

A Search for Dyson Spheres Around Late-type Stars in the Solar Neighborhood

Jun Jugaku

Research Institute of Civilization, 2-29-3 Sakuragaoka, Tama-shi, Tokyo 206-0013, Japan

Shiro Nishimura

National Astronomical Observatory, Mitaka, Tokyo 181-8588, Japan

Abstract. We continued our search for partial (incomplete) Dyson spheres associated with solar-type stars (spectral types F, G and K) within 25 pc of the Sun. No candidate objects were found in a total of 384 stars.

1. Introduction

We have shown that Dyson (1960) spheres associated with solar-type stars can be detected as the excess flux at 12μ (Jugaku & Nishimura 1991). Even if only 10^{-2} of the radiation energy of the central star is converted to thermal emission from a partial (incomplete) Dyson sphere maintained near 300 K, it could be easily detected with the present capability of infrared photometry. In particular, we note that 2.2μ radiation (K magnitude) is a good measure of the photospheric radiation of a central star. Then, the index $K - [12]$, where $[12]$ denotes the magnitude at 12μ , should show significant positive values for Dyson spheres.

2. Observational Material

The catalog compiled by Woolley et al. (1970) lists 1,744 star systems nearer than 25 pc. We find 887 stars of spectral types F, G, and K and luminosity classes IV, V, and VI in the catalog, out of which 458 stars are also listed in the IRAS Point Source Catalog (1988) as measured at 12μ . In Papers I - III (Jugaku et al. 1995; Jugaku & Nishimura 1997; 2000) we examined $K - [12]$ color of 365 solar-type stars from those 458 stars. In this continued study, we examine $K - [12]$ index for 19 stars by utilizing the recently released data of the Two-Micron All-Sky Survey (2MASS). The results are summarized in Table 1.

3. Conclusion

Combined with the results of Paper I (180 stars), Paper II (50 stars), and Paper III (135 stars), we have not found any candidate stars which may have Dyson spheres in a sample of 384 solar-type stars within 25 pc of the Sun.

Acknowledgments. Information retrieval for this study was supported by facilities of the Astronomical Data Analysis Center of the National Astronomical Observatory, Japan.

Table 1. The first column gives the star number in the Woolley et al. (1970) catalog, the second column shows the HD number, the third column is the spectral type from Woolley et al. (1970), the fourth column is K magnitude taken from 2MASS, and the fifth column gives $K - [12]$ color. For all stars the value of $K - [12]$ color is in the range of -0.30 to $+0.30$ mag. The scatter in this range can be explained by observational errors. If the waste heat of a Dyson sphere is in the order of 10^{-2} of the radiation energy of the central star, the color excess should be > 1 mag.

RGO Star No.	HD	Sp. Type	K (mag)	$K - [12]$ (mag)
42	5133	K3	4.89	-0.24
60A	9770	K3	4.68	0.05
103	16157	K7	4.89	0.22
142	21531	K7	5.08	0.29
157A	24916	K5	5.36	0.19
200A	34673	K3	5.01	0.11
201	35171	K5	5.22	0.22
204	36003	K5	4.87	0.10
259	52698	K0	4.62	0.02
260	53143	K0	4.98	-0.04
9409A	108799	F8	4.85	0.16
481	110315	K8	5.07	0.14
529	120467	K6	5.16	0.06
593A	139341	K4	4.71	0.04
614	145675	K1	4.69	0.09
9613	164922	K0	5.10	-0.11
859B	212697	G1	4.10	0.12
868	214749	K5	5.04	0.21
886	217580	K4	5.22	-0.02

References

- Dyson, F. J. 1960, *Science*, 131, 1967
- Infrared Astronomical Satellite (IRAS) Catalogs and Atlases 1988, Vols. 1-7, NASA RP-1190, (Washington D.C.: NASA)
- Jugaku, J., & Nishimura, S. 1991, in *Bioastronomy: The Search for Extraterrestrial Life*, ed. J. Heidmann & M. J. Klein, (Berlin: Springer), 295
- Jugaku, J., Noguchi, K. & Nishimura, S. 1995, in *ASP Conf. Ser. 74, Progress in the Search for Extraterrestrial Life*, ed., G. S. Shostak, 381 (Paper I)
- Jugaku, J. & Nishimura, S. 1997, in *Astronomical and Biochemical Origins and the Search for Life in the Universe*, ed. C. B. Cosmovici, S. Bowyer, & D. Werthimer, (Bologna: Editrice Compositori), 707 (Paper II)
- Jugaku, J. & Nishimura, S. 2000, in *ASP Conf. Ser. 213, Bioastronomy '99: A New Era in the Search for Life*, ed. G. A. Lemarchand & K. J. Meech, 213, 581 (Paper III)
- Woolley, R., Epps, E. A., Penston, M. J., & Pocock, S. 1970, *Roy. Obs. Ann.*, 5