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The Spectral Index of the Galactic Foreground Affecting CMB Measurements

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Abstract. We present results of measurements of the spectral index of the Galactic Diffuse emission (GDE), an information essential to evaluate the contamination of measured properties of the CMB by foregrounds.

1. Introduction

TRIS experiment is a set of three radiometers with geometrically scaled antennae (HPBW $= 18° \times 22°$) operating at 0.6, 0.82, and 2.5 GHz, installed at Campo Imperatore (2000 m a.s.l., lat. = 42.45 N, long. = 13.58 E) on the Gran Sasso Mountain. Goal of TRIS is the search of deviations from a Planck distribution in the spectrum of the Cosmic Microwave Background at frequencies close to 1 GHz (Bonelli et al. 1995, Zannoni et al. 1999) and, hopefully, get information on Ω_b, the baryon density of the Universe (see Partridge (1995)). The observing strategy is to make absolute maps of large regions of the sky at the three frequencies in order to disentangle the components of the diffuse celestial signal. Here we report TRIS measurements of the spectral index γ of the GDE.

2. The frequency spectrum of the Galactic diffuse emission

The Galactic foreground has a power law frequency spectrum with a spectral index γ which makes T_{Gal} the dominant component of the diffuse sky emission below 1 GHz. Using TRIS we measured profiles (drift scans) of the sky temperature versus right ascension α at constant declination ($\delta = 42°$) letting the sky transit through the beams of the antennae aimed at the zenith. The resulting profiles at 600 and 820 MHz are shown in fig. 1 (temperature scale accurate to 3%, accuracy of the zero level not important for the following analysis). They have been combined (see fig. 2) by the T-T plot method (Turtle et al. 1962) which provides a linear regression whose slope n is directly connected to γ of T_{Gal} ($\gamma = log(n)/log(\nu_1/\nu_2)$). We have also compiled T-T plots among our profiles and the 408 MHz sky map by Haslam et al. (1982), convoluted to the beam profile of our antennae. We obtain the following results:

820 *vs* 600	$n = 0.41 \pm 0.01$	$\gamma = 2.92 \pm 0.09$
600 *vs* 408	$n = 0.346 \pm 0.007$	$\gamma = 2.74 \pm 0.05$
820 *vs* 408	$n = 0.137 \pm 0.004$	$\gamma = 2.85 \pm 0.05$

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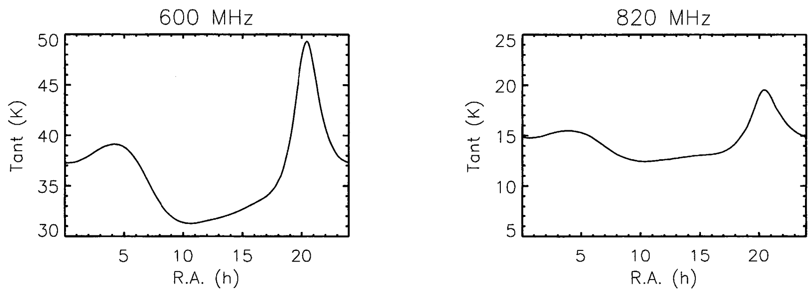

Figure 1. Drift scan profiles at 600 and 820 MHz along $\delta = +42°$. The zero level of the temperature scale is arbitrary.

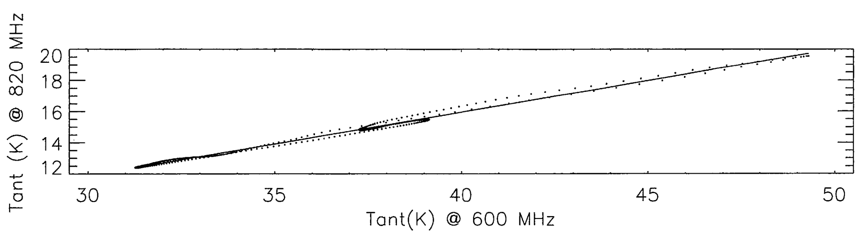

Figure 2. T-T plot of the sky temperature measured at 820 MHz versus the sky temperature measured at 600 MHz. The solid line is the linear regression of the scatter plot.

3. Discussion

The uncertainty on n is dominated by systematic effects and on γ is amplified by the factor $1/log(\nu_1/\nu/2)$ which is bigger when ν_1 and ν_2 are closer. The results obtained from the full sample of TRIS data are average values of n and γ. However it is reasonable to expect different values of n and γ looking at different regions of the Galaxy. A detailed analysis of these variations is underway.

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