RELIKT1 and COBE-DMR* Results: A Comparison

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Abstract: A recent reanalysis of the RELIKT1 data (Strukov et al., 1992) shows a statistically significant decrement in temperature in a highly smoothed sky-map. COBE-DMR has observed the same region of sky at higher signal-to-noise ratio at three discrete wavelengths. We present results from the DMR sky-maps smoothed to equivalent resolution as RELIKT1 and discuss possible sources of contamination.

1 Introduction

RELIKT1 and the COBE-DMR are to date the only two dedicated space-borne experiments to attempt to detect and map the anisotropy of the Cosmic Microwave Background (CMB). A recent reanalysis of the RELIKT1 data (Strukov et al., 1992) has detected a signal reputedly of cosmological significance at -20° $< \lambda <$ 65°, -45° $< \beta <$ -20° (the so-called 'blamb' region). The COBE-DMR has detected a statistically significant signal on the sky which cannot be attributed to known systematic instrumental errors or Galactic emission (see Smoot et al., 1992; Bennett et al, 1992; Kogut et al, 1992; Wright et al, 1992). This structure is consistent with a description in terms of scale-invariant fluctuations with a Gaussian distribution of amplitudes and random phases. However, COBE-DMR has only claimed a statistical detection of anisotropy, and no claim has been made about individual features on the maps. The unambiguous identification of anisotropy would be useful

- As an aid to searches for small-scale anisotropy.
- As a probe of cosmological models from the properties of hot spots and cold spots (Bond & Efstathiou, 1987).

We therefore reanalyse the DMR skymaps using the same technique adopted by the RELIKT1 group.

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2 Analysis Technique

A weighted sum of the 2 independent A and B channels at each frequency was formed to increase sensitivity, and then the 3 resulting 'sum' maps were masked to reproduce the RELIKT1 sky coverage. The analysis technique from Strukov et al. was then reproduced on the DMR maps, that is

- the best fit monopole and dipole were removed from each map, assigning zero weight to pixels within $\pm$ 15° of the Galactic plane
- the maps were smoothed with a Gaussian beam chosen to match the final smoothings of the RELIKT1 map, (FWHM $\sim$ 15°, 29°, 57°), assigning zero weight to pixels within $\pm$ 15° of the Galactic plane
- the mean temperature in the 'blamb' region was evaluated.

3 Discussion

Figure 1 shows the RELIKT1 and DMR maps in an ecliptic projection. It is clear from the figures that

- the DMR maps have lower noise than the RELIKT1 map
- the only obvious features in the DMR maps have spectral indices suggestive of a Galactic origin (corresponding to structure associated with Ophiuchus and Orion lying outside the Galactic exclusion zone).
- the DMR maps show **no** evidence for the blamb.

Table 1 gives the weighted average temperatures in the blamb region. The RELIKT numbers are from Strukov et al. (1992). The errors are 68% c.l. and include systematic error estimates. The DMR results are consistent with no statistically significant structure in the blamb region. Table 2 gives the likely contribution from Galactic foregrounds, determined at the three DMR frequencies from the models described in Bennett et al. (1992). The RELIKT1 numbers are again from Strukov et al. Our conclusion remains unchanged if we correct for the Galactic foreground signals.

	T (μK)
RELIKT1	-71 $\pm$ 27
DMR 31 GHz	-4 $\pm$ 11
DMR 53 GHz	-1 $\pm$ 4
DMR 90 GHz	+5 $\pm$ 5

Table 1. Sky temperatures in the direction of the claimed RELIKT1 fluctuation.

	T (μK)			
Term	31 GHz	53 GHz	90 GHz	RELIKT1
Synchrotron	-1	0	0	< 13
Free-Free	-12	-4	-1	< 3
Dust	0	-1	-2	< 1

Table 2. Estimate of the Galactic contribution.

4 Conclusions

We find no evidence for the temperature decrement claimed by the RELIKT1 group. It is unlikely that systematic errors or Galactic foregrounds have affected our analysis.

References

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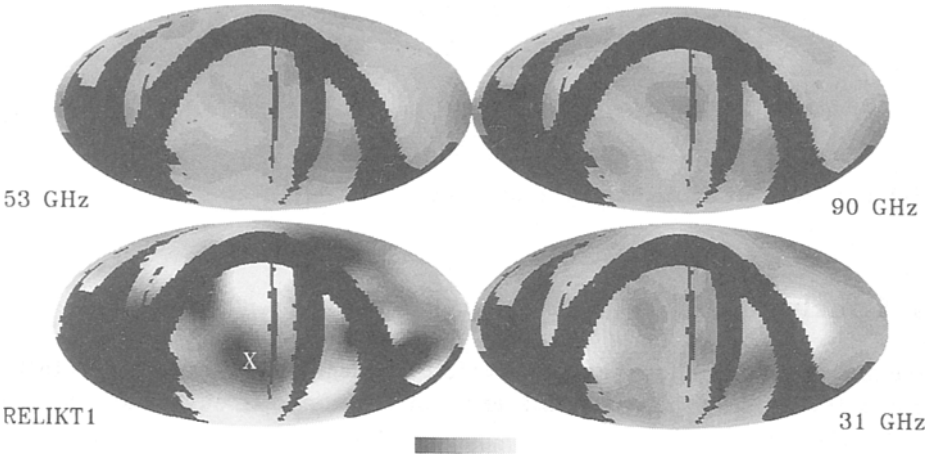

Figure 1: RELIKT1 and DMR sky maps in ecliptic coordinates smoothed to an effective FWHM of $\sim 29°$. The temperature scale is thermodynamic. A band of width $\pm 15°$ about the Galactic plane has been given zero weight, other blank regions correspond to the RELIKT1 sky coverage. The white cross on the RELIKT1 map shows the approximate centre of the 'blamb' region.