THE DIFFUSE COSMIC X-RAY BACKGROUND SPECTRUM
IN THE 2-10 keV ENERGY RANGE

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(Received 23 May, 1973)

Abstract. We report a measurement of the background spectrum based on 10000 counts observed in the energy range 2-10 keV. The rocketborne detector system was optimised for cosmic ray noise rejection. A best fit power law spectrum

\[ \frac{dN}{dE} = 16 E^{-1.8} \text{ photons cm}^{-2} \text{ s}^{-1} \text{ sr}^{-1} \text{ keV}^{-1}. \]

resulted from the analysis. At 10 keV this result is consistent with recently assessed higher energy data. We show therefore that the change in spectral index between 5 and 50 keV is approximately \(-0.2\).

1. Experiment Description

The measurement was made using two large area proportional detectors mounted to look out sideways from a sun pointing Skylark rocket SL 904. Each detector had a field of view of 6° \times 23° (FWHM) with the larger angle parallel to the main rocket axis. The effective areas of the two detectors C1 and C2 were 312 and 408 cm². The gas filling was 4.5 cm-atm equivalent depth of 90% argon, 10% methane and the windows were of 6μ melinex. Background rejection systems consisted of anticoincidence by a proportional counter guard detector separated from the main detector by an earthed openwork grid, and risetime discrimination of the main detector pulses. During the observations of the sky, the guard detector vetoed coincident main detector events, and the risetime discriminator coded the main detector pulses. During the rocket ascent, both the guard detector and the risetime discriminator coded the main detector pulses, so that the background rejection parameters could be studied in detail. The counter pulses were stretched and transmitted to the ground by an analogue system which had been checked for linearity. These pulses were analysed by a decoding and destretching system feeding a kicksorter, also checked for linearity. Energy calibration was achieved by the use of an Fe⁵⁵ X-ray source, shone into each detector at 50 s after launch and again at 400 s after launch.

The rocket flight took place at 21h33m UT on 19 November 1970 from Woomera in South Australia. The region of sky scanned extended from the M87 region down across the Milky Way in Centaurus. More details are given in Janes et al. (1971). Discrete sources were observed in Virgo (M87) and in Vela and Centaurus. Cen X-3
was scanned but appeared faint. Figure 1 indicates the integrated counting rate profiles obtained from the first two scans. An electronic fault occurred during Scan 3; therefore this data has not been used. The high counting rate at the beginning of Scan 1 is caused principally by an excess of counts with \( E < 1.7 \) keV. This phenomenon occurs towards the end of Scan 3, and is attributed to solar X-rays scattered by the atmosphere.

![Fig. 1. The Counting Rate Profiles (1-13 keV) for the two detectors. Background spectral data was taken from the periods 150-180 s and 210-240 s. The counting rates shown have been corrected for 25% dead time loss.](image)

because it is only seen at low altitude and at low elevation angles. An excess of counts with \( E > 12 \) keV occurred near the end of Scan 2. This effect occurred when the detector was viewing a direction perpendicular to the Earth's magnetic field. The effect is attributed to atmospheric electrons. Data at \( E > 10 \) keV has been excluded from the spectral analysis.

**2. Spectral Analysis**

Data for the background spectral analysis was taken from the periods 150-180 s in Scan 1, and 210-240 s in Scan 2. No sources were apparent in this data, and an inspection of the Uhuru catalogue (Giacconi et al., 1972) confirms that no discrete source with a strength exceeding 10 Uhuru units (Crab Nebula =950 Uhuru units) was viewed by the detector. Using the decoding and destretching system working from the analogue magnetic tape, spectral data was accumulated in a kicksorter using pulse height channel widths corresponding to an energy bandwidth of roughly 0.15 keV. These channels were subsequently summed to give 0.6 keV channels. Data from the two detectors, and from the two sky scans, was treated separately in order that gain differentials could be taken into account. The energy calibration was established using the Fe\(^{55}\) exposures at 50 s and 400 s. It was assumed that the Fe\(^{55}\) photopeak is centred on 5.95 keV and that the 20% gain increase measured between 50 s and 400 s occurred