets this test, to offer efficient dealings with a galactic-wide civilization.

A fourth test, the creativity test, refers to whether creativity/curiosity/scientific research are actively encouraged. Table I shows that none is actively promoting what could be an exportable value of the mind.

2.4 Discussion

No major church-like assembly can currently meet all four tests in Table I, maybe implying a lack of strong outside intervention in their affairs after their creation. Some might meet them in the future, in the optimist approach to the great silence. Evolution can be seen in Table I, as some assemblies opened up to individuals in other cultures despite what their human founders had said (Toynbee, 1972, p.336).

TABLE I - The largest church-like assemblies

No. of members[a]	Name of assembly	Test[b] no. 1	Test[b,c] no. 2	Test[b,c] no. 3	Test[c] no. 4
1100 M	Christianism	yes	yes[g]	yes[d]	neutral
500 M	Islamism	yes	yes[g]	no	no[f]
470 M	Hinduism	yes	no[g]	no	no[e,f]
300 M	Buddhism	yes	yes[h]	no	no[e,f]
300 M	Confucianism	no	-[c]	-[c]	-[c]
200 M	Animism	no	-[c]	-[c]	-[c]
65 M	Shintoism	no	-[c]	-[c]	-[c]
55 M	Taoism	no	-[c]	-[c]	-[c]
15 M	Judaism	yes	no[g]	no	neutral
Total no. of yes:		5	3	1	0

Notes- a: one M equals one million members.
b: from Toynbee (1972, chap. 40).
c: restricted to those already satisfying test no. 1.
d: yes applies to the roman catholic denomination.
e: inward-looking Hindu meditation, Buddhist extinction of desire.
f: too few scientific inventions from Africa, Middle-East and Far-East.
g: no, at earlier times.
h: yes, at earlier times.

REFERENCE:

Toynbee, A. 1972, A Study of History, One-volume edition, revised and abridged by the author and Jane Caplan, Oxford Univ. Press, chapter 40.

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