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Talk Presented at

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## ABSTRACT

Preliminary maps covering more than 85% of the sky are presented for three energy bands: 0.1 - 0.188 keV(B-band), 0.15 - 0.284 keV(C-band), and 0.45 - 1.0 keV(M-band). Preliminary analysis finds: 1) Although large-scale anticorrelations between the lowest energy X-ray intensity and $H_I$ column density exist, most of the observed spatial variation cannot be explained by simple photo-electric absorption. 2) There is no evidence requiring any substantial fraction of the soft X-ray background in this energy range to be extragalactic. 3) Although most of the B and C-band flux has a common origin, probably in a $\sim 10^6$ K region surrounding the sun, most of the M-band flux does not come from the same material.

## 1. Introduction

Strong evidence that most of the diffuse X-Ray background at energies less than 1 keV is local to the Galaxy and lack of acceptable non-thermal models for its production (Sanders et al., 1977, and references therein) have lead to the conclusion that it most probably is due to thermal radiation from a $\sim10^6$ K low-density plasma which must fill a substantial fraction of interstellar space. Such a model is at least self-consistent since a supernova explosion which has access to an interconnected coronal gas will expend a good part of its energy reheating a large volume of this material to high temperatures where radiative cooling is very slow. Thus even a modest supernova rate is adequate to maintain such a network (Cox and Smith, 1974; Smith, 1977; McKee and Ostriker, 1977).

Although such models are a radical departure from earlier pictures of the interstellar medium, there is considerable corroborating observational evidence. The implications of this new picture are broad and fundamental to understanding the nature of the Galaxy, including the concepts of star formation, spiral structure, cosmic ray confinement and acceleration, and mechanical heating of neutral material (McCray and Snow, 1979, and references therein; Cox, 1979).

In order to study the nature of this supposedly Galactic emission, a systematic survey of the sky in three energy bands was begun in 1972, and is now almost complete. Two recent failures on flights intended to map the one remaining area have necessitated at least another year delay in completing this last section, prompting us to compile a preliminary version of the data now in hand.

## 2. Experiment

Data from eight survey flights are included in the maps presented here. An earlier flight covering part of the missing area has been added to the C-band map, but B and M-band data were not available from this flight. All detectors were thin-window wire-wall proportional counters with antireflection coated collimators giving a circular 6.5° FWHM field of view. One detector on each flight was equipped with a boron-coated Formvar window to provide the B-band data. C-band data were obtained from counters with relatively thick Kimfol (poly-carbonate) windows. Counts in the pulse height range from 0.45 and 0.85 keV from both detectors were combined to form the M-band data. Figure 1 shows the resulting absolute sensitivity curves for each of the three bands. The instruments used in the survey have been more completely described by Williamson et al. (1974) and Burstein et al. (1977).

The scan paths shown in Figure 2 for three flights in the northern Galactic hemisphere are typical of this survey. Operational constraints on the attitude control system dictated the pie-shaped scan pattern, which results in uneven sky coverage, but the 12° spacing at the outer ends of the long scans guarantees at least some response to flux from all points within the pattern, and the heavy coverage near the inner ends has proven useful for detailed spectral fits at a limited number of points in the sky.

Non-X-ray background rates were less than 10% of observed counting rates in all bands, and data for which atmospheric transmission corrections were larger than 30% have been discarded.

## 3. Data

Figures 3, 4, and 5 show composite maps in galactic coordinates for the B, C, and M-bands, respectively. Interflight normalizations are preliminary, but are consistent to better than 15% in almost all cases. The legend at the lower left corner of each map refers to the shading interval. For example, on the B-band map areas with counting rates from 10 to 30 counts $s^{-1}$ are shaded with one line per pixel, areas with rates from 30 to 50 cts $s^{-1}$ have two lines per pixel, etc. Contour intervals are 10 cts $s^{-1}$ for the B map, and 20 cts $s^{-1}$ for the C and M maps.

The mapping procedure used has been described by Williamson et al. (1974). It distributes the counts observed at any moment under the assumption that the sky is locally uniformly bright. While this simple procedure doesn't take advantage of all the information in the data, it does show a comforting degree of resistence to generating spurious features.

One of its less fortunate characteristics is that it can spread counts from bright point sources as much as 13° away from the source. In figure 4, the large black areas near the plane are caused by the Cygnus Loop and the Vela SNR. Both of these bright supernova remnants are almost point sources at the resolution of this survey, but their very high intensity causes them to affect a large area of the map. The two additional bright sources on the M-band map are Sco X-1 and the Crab Nebula.

## 4. Discussion and Conclusions

The B and C-band fluxes vary by about a factor of five from place to place on the sky, with a high degree of anticorrelation with $H_I$ column density which is especially striking in the B-band. This immediately suggests absorption by interstellar gas as the source of the variations. But the effective cross sections for B-band X-rays are about twice those for C-band, so the C/B ratio should increase rapidly with decreasing total rate. What is observed is a slight tendency in the opposite sense. The simplest model seems to be one in which most of the B and C-band flux is produced in an asymmetrical region of $\sim 10^6$ K gas surrounding the sun. Variations in the extent of this region cause most of the intensity fluctuations. The M-band flux does not show the same fluctuations, exhibiting instead an enhanced area about 90° across near the Galactic center which may be associated with the interior of Loop I (Hayakawa et al., 1977). Since the difficulties with producing the M-band X-rays in the same gas which provides the B and C-band flux also seem to get worse when non-equilibrium effects are taken into account (Cox and Anderson, 1979), we conclude that the bulk of the M-band flux has a separate source: perhaps some more extensive corona structure or Galactic halo.

## 5. Acknowledgements

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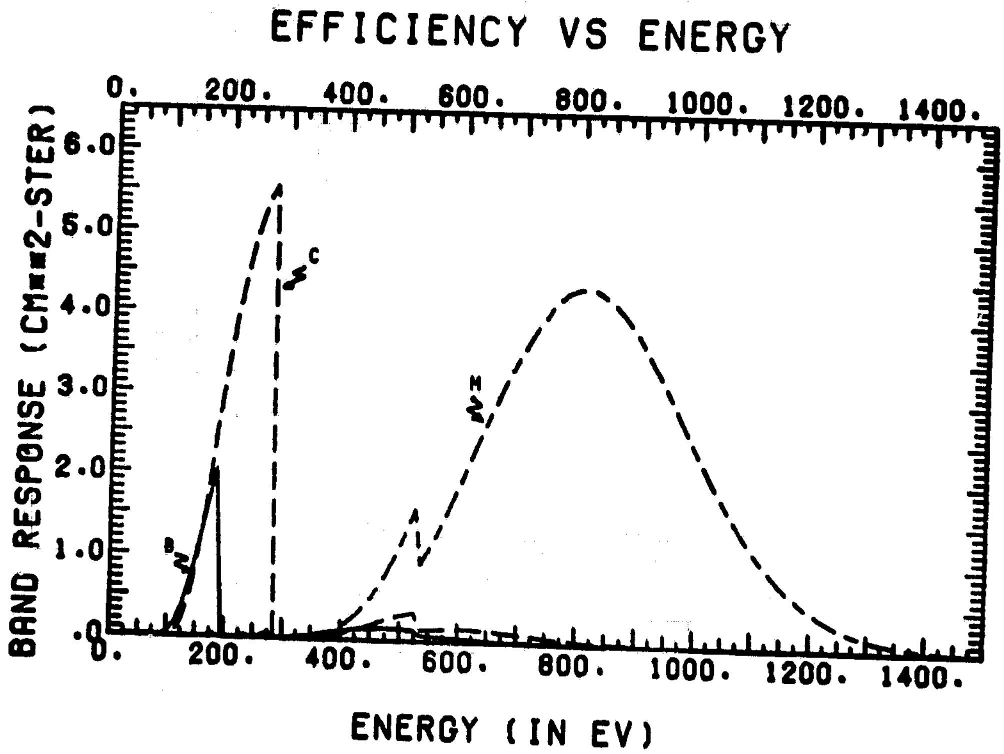



FIGURE 1

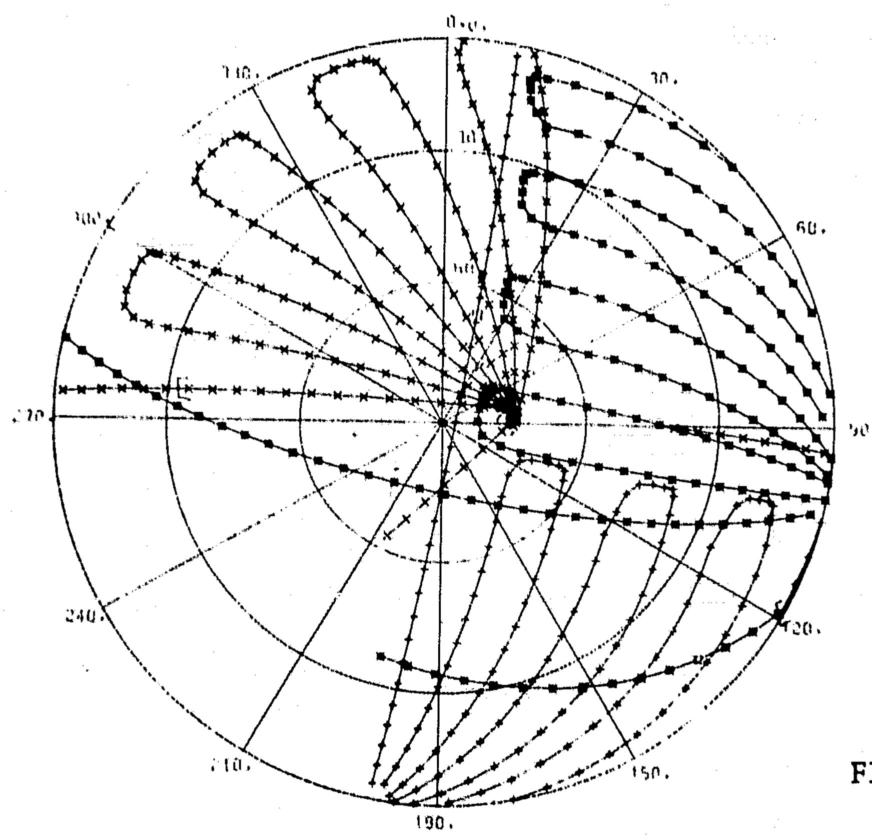
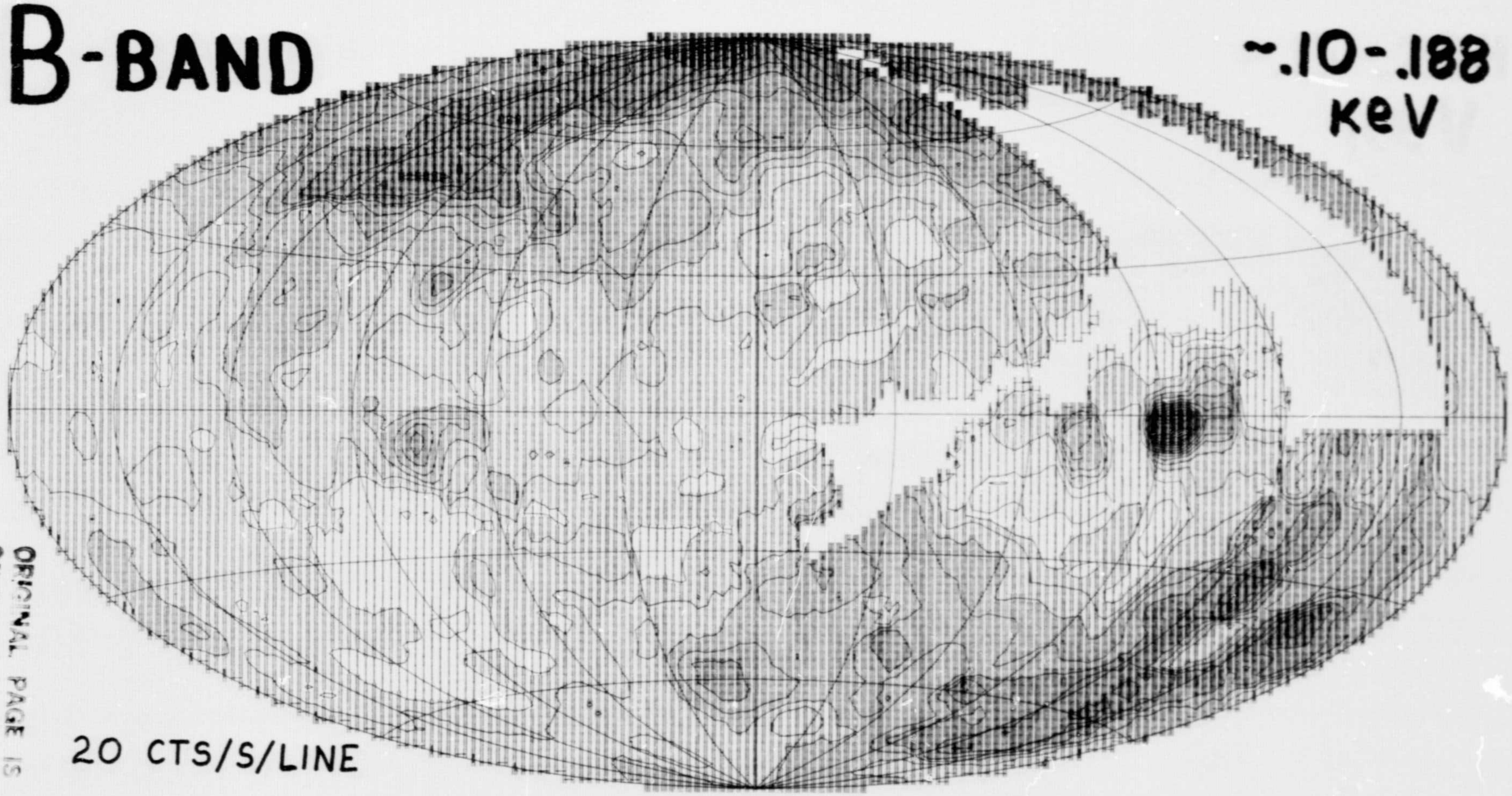
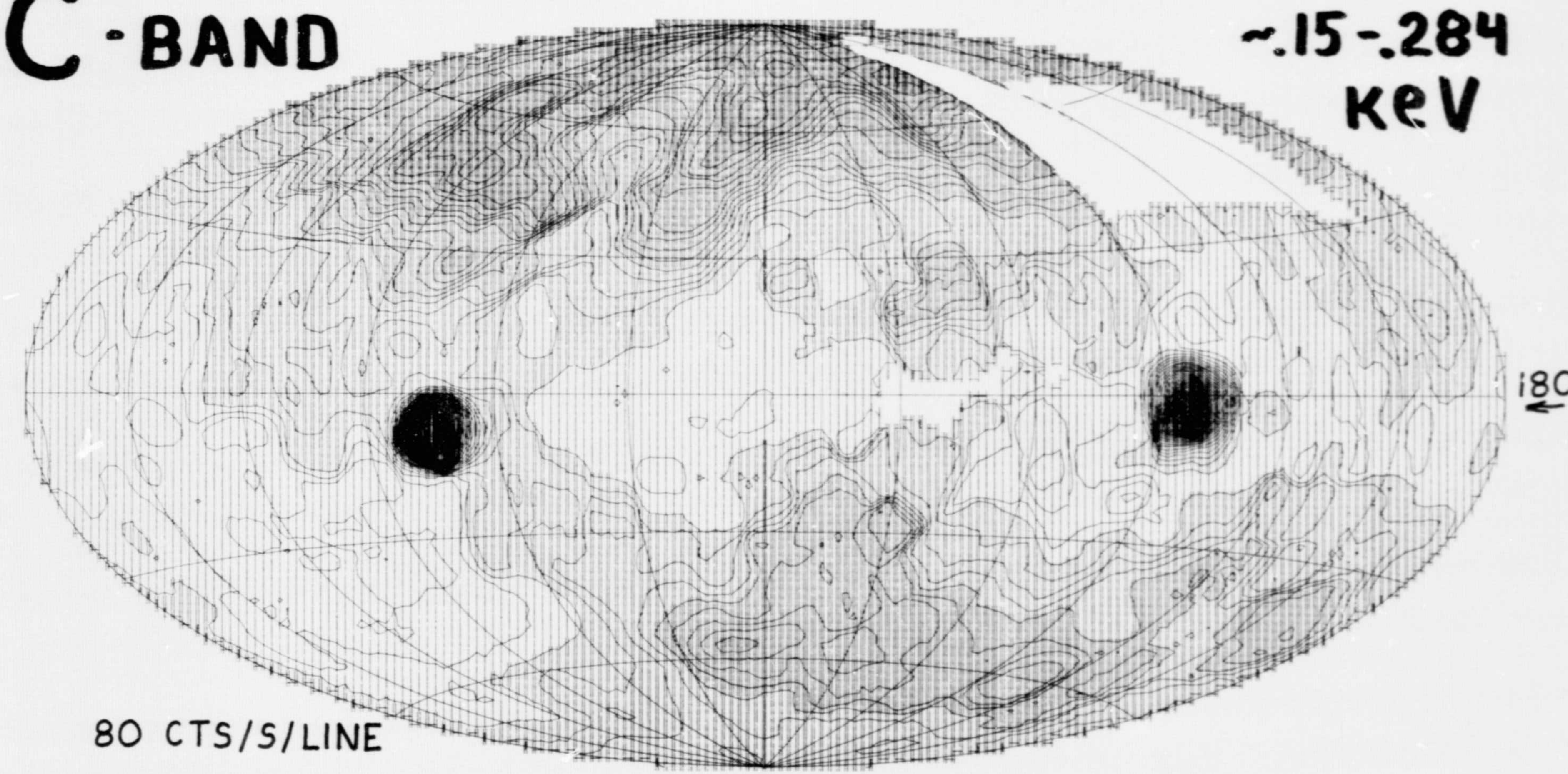
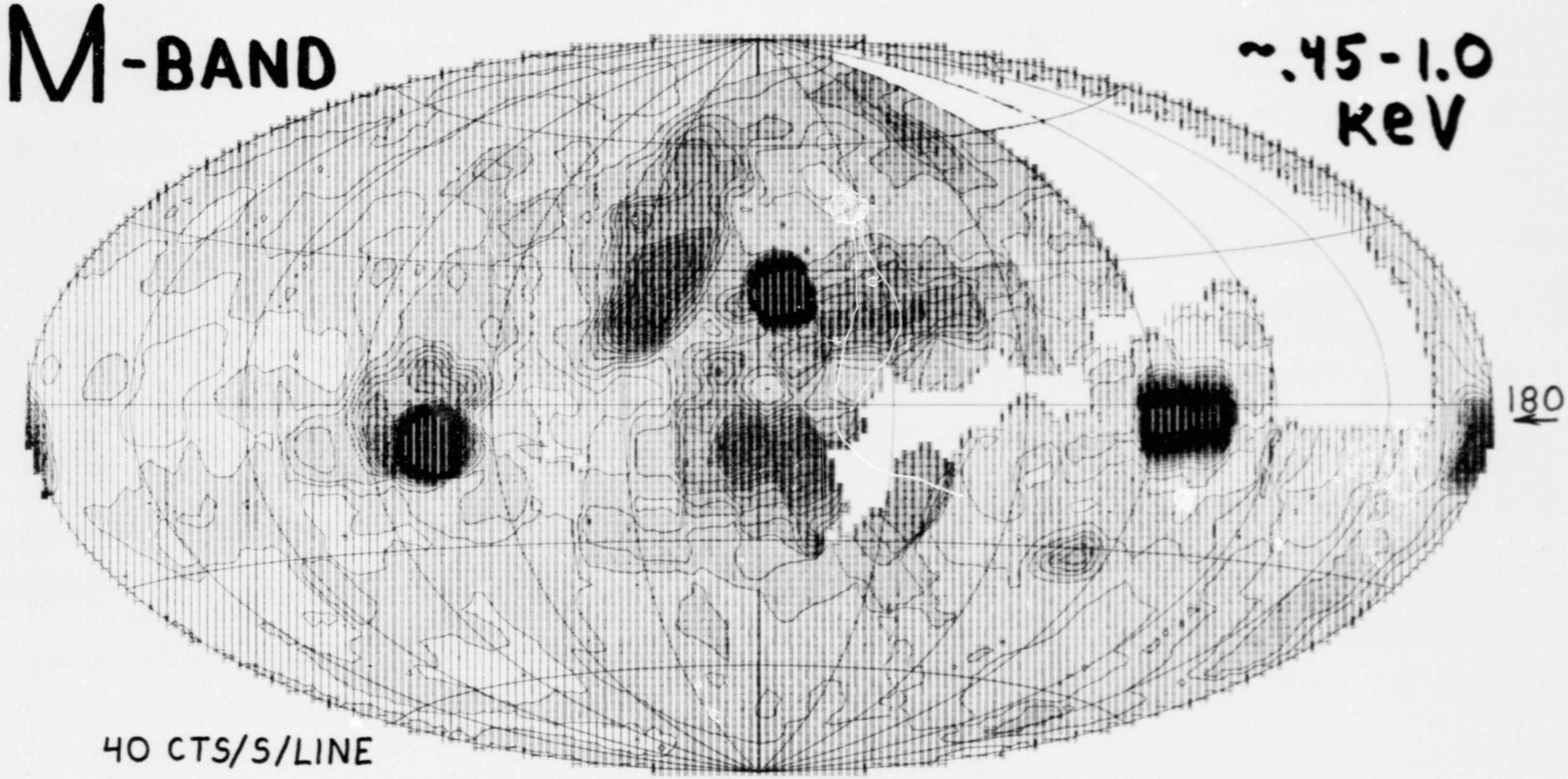



FIGURE 2


B-BAND
~.10-.188
KeV
180°
20 CTS/S/LINE


C-BAND
~.15-.284
KeV
180°
80 CTS/S/LINE


M-BAND
~.45-1.0 keV
180
40 CTS/S/LINE