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Vela V and VI Solar X-Ray Atlas
VI. January 1 to May 1, 1971

The logo features a vertical line that transitions into a wavy line, which then forms a circular emblem. Inside the circle are several smaller circles and dots, resembling a stylized atomic structure or a solar system diagram.

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Vela V and VI Solar X-Ray Atlas

VI. January 1 to May 1, 1971

by

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VELA V AND VI SOLAR X-RAY ATLAS

VI. January 1 to May 1, 1971

by

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J. C. Fuller, W. E. Kunz, and R. W. Milkey

ABSTRACT

This report (Vol. VI) presents data obtained from the solar radiation monitors on the Vela VI Satellites. Equivalent graybody flux in three bands (0.3 to 3, 1 to 8, and 1 to 16 Å) is plotted as a function of universal time, one day per page. Data from January 1 to May 1, 1971, are presented.

I. Introduction

This is the sixth in a series of reports on data from the solar radiation detection instruments developed at the Los Alamos Scientific Laboratory¹ for the Vela V and VI spacecraft. The reader is referred to the first volume of this series² for a detailed description of the instruments and data-reduction techniques, and to Volume IV for changes which apply to Vela VI. This report summarizes the data collected from Vela VI during the period January 1 to May 1, 1971.

II. Presentation of Data

The Vela VI x-ray data are presented one day per plot; incident flux in each of three bands is plotted against universal time. The upper curve is equivalent flux in the 1- to 16-Å band derived from the aluminized-mylar-window ion chambers, the middle curve is equivalent flux in the 1- to 8-Å band derived from the beryllium-window ion chambers, and the lower curve is equivalent flux in the 0.3- to 3-Å band derived from the scintillator data.

The equivalent flux values are the incident flux values for the 2×10^6 or 10^7 °K graybody sources necessary to produce the observed ion-chamber currents or scintillator count rate. Thus, the fluxes given here depend on the shape of the solar x-ray spectrum. Differences between the plotted flux and actual solar output are most pronounced during x-ray flares when the spectrum may

become definitely nonthermal in shape or deviate markedly from our chosen temperatures.

The band efficiency used to calculate the 0.3- to 3-Å flux has recently been recalculated, and the results appear as correction factors in Section III.

As do most computer-processed data displays, this collection of plots includes some unreliable anomalous portions. The following is a list and brief explanation of known anomalies.

A. Charged Particles. We have attempted to label those places where charged particles cause a significant fraction of the signal; the letters CPC (charged particle contamination) are used.

B. Saturation. Saturation equivalent fluxes are as follows.

1. Mylar-window ion chambers: $2 \text{ ergs cm}^{-2} \text{ sec}^{-1}$.
2. Beryllium-window ion chamber: $1.2 \text{ ergs cm}^{-2} \text{ sec}^{-1}$.
3. Thick-window scintillator: $0.2 \text{ erg cm}^{-2} \text{ sec}^{-1}$.

Plotted values higher than these can be due to the way the computer code handles data when omnidirectional charged particles interact with a pair of ion chambers with significantly different sensitivity.

C. Double Sets of Points. Double sets of points can occasionally give the appearance of a double line in the

ion-chamber data. The problem arises because of an asymmetry in the response of a pair of chambers.

D. Bit Errors. Bit errors usually cause a few isolated points to be plotted far from the main body of the data. They can easily be ignored.

E. Logics Problem. Recently, a problem has appeared in the Vela VI spacecraft which allows data from the thin-window scintillator detector to be processed as thick-window detector data during some periods when the solar aspect angle is such that only the thin-window detector sun sensor is triggered. Such data are labeled "LP."

III. Band-Efficiency Redetermination

The band efficiencies used in converting scintillator count to incident flux have been recalculated using our current estimate of discriminator levels and impurity content of the beryllium windows. The results are presented in Table I in the form of multipliers for all four spacecraft and a number of graybody source temperatures. These may be used to convert plotted flux values to the flux incident from a graybody source at the indicated temperature. When applying the multipliers to Atlas data, one does not know whether the plotted data were derived from the thin-window or the thick-window detector, and one cannot be certain which detector is being used from the information at hand. As a guide, we have indicated in Table I a crossover flux, above which thick-window detector data are used, for the specific case in which the solar aspect angle is about 48° . This 48° angle corresponds to

the midpoint in the range of subtended detector area, and one must realize that the actual transition between detectors may occur anywhere within about $\pm 40\%$ of the tabulated crossover flux. To convert a flux value read from an Atlas plot, one multiplies it by the thin-window multiplier if the flux value is well below the crossover flux, or by the thick-window factor if it is well above.

In addition to recalculating the graybody band efficiencies, we have also calculated band efficiencies for an optically thin source using an empirical expression for the thermal continuous spectrum developed by Culhane and Acton.³ Table II contains results in the form of multipliers with which one may obtain incident flux for an optically thin source at the indicated temperatures. For completeness, similar factors are included for the beryllium-window ion chamber 1- to 8-Å band.

References

1. N. K. Blocker, W. H. Chambers, P. E. Fehlau, J. C. Fuller, and W. E. Kunz, "Extreme Ultraviolet and Soft X-Ray Detector Development for Vela Satellites," Los Alamos Scientific Laboratory report LA-4251 (1969).
2. N. K. Blocker, W. H. Chambers, P. E. Fehlau, J. C. Fuller, W. E. Kunz, and R. W. Milkey, "Vela V and VI Solar X-Ray Atlas-I. May 27 to September 1, 1969." Los Alamos Scientific Laboratory report LA-4454 (1970).
3. J. L. Culhane and L. W. Acton, Monthly Notices Roy. Astron. Soc. 151, 141 (1970).

TABLE I

0.3- to 3-Å GRAYBODY MULTIPLIERS

T(10^6 °K)	Thin-Window Scintillator				Thick-Window Scintillator			
	5A	5B	6A	6B	5A	5B	6A	6B
4	0.11	0.12	0.19	0.75	2.01	2.94	1.56	1.54
6	0.25	0.24	0.51	0.98	1.33	1.69	1.28	1.16
8	0.32	0.29	0.74	1.03	0.93	1.10	1.01	0.91
10	0.36	0.31	0.88	1.05	0.71	0.81	0.84	0.77
12	0.39	0.32	0.96	1.07	0.59	0.65	0.73	0.68
14	0.40	0.33	1.03	1.08	0.51	0.55	0.66	0.62
16	0.42	0.34	1.08	1.11	0.46	0.49	0.61	0.58
18	0.43	0.34	1.13	1.13	0.42	0.44	0.58	0.55
20	0.44	0.35	1.13	1.17	0.40	0.41	0.55	0.53
Crossover Flux					Above 3×10^{-3} erg/cm ² sec		Above 3×10^{-4} erg/cm ² sec	

TABLE II
0.3- to 3-Å OPTICALLY THIN SOURCE MULTIPLIERS

<u>T(10⁶ °K)</u>	<u>Thin-Window Scintillator</u>				<u>Thick-Window Scintillator</u>				<u>Be Ion Chamber (1 to 8Å)</u>
	<u>5A</u>	<u>5B</u>	<u>6A</u>	<u>6B</u>	<u>5A</u>	<u>5B</u>	<u>6A</u>	<u>6B</u>	
4	0.04	0.05	0.06	0.44	2.15	3.44	1.45	1.60	0.54
6	0.13	0.14	0.22	0.77	1.76	2.45	1.48	1.41	0.40
8	0.20	0.20	0.39	0.91	1.38	1.79	1.31	1.20	0.32
10	0.25	0.24	0.52	0.98	1.13	1.39	1.16	1.05	0.26
12	0.29	0.26	0.62	1.00	0.97	1.16	1.05	0.95	0.23
14	0.31	0.28	0.69	1.02	0.86	1.00	0.96	0.87	0.21
16	0.33	0.19	0.75	1.03	0.77	0.88	0.89	0.82	0.19
18	0.34	0.30	0.79	1.04	0.71	0.80	0.84	0.77	0.18
20	0.35	0.30	0.83	1.05	0.66	0.74	0.80	0.74	0.17

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