Pergamon
www.elsevier.com/locate/actaastro
PII: S0094-5765(00)00028-X
Acta Astronautica Vol. 46, No. 10–12, pp. 655–659, 2000

Printed in Great Britain
0094-5765/00 $ - see front matter

A SEARCH OF THE IRAS DATABASE FOR EVIDENCE OF DYSON SPHERES

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Abstract—One of the forms of astroengineering activity that a very advanced civilization could possibly carry on is the constructions of huge "buildings" in space around the central star. Historically such constructions are called Dyson Spheres. We would like to introduce a new name — Astroengineering Constructions (AC) — to mean a more general type of construction not necessarily related to any specific star. AC absorb energy from different types of activity and re-emit it as infrared radiation, i.e. radiation lying in the submillimeter and millimeter range. Further, AC are expect to have spectra similar to the black-body spectra because they re-emit all the energy that they absorb, although in the infrared range, as already mentioned. Thus, the effective temperature of these Planckian distributions is expected to lie between 3–300 K with the spectrum peaking between 10 μm and 10 mm. We have analyzed the IRAS database and extracted a catalog of sources whose spectra are similar to the black-body emission. The catalog of these sources and their preliminary parameters are discussed. The distribution of the color temperatures of IRAS sources and the sky distribution of sources are also considered. The possibility of the distinction of AC from thick circumstellar dust shells around red giant stars is discussed.

1. INTRODUCTION

At the beginning of the search for life in the Universe two different research trends were suggested. The first trend is the systematic search of information signals from nearest Sun-like stars in the radio range. Here it is proposed that extraterrestrial civilizations are associated with a planet system, and they have a similar technology with earthly civilization. Now several projects are in progress (e.g. Phoenix, SERENDIP).

The second trend is the search of new astrophysical types of objects which can be associated with astroengineering activity in Space of super civilization. This way aims at research of physical conditions that are necessary for origin and evolution of life limited by real physical laws. In the present paper we discuss the second astrophysical way for searching extraterrestrial civilizations and present the result of our research of IRAS database in order to extract astrophysical objects that may be associated with astroengineering activity in Space of super civilizations.

In our opinion the most interesting and perspective range is infrared — submillimeter — millimeter range. The reason is that super civilizations in principle have a possibility to build huge constructions in space. Historically such constructions are called Dyson Spheres (DS). We suggest a new name for such kind of objects — Astroengeneering Construction (AC). DS has to be placed near the star and screen it; in reality the space constructions may be not related with stars. AC my also be placed near the star without full coverage.

Such kind of objects should absorb most of internal energy of different sources and re-emit it at longer wavelength. These AC should be seen as infrared — submillimeter — millimeter sources. The spectra of such type of objects must have the black-body spectrum with the peaking between 10 μm and 10 mm [1]. Correspondingly the effective temperature is in the range 3–300 K. Note, that optical counterpart have to absent or at best be a very weak one compared to these sources.

One of the first attempts to use the IRAS Database for searching astroengineering activity was made by Slysh [5]. He took five IRAS objects with spectra close to black-body spectrum and analyzed the possibility that these sources were Dyson Spheres. His main conclusion is following. It is necessary to produce the new surveys at millimeter and submillimeter wavelengths with high angular resolution and searching through the full IRAS Database for sources whose nature may be related astroengineering activity of the super civilizations.

2. DATABASE ANALYSIS AND RESULTS

For our research we have used IRAS Database which was obtained by the satellite's infrared telescope with four detectors sensitive at 12, 25, 60, and 100 μm [4]. The temperature of sources was estimated within the approximation of the black-body spectrum.

From previous analyses of IRAS Database several interesting peculiarities were found [2,3]. Two peaks

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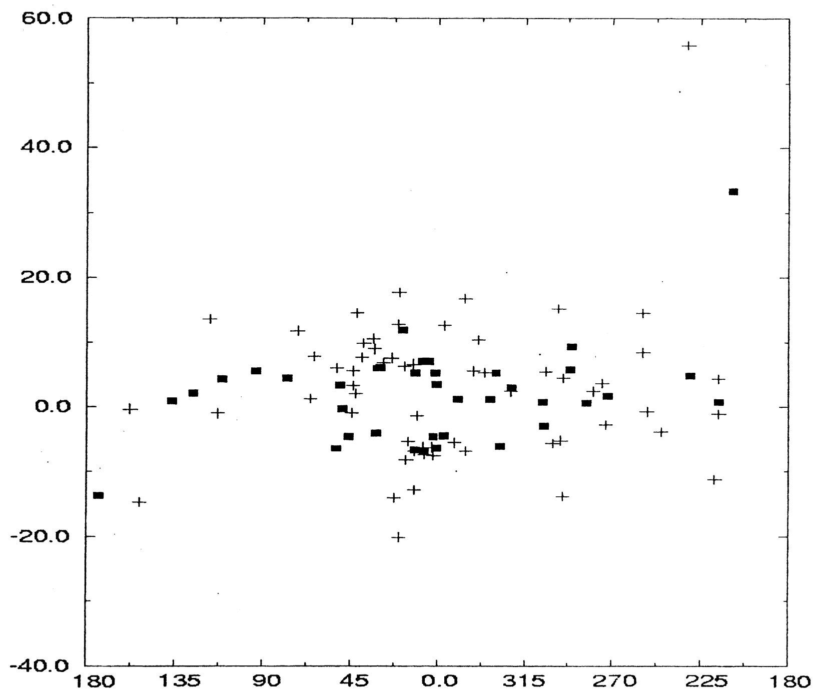

Fig. 1. The sky distribution of the selected sources. The squares are 100–120 K temperatures objects, the plus are 280–290 K temperatures objects.

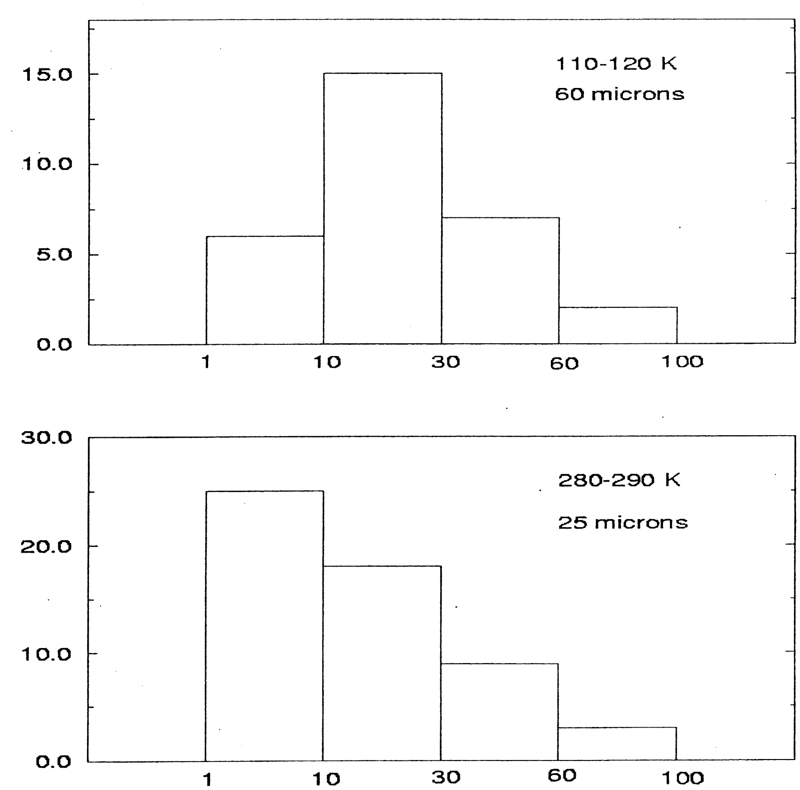

Fig. 2. Histogram of the fluxes for the selected sources.

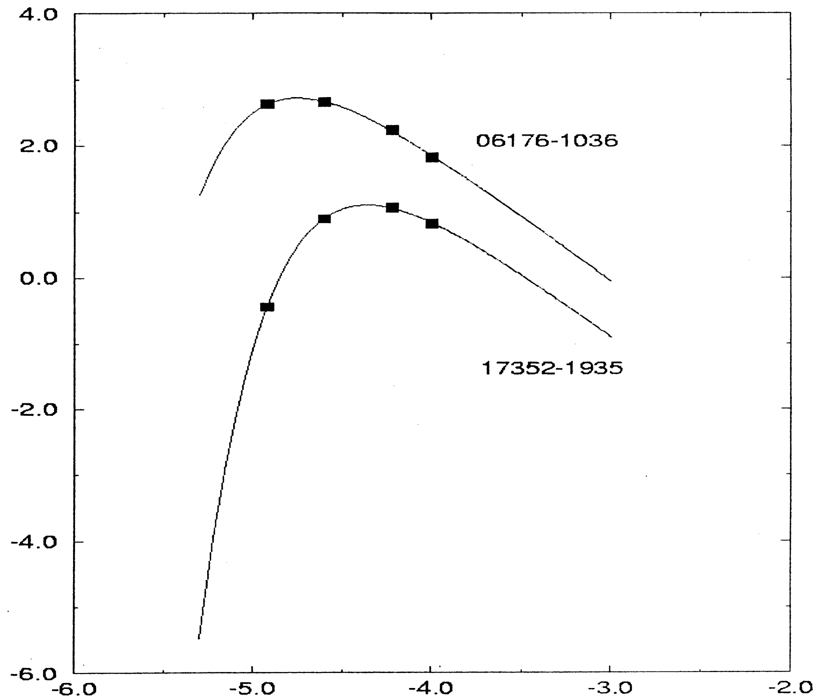

Fig. 3. Spectra of the two IRAS sources 06176–1036 (T = 289, q = 0.0007) and 17352–1935 (T = 117.95, q = 0.0011) with the fitting of black-body spectra. The solid line is Planck-function for the calculated temperatures. The squares are the observation points of spectrum. $Y - \log(\text{flux})$ (Jy), $X - \log(\lambda)$ (m).

were found for temperatures of 110–120 K and 280–290 K from the temperature histogram which was built for 3000 brightest sources in direction of the poles. Analysis of the sky distribution has shown that objects with 110–120 K temperature are concentrated directly around the Galactic plane and the center of distribution is in the longitude 180–330°. The same situation is also typical for sources with temperature 280–290 K, but the concentration is not so strong as for sources with temperature 110–120 K and there is no maximum in the direction to Galactic center.

Using these detected peculiarities we have decided to devote specific attention to these two temperatures ranges. At first the catalog of all sources at these two temperatures ranges was formed. Then the parameter q was calculated by

$$q = \sum_i \left(\frac{F_{\text{app}_i} - F_{s_i}}{\max} \right)^2 \tag{1}$$

Table 1. Table of four brightest IRAS selected sources

Source	α 1950 hh mm ss	δ 1950 dd mm ss	IRAS fluxes† (Jy)	q	Flux at 100 Ghz (Jy)	Flux at 10 Ghz (Jy)	Assoc. Name
06176–1036	06 17 37.7	−10 36 53	421.6 456.1 173.1 66.19	0.0007	0.224	0.1	RAFCL 981
10216–5737	10 21 36.0	−57 37 15	4.729 122.9 125.8 140.6	0.126	0.463	2.13×10^{-3}	G284.30 8
17103–3207	17 10 21.7	−37 02 32	32.08 335.90 849.7 537.4	0.088	2.091	9.55×10^{-3}	PK 349 + 1.1
19486 + 1350	19 48 41.8	+ 13 50 32	0.2693 5.232 11.25 3.482	0.076	2.7×10^{-2}	1.22×10^{-4}	TW AQL

†Four IRAS fluxes are listed for 12, 25, 60, 100 μm, respectively.

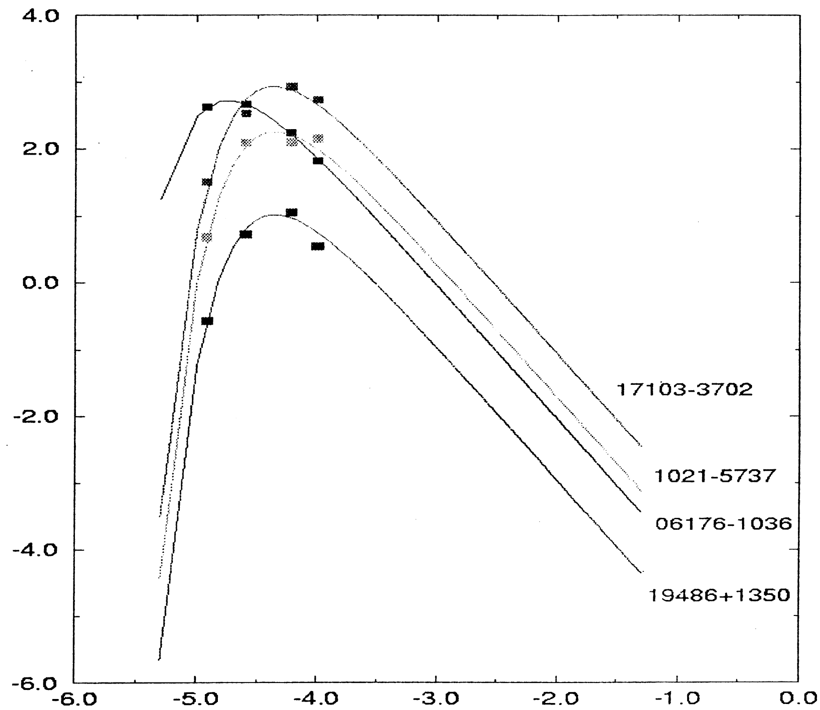

Fig. 4. Spectra of four IRAS brightest selected sources. The solid line is the Planck-function for the calculated temperature. The squares are the observed points of the spectrum. $Y - \log(\text{flux})$ (Jy), $X - \log(\lambda)$ (m).

where $Fapp_i$ is approximation fluxes for black-body spectrum, Fs_i is observation fluxes, max is maximum value from $Fapp_i$ and Fs_i. The parameter q characterizes a quality of fitting of observational spectra. Using $q = 0.15$ as a limit for coincidence we have formed second a catalog of sources with the temperatures 110–120 and 280–290 K. This catalog contains 38 sources with temperature 110–120 K and 60 sources with temperature 280–290 K. The sky distribution of the selected sources is presented in Fig. 1. The sources are concentrated near the Galactic Plane and the Galactic Center.

No relation between the parameter q and fluxes is showing up. In Fig. 2 the distribution of flux is present. For sources with temperature 110–120 K maximum (15 sources) is the flux range 10–30 Jy, for sources with temperature 280–290 K the flux is in the range 1–10 Jy (25 sources), respectively.

In Fig. 3 spectra of the two sources 06176–1036 and 17352–1935 are shown. These two sources have the best fitting with theoretical spectra for the approximation temperatures. Source 17352–1935 is associated with the Planetary Nebula 7+6.2. Source 06176–1036 is associated with infrared source 3RAFLC. Fifty eight selected sources are unidentified. Table 1 presents parameters of fours brightest sources. The analysis of the approximated spectra shows (Fig. 4) that it is possible to observe these sources in mm–cm-wavelength. In this case we can check the behavior of the spectra at these frequencies and determine the conformity of the real spectra of the sources to the black-body spectrum.

In a future investigation we have selected 10 stellar sources (see Table 2). Seven sources are variable stars, five of them are single stars, one is a binary star, and one is of unknown type. We plan to use these 10 objects for next observations at the different frequency ranges.

Finally, we wish to stress a possibility, of confusion between AC and thick circumstellar dust shells around red giants exists. However, we are confident that the confusion may be resolved by additional observation of OH emission, infrared spectra, proper motions, etc.

3. CONCLUSIONS

1. Analysis through of the full IRAS catalog has shown that the two temperatures range of 110–120 K and 280–290 K are most interesting for searching AC.
2. Sources were selected for investigation by the parameter q and their association with stars. Variable stars are the majority among the selected sources.
3. Future work has to involve new surveys at milli-

Table 2. Table of 10 IRAS source which associate with stars

Source	T (K)	q	Flux† (Jy)	Ass. Cat.	Ass. Name	Sp. Class
03227+3841	286.91	0.009	6.625	Deaborn Obs.	DO 9931	
			7.625			
			2.010			
			1.423			
07098−0119	284.88	0.14	2.986	GVVS	MW MON	
			2.370	Suspect. Var	03454	
			0.4172	Rev. AFGL	BAFGL	
			1.131		45725	
12185−4856	289.99	0.13	5.918	GCVS	SX CEN	F5-G3
			3.587	SAO	223370	F5
			1.101			
			1.550			
16473−2528	289.10	0.13	24.15	GCVS	AF SCO	
			17.69			
			3.498			
			8.137			
18228−2618	286.35	0.11	8.517	GCVS	HI SGR	
			7.724			
			1.209			
			3.219			
19199+3950	283.32	0.039	3.656	GCVS	HP LYR	A6
			4.564			
			1.075			
			1.246			
19399−2131	286.99	0.14	3.027	GCVS	V984 SGR	M0E
			2.105			
			0.4628			
			1.000			
16206−5956	118.3	0.078	0.3564	SAO	243756	B0
			11.04			
			12.30			
			4.828			
19486+1350	116.81	0.076	0.2693	GCVS	TW AQL	G0-K0
			52.32			
			11.25			
			3.482			
08440+1803	113.75	0.022	2.113	Star with em.	ABELL 30	
			41.55	Line	PK 208+33.1	
			89.75	Str. Pl. Neb.		
			50.46			

†Fluxes are presented for 12, 15, 60 and 100 μm, respectively correspondingly.

meter and submillimeter wavelengths, and observations for selected sources at different wavelengths including optical, radio and other ranges.

Acknowledgements—We would like to acknowledge the very helpful discussions we had with L.M. Gindilis and V.L. Zhuravlev. The special thanks to SETI Institute and personally to Dr Billingham for financial support to present this paper in 48th IAF Congress.

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