ON DUST-CORRELATED GALACTIC EMISSION IN THE TENERIFE DATA

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Recently correlation analyses between Galactic dust emission templates and a number of CMB data sets have led to differing claims on the origin of the Galactic contamination at low frequencies. de Oliviera-Costa *et al.* [1] have presented work based on Tenerife data supporting the spinning dust hypothesis. Since the frequency coverage of the Tenerife data is ideal to discriminate spectrally between spinning dust and free-free emission, we use the latest version of the Tenerife data to study the correlation in greater detail. We find that correlation with dust exists only at low Galactic latitude, and that at present we do not have enough evidence to make a conclusive claim on the origin of the dust-correlated component.

1 Introduction

Cross correlation of CMB data with maps of far-IR emission have shown the existence of a microwave emission component whose spatial distribution is traced by maps of dust emission. Different experiments together indicate a spectral index of $-3.6 < \beta < -1.3$ for this emission component, consistent with free-free, over the frequency range 15-50 GHz (Kogut *et al.* [3], and references therein). However if this emission is indeed free-free a similar correlation must exist between H_α and CMB/dust data. The observed correlation of a small patch of sky that has been mapped in both H_α and microwaves is marginal and inadequate to support the free-free hypothesis. Recent work by Draine *et al.* [2] suggests that the emission could originate from electric dipole radiation from spinning dust grains. Their model predicts a microwave emission spectrum that peaks at low frequencies, the exact location of the peak depending on the size distribution of dust grains and environmental conditions. de Oliviera Costa *et al.* [1] earlier claimed to have found evidence of a rising spectrum between 10 and 15 GHz using the Tenerife data, and hence evidence for spinning dust. We use the most recent Tenerife data to show that the correlation is not necessarily indicative of spinning dust[5].

2 Results and discussion

We use the latest version of the Tenerife data, the destriped DIRBE+IRAS $100\mu m$ template of dust emission (Schlegel *et al.*[6]) and the destriped and cleaned versions of synchrotron maps at 408 and 1420 MHz (Lawson *et al.*[4]). The minimum variance estimate of the correlation between the data and the synchrotron and dust templates (in a joint fit) was found.

We find that the spectral index of the dust-correlated emission between 10 and 15 GHz is negative for all Galactic cuts except for the $b > 20^\circ$ cut. de Oliviera Costa *et al.*[1] interpreted this result for the $b > 20^\circ$ cut as evidence for spinning dust emission. However we find that in this region only a small number of pixels close to the Galactic plane, where signal from the Galactic centre comes in, are actually correlated in the case of both the 10 and 15 GHz data. The remaining pixels are uncorrelated, or even anticorrelated (in two declination stripes in the case of the 10 GHz data). The strength of the correlation and hence the deduced spectral index of this region is strongly affected if we ignore spatial variations as the significance of the correlation in this region is low. The anticorrelation in particular lowers the correlation at 10 GHz and hence raises the spectral index of dust-correlated emission. Further, using sky-rotations we find that the observed correlation in this particular cut is only an alignment of structure due to the rise in the Galactic plane signal and that many rotated patches of the dust map actually correlate more significantly. We have also identified various systematic effects that arise due to the presence of intrinsic errors in the template maps and because the spatial distribution of Galactic emission is in fact different in the templates and the data. All these effects cause a misleading increase in the inferred spectral index.

We also find that the correlation is different for each of the 5 different declination stripes and hence again not spatially invariant. A direct comparison of the correlation coefficients with those from other experiments should therefore only be performed with caution as different experiments look at different regions of the sky and are sensitive to different angular scales. The Tenerife 10 and 15 GHz data were taken on the same patch of sky and their beam sizes are very similar, allowing a direct comparison. When we focus in on the region that is correlated in both data sets, we get high values for the correlation as the pixels considered are close to the Galactic plane, and we get a negative spectral index for the correlated emission. However, uncertainties are large and the use of better quality data and pixel by pixel component separation methods including more low frequency data, Galactic templates and H_α maps would lead to more reliable and better constraints on the origin of the dust-correlated microwave emission.

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