"QUI APPELLE ?"

The demise of the 1.35-cm receiver aborted the observing time assigned to this program after the June meeting of the Program Committee. We therefore have no further observational progress to report. The following summarises the objectives of the program and the progress to May 1974 for the Committee's convenience.

The program is a search for 1.35-cm line radiation from nearby stars that are likely to have accompanying planetary systems. The search was proposed in the following context. Present models of stellar, planetary, biochemical and biological evolution do not lead to firm predictions about the existence of terrestrially-patterned life beyond the Earth. The possibility that such life may be widespread throughout stellar Population I must however be considered seriously; it is not an extreme estimate on the basis of present knowledge (e.g. refs 1 and 2). The feasibility of detecting communicative examples of such life using radio astronomy has generated vigorous debate which cannot satisfactorily be concluded on the basis of available evidence. Without some experiments even the most extreme possibilities for the abundance of extraterrestrial civilisations cannot be eliminated.

Our proposal has argued that small-scale continuing searches for radio signals of artificial origin are justifiable despite the small a priori probability of success because they are among the few experiments possible with present technology that have any chance, however small, of providing experimental evidence for life beyond the Solar System. The 1.35-cm line has four distinct claims to significance as a possible frequency for "beacon" signals. These are: the anomalous nature of the known inter- and circum-stellar sources, the unique biochemical significance of the water molecule for our life-form, the relative freedom from astronomical confusing signals, and the relative freedom from fundamental background noise. We proposed a two-level program: observations of a small number of stars for which there was some evidence for planetary companions (approx. 1 day per star), and observations of a complete list of a few hundred single stars to a given limiting distance (approx.30 min per star).

In May we carried out an exploratory experiment in which 13 stars* of particular interest were observed for on-source integration times up to one hour, together with known water-line sources including some of the weaker IR-H_2O stars. Single-channel upper limits for 1.35-cm line emission near the target star radial velocities were typically 100mK while all expected "control objects" were successfully detected. This exploratory experiment demonstrated the feasibility of our search procedure and provided necessary experience with the system under various weather conditions. During the interruption in 1.35-cm observing we have developed a magnetic tape data file on all single stars within 75 L.Y. of the Sun.

References

1. "Project Cyclops" - NASA/Ames Research Centre Report CR114445 (1971)
2. "Interstellar Communication: Scientific Perspectives", ed. Ponnamperuma and Cameron (Houghton Mifflin 1974)

*listed in Appendix A

REQUEST FOR OBSERVING TIME IN THE JANUARY-JUNE 1975 PERIOD

We wish to carry out an experiment of the "second-level" kind in our original proposal, and will request 100 hours of 46-metre time in the April-June quarter for a search for 1.35-cm line emission near the radial velocities of single stars out to 45 L.Y. distance. Appendix B lists star numbers from the Herstmonceux Catalogue, 1950.0 positions, and other data for the 217 such stars in our data file. Radial velocities listed as 999.0 km/s are either unknown or not yet entered in the file; stars whose velocities are still unknown when we observe will be studied over the appropriate range of galactic radial velocities with lower priority than those of known velocity. Each star will be observed for about 10 minutes in total-power mode on at least two occasions. Control observations of "blank sky" will be included in addition to normal calibrations and performance checks.

We recognise that a study of a complete stellar sample chosen by distance criteria alone could encounter line radiation of "astrophysical" origin. "False alarms" in the beacon context could lead to "results" in an orthodox context. Initial data reduction will however be quite standard - is there a line above noise in any spectrum ? We are developing off-line procedures for analysis of spectra singly and in time series and will record all spectra in machine-readable form.

PUBLICATION PLANS

A discussion of the rationale for the program will be prepared for publication in the New Year. Publication of results, even if negative, has been invited by a major astronomical journal and would be considered if the requested run were reasonably trouble-free.

ALAN BRIDLE
Queen's University

PAUL FELDMAN
D.R.A.O.

6th December 1974

Appendix A

STARS OBSERVED IN MAY 1974 RUN

BD $+5^{\circ}1668$
Epsilon Eridani
Tau Ceti
BD $+43^{\circ}4305$
61 Cygni
Barnard's Star
Lalande 21185
Tau Bootis
BD $+20^{\circ}2465$
Groombridge 1618
Lalande 25372
Luyten 726-8
AOe 17415-6

1 June 1974

"Qui Appelle?" Programme

Progress Report: We have begun implementing our search for 1.35 cm H_2O-line emission from the vicinities of nearby stars that are likely to have planetary systems. Our February observing session was cancelled when the line receiver became non-operational but the May session did enable us to complete a first exploratory experiment.

To date we have observed thirteen nearby stars for on-source integration times of up to one hour (total power mode). The list of candidate stars is given in the Appendix. Our preliminary single-channel upper limits for H_2O-line emission in the integrated spectra are typically 100 mK. However, we have observed several possible cases of 'transient phenomena' at the 200 mK level. These may merit further investigation.

In the course of pursuing our programme we found it possible to use the H_2O-line system to detect in a single scan some of the weakest of the known first-generation IR/H_2O sources (U Her, S Cor B).

Proposal (for second half of 1974):

We wish to continue and extend our H_2O-line observations of nearby stars. What has been carried out thus far was only an exploratory experiment which does not represent the best that we would like to do either in terms of sensitivity on single stars of exceptional interest (e.g. Barnard's Star) or in terms of the number of stars observed.

In the next six months we wish to continue our observations of several stars which are of great intrinsic interest (astrometric evidence for planets has been claimed) which also gave rise to possible 'transient phenomena' in our May 1974 observing session. We wish to make fairly intensive ($\sim$ 1 day per star) observations of these stars; as outlined in our initial programme proposal (Nov. 1973). We also wish to extend our observations to cover the Palmer-Zuckerman sample of several hundred nearby stars, taken from the Gliese Catalogue. As mentioned in the Nov. 1973 proposal, we wish to spend only $\lesssim$1/2 hour per star in this phase of the programme.

We have considered some of the problems that might arise should we actually be fortunate enough to discover a positive signal. In order to test our ideas on data analysis and de-coding, we propose to spend a few hours observing the VY CMa IR/H_2O source, which is known to be variable on time scales of $\lesssim$ 1 hour.

The total amount of time requested for this programme over the next six months is 150 hours.

P.A. Feldman
York University

A.H. Bridle
Queen's University

APPENDIX

BD + 5°1668

ε ERIDANI

τ CETI

BD + 43°4305

61 CYGNI

BARNARD'S STAR

LALANDE 21185

τ BOOTIS

BD 20°2465

GR 1618

LALANDE 25372

LUYTEN 726-8

AOe 17415-6