ON THE LARGE-SCALE ANISOTROPY OF THE COSMIC BACKGROUND RADIATION IN THE FAR INFRARED

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1. ABSTRACT

We report preliminary results relative to a balloon-borne search for the large-scale anisotropy carried out in 1980 by means of two far infrared photometers centered at 400 and 1100 microns. While these results are consistent with those obtained in an earlier flight, the second, shorter wavelength channel included in the 1980 work provides interesting insights into the influence of galactic dust on such far infrared observations.

2. INTRODUCTION

Fabbri et al. (1980) have reported the existence of a distortion in the dipole anisotropy observed at millimeter wavelength (500 to 1500 microns). Subsequent analysis by Melchiorri et al. (1981) and by Ceccarelli et al. (1982) have shown that galactic emission could be responsible for at least part of the observed signal. Furthermore, the analysis of the celestial intensity distribution in terms of spherical harmonics is less than satisfying due to the limited sky coverage. Ceccarelli et al. (1982) found that Q_2 and perhaps Q_5 are above the noise, while Fabbri et al. (1982) found that Q_3 and Q_4 are marginally significant. In any case, the agreement with the data of Cheng et al. (1981), who claim to have detected Q_5 at 5 sigma, could well be fortuitous. Due to limited sky coverage, we believe that the best representation of our 1978 data is provided by the isophotes of Fig. 1. We note several sources (which are believed to be galactic, since they concentrate in the galactic plane), as well as a large-scale "hot spot" on the right of the figure. It corresponds to a gradient of about 0.1 mK over 6 degrees of wobbling amplitude and it turns out to be of the order of 0.3 to 0.9 mK when interpreted as part of a general quadrupole distribution. The dipole anisotropy is well evident in the figure with the maximum concentrated toward the lower left corner around 8 to 9 hours of Right Ascension.

3. RESULTS OF 1980 FLIGHT

In order to clarify the nature of the distortion, we carried out another set of observations using two detectors operating at 400 and

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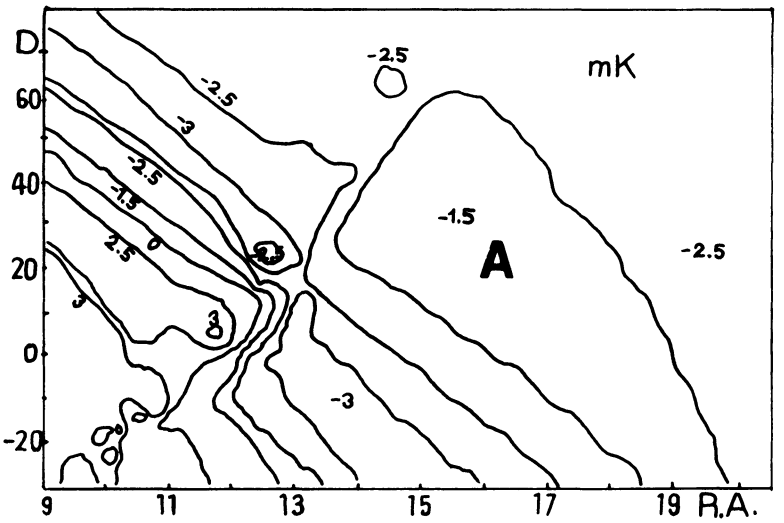

Figure 1. Isophotes of 1978 flight. The "hot spot" A is discussed in the text.

1100 microns, respectively, with roughly unit fractional bandwidth. As in the case of the 1978 flight, the dipole anisotropy was observable in real time in the far infrared channel. (See Figure 2.)

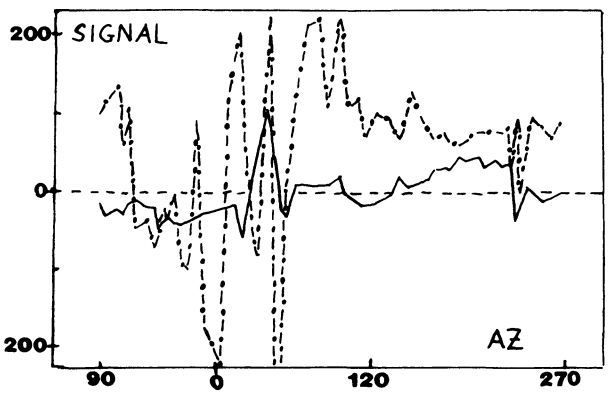

Figure 2. Far infrared (continuous line) and middle infrared channel (dotted line) during one revolution of the gondola in the 1980 flight.

Galactic sources present in both channels have been used in order to normalize the relative amplitude of the two channels. Subsequent subtraction of the 400 micron from the 1100 micron channel should eliminate the local galactic contribution, if all sources (extended as

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well as unresolved at 5 degrees of resolution) have the same spectrum. It is clear, however, from Fig. 2 that several 400-micron sources are not present in the far infrared channel. Therefore, application of this procedure tends to transfer the galactic contribution from the 400-micron into the 1100-micron channel. We decided on filtering out the unresolved sources in both channels and then we subtracted the 400-micron channel from the far infrared channel. The new isophotes are plotted in Fig. 3.

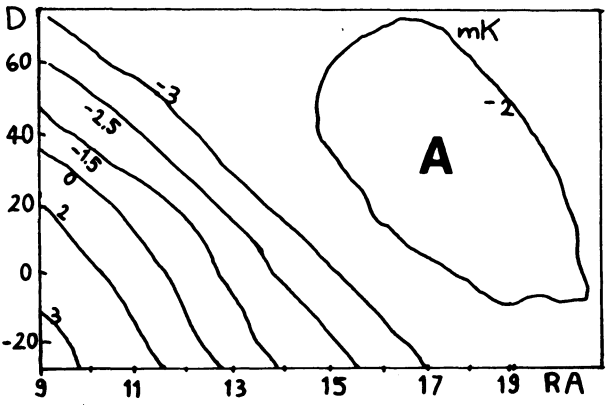

Figure 3. Isophotes of the 1980 flight after subtraction of 400-micron sources from the 1100-micron channel. Note the presence of the "hot spot" A.

Neither the amplitude of the inferred dipole anisotropy nor that of the extended "hot spot" distortion are significantly affected by this source correction technique. This insensitivity of the properties of large scale features to the 400-micron contribution suggests that these features could be in fact cosmological. That is, neither the dipole anisotropy nor the "hot spot" are evident in the 400-micron channel as would be consistent with features having a radiation temperature around 3 K. However, the difficulty we found in correcting for point-like sources is troublesome. Our result implies that correction for galactic emission is a rather difficult task. Therefore, the existence of a large-scale cosmological distortion could be proved beyond any reasonable doubt only after a detailed survey of dust emission at different wavelengths becomes available.

4. REFERENCES

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