GALACTIC BACKGROUND RADIATION IN THE 78 TO 111 EV BAND

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1. EXPERIMENT DESCRIPTION

Galactic background radiation has been observed in the 78–111 eV Be band using 5000 Å beryllium filters in front of a thin-window proportional counter collimated to a 15° full width at half maximum field of view. Be band data have been analyzed from two sounding rocket flights (Bloch et al. 1986, Juda 1988) that viewed seventeen different directions distributed over the northern galactic hemisphere. In Figure 1 the pointing directions of the two flights are indicated on a map from McCammon et al. (1983) of the 130–188 eV B band count rate.

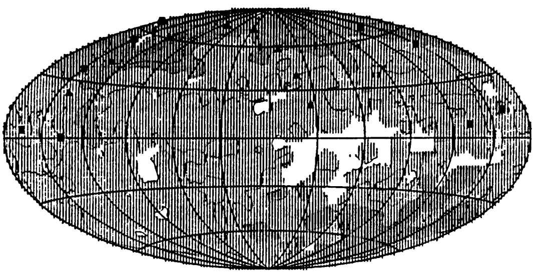

Figure 1. The pointing directions of the Be band detectors superimposed on a map in galactic coordinates of the B band count rate. The triangles show pointings of the first flight, and the squares show pointings of the second. The shading is proportional to counting rate: one vertical shading line in a pixel per 40 cts s^{-1}. The contour interval is 20 cts s^{-1}. The map is an Aitoff projection centered on $l = 0°$.

2. RESULTS

Figure 2 shows the observed count rates in the Be band from the second flight plotted against the count rate from an on-board detector with a boron filter (B′ band). The observed average Be band rate of 6.1 counts s^{-1} corresponds to a flux of 1.4 ph cm^{-2} s^{-1} sr^{-1} eV^{-1} at an effective energy of 96 eV, assuming an $E^{-2.5}$ photon spectrum. The count rate we observe in the Be band is proportional to that observed in the B′ band. The ratio of the count rates is consistent with that expected from a plasma at a temperature in the range $7\times10^5 - 1.6\times10^6$ K (Raymond 1988), if we assume no significant absorption. The inferred emission measures in different directions are then in the range 0.002–0.005 cm^{-6} pc.

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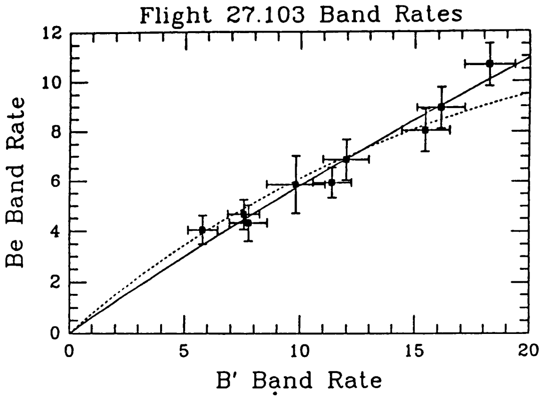

Figure 2. The observed Be band count rates from the second flight plotted against the B′ count rates from an on-board detector with a boron window. The curved line shows the predicted effects of an interspersed absorber, as discussed in the text.

3. DISCUSSION

Because the effective cross section for interstellar absorption of Be band photons is about five times larger than that for the B′ band, there would be large variations in the Be/B′ ratio with H I column density, which are not seen, if an appreciable fraction of the soft x-ray flux had an extragalactic origin. Our observations are consistent with the picture that the Sun is located near the center of an irregularly shaped cavity of typical dimension 100 pc that contains a low-density ($n \approx 0.005\ cm^{-3}$) high-temperature ($T \approx 10^6$ K) plasma responsible for essentially all the galactic background radiation in the Be band and in the B′ band (Snowden et al. 1989). In this model, the intensity in each band in a given direction is proportional to the extent of the hot plasma in that direction.

The lack of variation with intensity of the ratio of the count rate in the Be band to that in the B′ band provides a useful constraint on the amount of neutral material permitted within the emitting volume described above. In a model in which neutral material in the form of small optically thin clouds is homogeneously mixed in with the hot plasma, the ratio of the counting rate in the Be band to that in the B′ band is lower in directions of high count rate. The curve in Figure 2 shows the effect of the 2 σ upper limit to the amount of interspersed absorber along the line of sight in the cavity. It corresponds to an average of one cloudlet of column density $2 \times 10^{18}\ cm^{-2}$ per 20 pc.

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