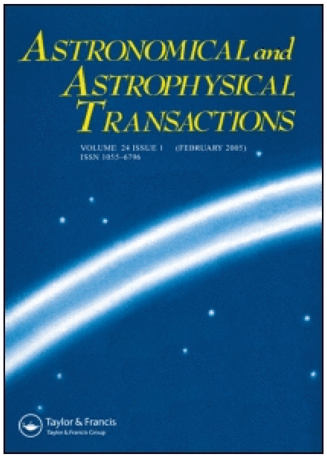

Astronomical & Astrophysical Transactions
The Journal of the Eurasian Astronomical Society
Publication details, including instructions for authors and subscription information:
http://www.informaworld.com/smpp/title~content=t713453505

Low-frequency cosmic background for the cloudy interstellar medium model

Yu. V. Tokarev [a]
[a] Radiophysical Research Institute, N. Novgorod

Online Publication Date: 01 August 1999
To cite this Article: Tokarev, Yu. V. (1999) 'Low-frequency cosmic background for the cloudy interstellar medium model', Astronomical & Astrophysical Transactions, 18:1, 151 - 153
To link to this article: DOI: 10.1080/10556799908203048
URL: http://dx.doi.org/10.1080/10556799908203048

Astronomical and Astrophysical Transactions, 1999, Vol. 18, pp. 151–153
Reprints available directly from the publisher
Photocopying permitted by license only

LOW-FREQUENCY COSMIC BACKGROUND FOR THE CLOUDY INTERSTELLAR MEDIUM MODEL

Yu. V. TOKAREV

Radiophysical Recearch Institute, N. Novgorod

(Received January 13, 1997)

The first interpretation of the cosmic noise background spectrum in the broadband frequency range 0.25–200 MHz with a model of the cloudy interstellar medium is presented.

KEY WORDS Interstellar medium, cosmic background, interstellar clouds

1 INTRODUCTION

A model of an inhomogeneous medium is generally used for the analysis of the cosmic noise background spectrum $I(f)$ (see for example Kaplan and Pikel'ner, 1979). Inherent contradictions of this approach for the frequency range below 1 MHz have been shown recently (Fleishman and Tokarev, 1995; Korsakov *et al.*, 1996).

2 MODEL DESCRIPTION

In this paper we present a new interpretation of $I(f)$ with a model of the diffuse ISM described as a set of ionized H clouds which were discovered by Reynolds (1990) (electron concentration of 0.15 sm^{-3}, temperature of 6000 K, filling factor of 20%). For the usual value of 6 μG for the interstellar magnetic field the Razin cut–off frequency $f(r)$ would be 3 MHz for the conditions in the clouds; that is, near the observed $I(f)$ maximum (see Figure 1). The spectrum $I(f)$ was considered to result from three components: (a) synchrotron radiation from cosmic ray electrons in the clouds; (b) similar radiation from the intercloud medium; (c) extragalactic radiation with an effective temperature at 178 MHz of 17 K and a temperature spectral index of 2.8. This was used so that the effective optical depth of the cloudy ISM increases, with a fall in frequency, more slowly than is predicted by an inverse power law (Tokarev, 1972). It was also taken into account that the sharp

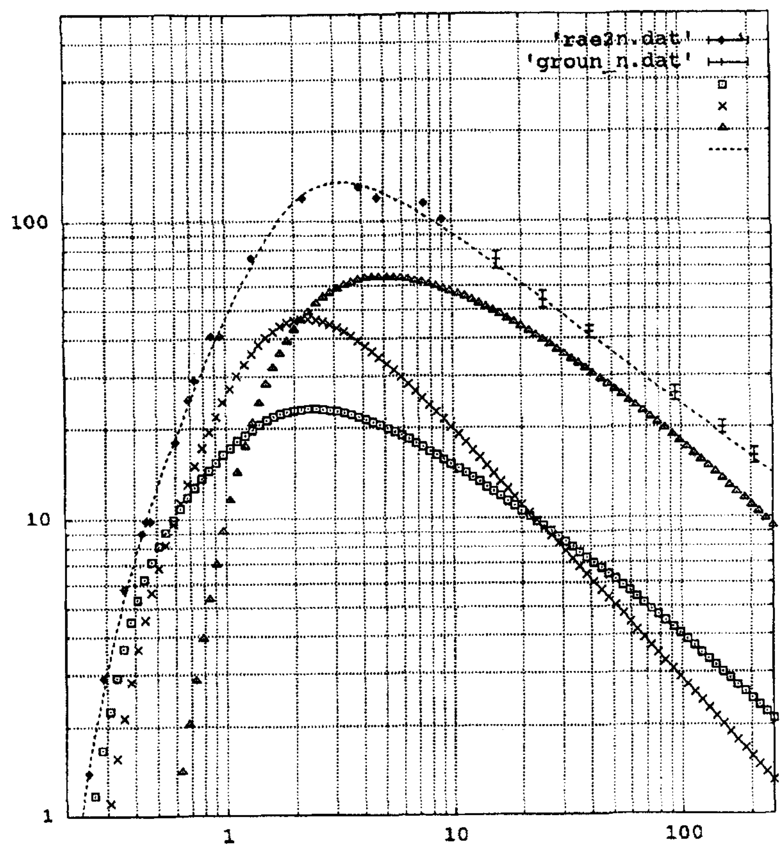

Figure 1 Cosmic noise background spectrum from 0.25 to 200 MHz for the region of the "north halo minimum" (intensity in units 10E-22 W m^{-2} Hz as a function of frequency in MHz). Diamonds – RAE-2 data; vertical bars – groundbased data. The solid line is the sum of the a,b,c background component (see text). The dashed plots are the spectra of the separate components (a,b,c components from top to bottom at 200 MHz respectively).

depression of $I(f)$ at $f < 0.6$ MHz is caused by absorption in a local interstellar cloud (Korsakov *et al.*, 1996).

3 RESULTS AND CONCLUSIONS

The best fit of the $I(f)$ curve calculated in the manner described above to the observed spectrum from 0.25 to 200 MHz was made. The results are presented at Figure 1 for the total background as well as for its separate components.

The following conclusions can be drawn. The observed $I(f)$ maximum near 3 MHz is due to the ambient plasma undergoing synchrotron emission; the volume synchrotron emissivity into the Reynolds clouds with a 20% filling factor must be about 16 times higher than the emission out of them; and the extragalactic spectrum has no significant low-frequency turnover outside the galactic absorption gas at least up to 1 MHz. The results are valuable for the investigation of spatial variations of the interstellar magnetic field and the propagations of cosmic ray electrons in the cloudy ISM; they are also useful for low-frequency extragalactic radiation studies.

Acknowledgments

I thank the Russian Fundation for Basic Research for financial support (grant No. 96–02–18508).

References

Fleishman, G. D. and Tokarev, Yu. V. (1995) *Astron. and Astrophys.* **293**, 565.
Kaplan, S. A. and Pikel'ner, S. B. (1979) In: N. G. Bochkarev (ed.), *Physics of the Interstellar Medium*, Nauka, Moscow, 592 (in Russian).
Korsakov, V. B., Tokarev, Yu. V., and Fleishman, G. D. (1996) *Pis'ma AJ*, in press.
Reynolds, R. J. (1990) *Astrophys. J.* **349**, L17.
Tokarev, Yu. V. (1972) *Astron. Zh.* **48**, 710.