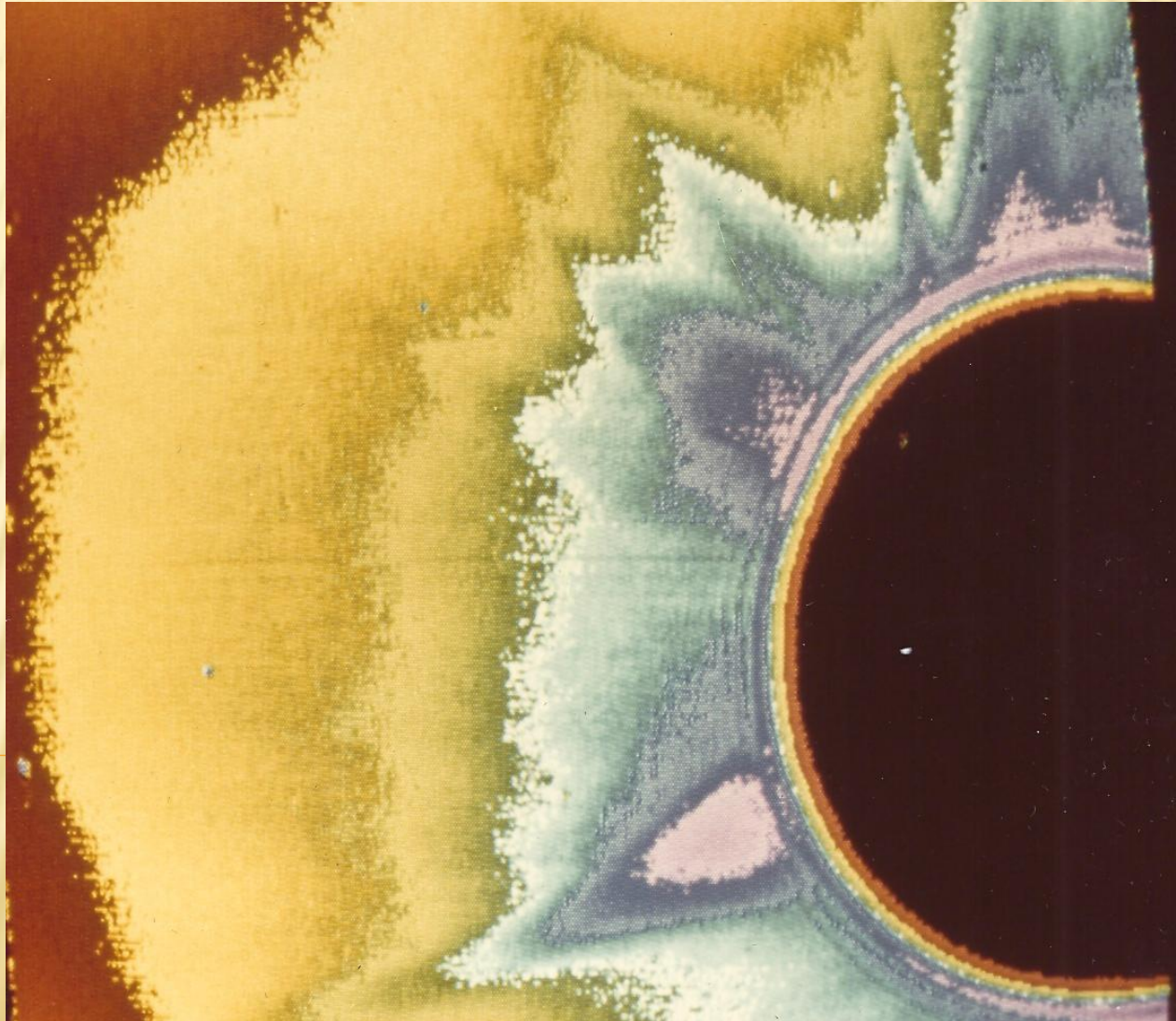


THE SOLAR MAXIMUM MISSION YEARS

1980-1989



SMM THE 1ST FLARE SPACE OBSERVATORY

Launch

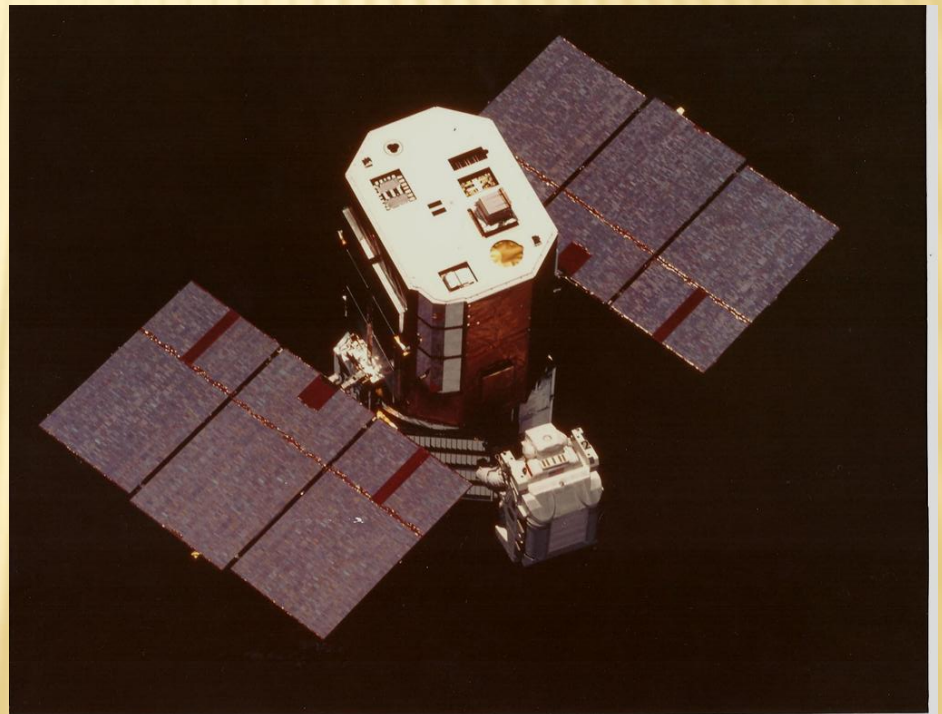
14 February 1980 Peak of activity cycle # 21

Repair & release in orbit

10 April 1984

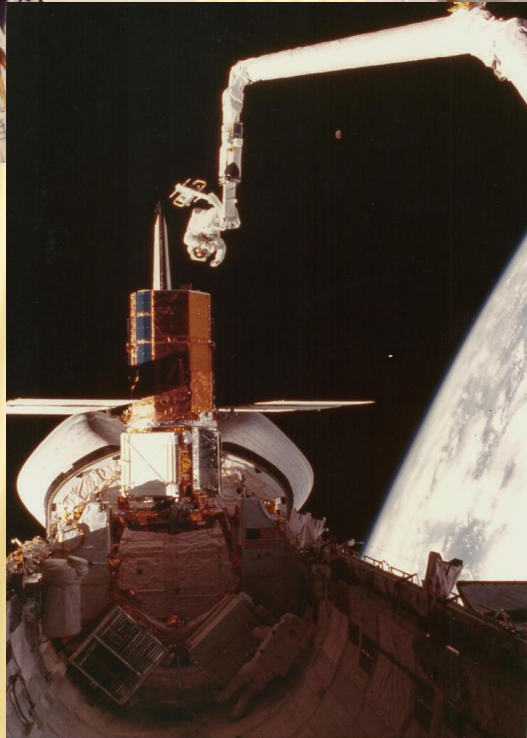
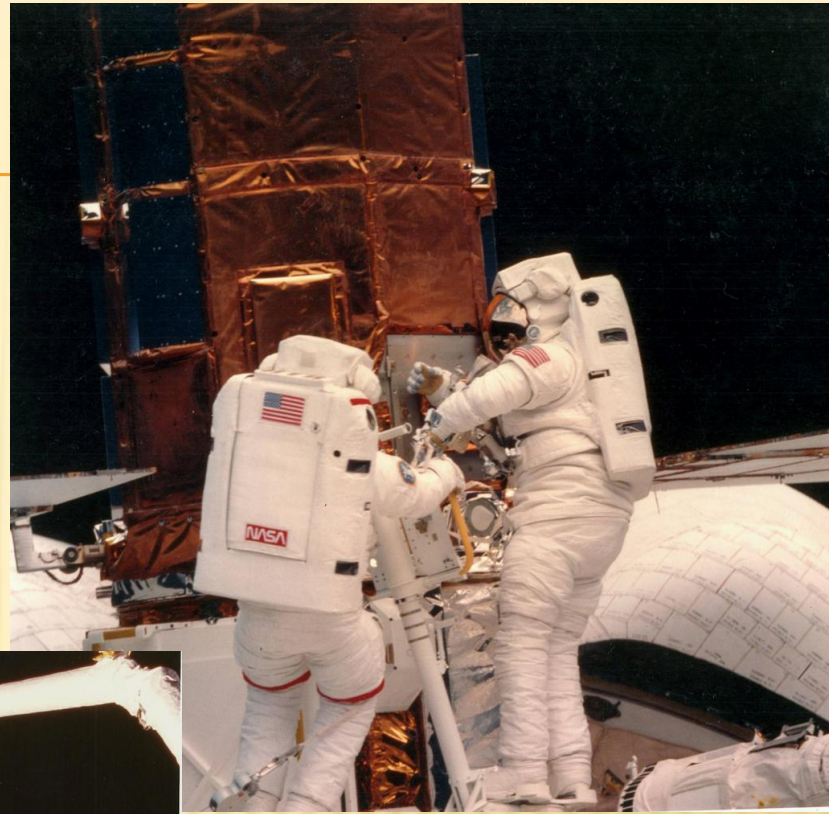
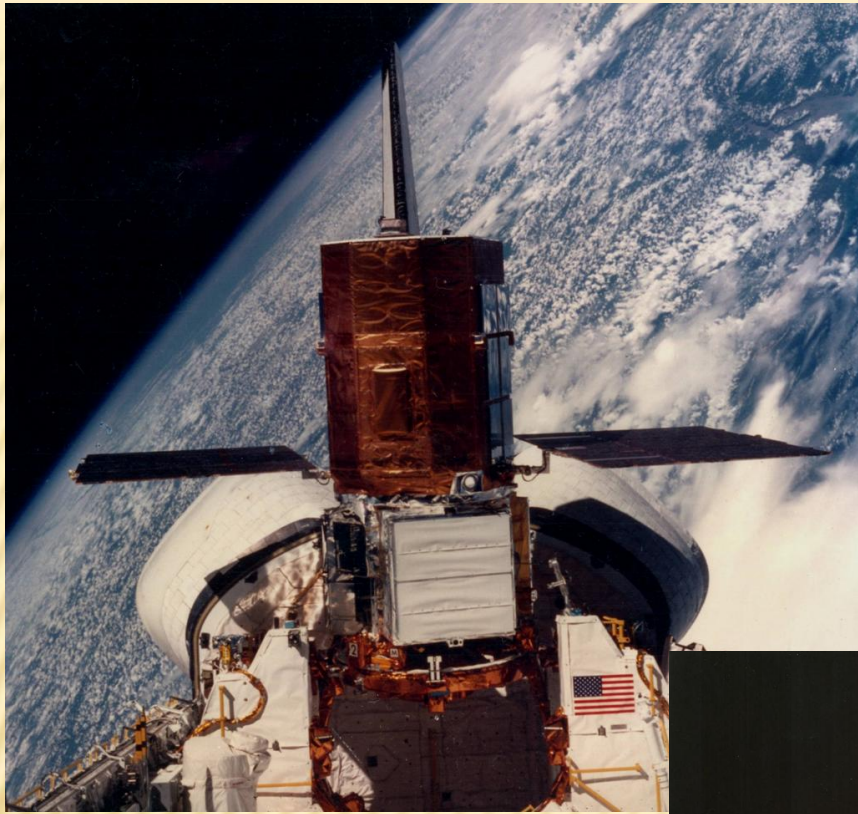


NASA-G-80-1121



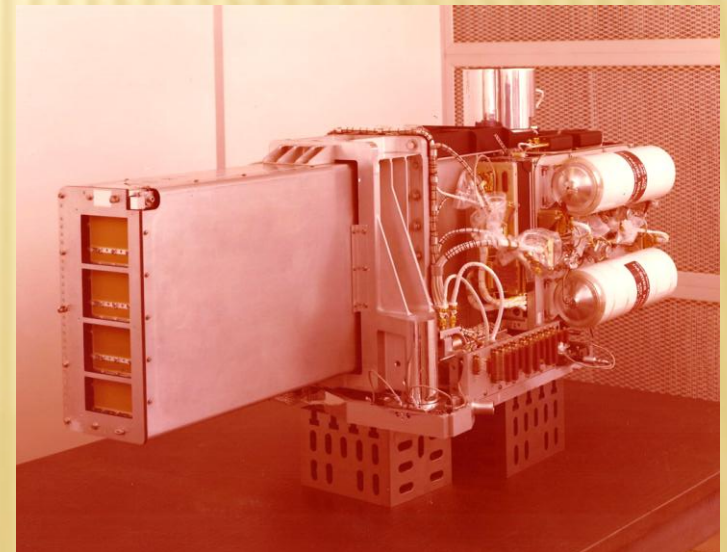
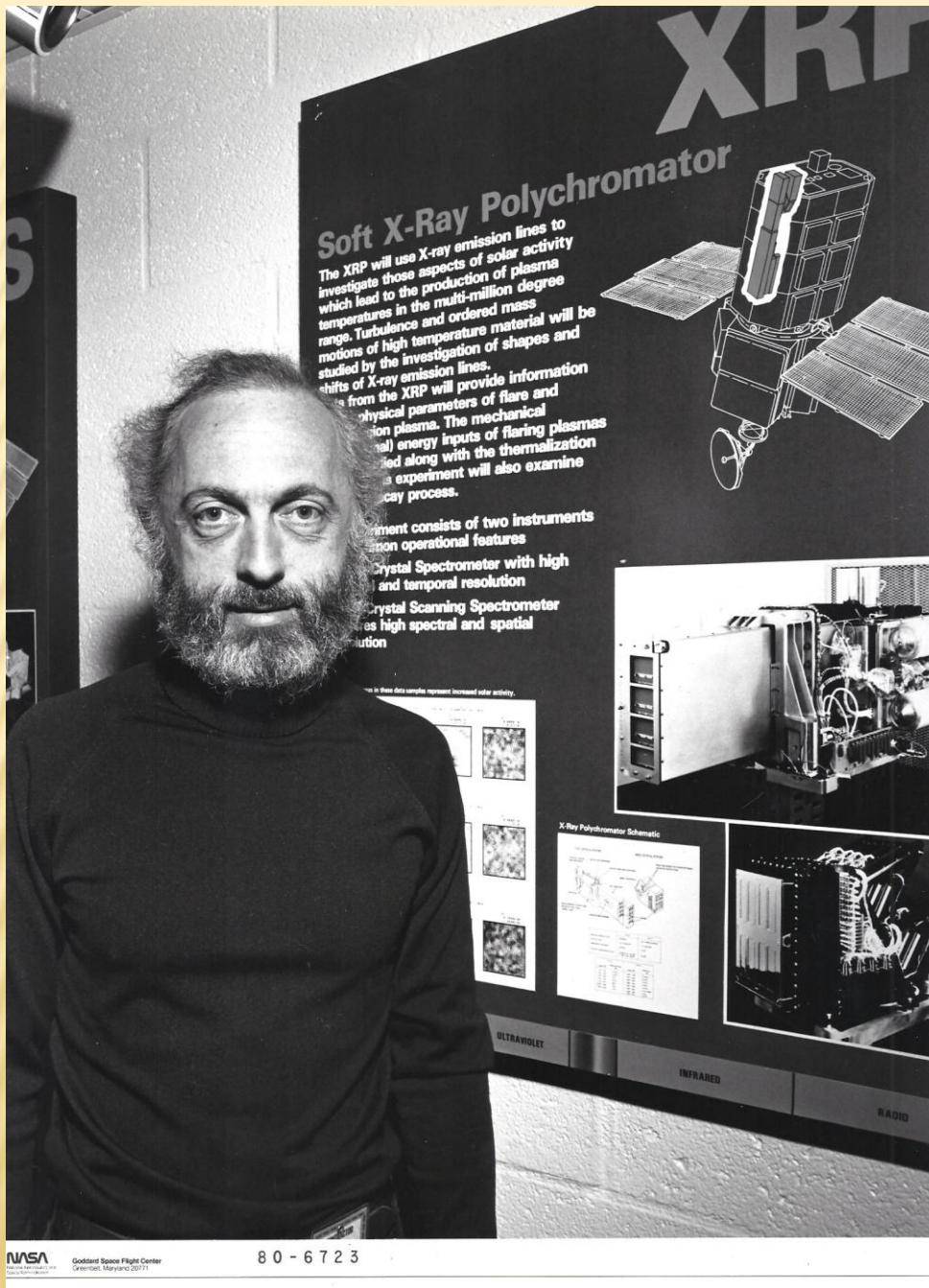
24 0153

SMM ended in November 1989



AHG PI XRP-SMM SOFT X-RAY POLYCHROMATOR

Flat Crystal Spectrometer
At Appleton Laboratory
Culham 1978



XRP - FLAT CRYSTAL SPECTROMETER FCS

XRP - BENT CRYSTAL SPECTROMETER BCS

XRP

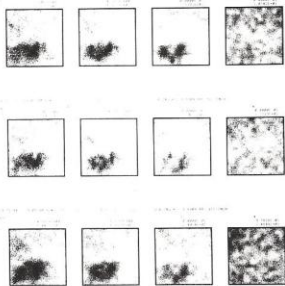
Soft X-Ray Polychromator

The XRP will use X-ray emission lines to investigate those aspects of solar activity which lead to the production of plasma temperatures in the multi-million degree range. Turbulence and ordered mass motions of high temperature material will be studied by the investigation of shapes and shifts of X-ray emission lines. Data from the XRP will provide information on the physical parameters of flare and active-region plasma. The mechanical (non-thermal) energy inputs of flaring plasmas will be studied along with the thermalization process. This experiment will also examine the flare decay process.

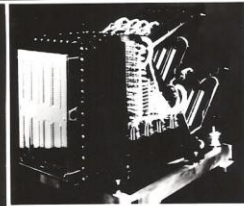
The experiment consists of two instruments with common operational features

- a Bent Crystal Spectrometer with high spectral and temporal resolution
- a Flat Crystal Scanning Spectrometer features high spectral and spatial resolution

The intense gray areas in these data samples represent increased solar activity.



X-Ray Polychromator Schematic



XRP a high spectral and time resolution spectrometer and imager in the 1-22 Å range

Table 1.1. SMM Instrument Parameters

	Energy Range	Energy Resolution	FOV	Spatial Resolution	Image Cadence (s)	Time Resolution (s)
GRS	0.01-160 MeV	14 at 0.7 MeV	Full Sun	N/A	N/A	0.064
HXRBS	20-300 keV	5 at 100 keV	Full Sun	N/A	N/A	0.128
HXIS	3.5-30 keV	<5	6.5/2.7 arcmin	32/8 arcsec	<7	0.5
BCS	1.7-3.2 Å	<25000	6 arcmin	6 arcmin	N/A	0.064
FCS	1.4-22 Å	<7000	0.25-7 arcmin	<15 arcsec	30-900	0.26
UVSP	1150-3600 Å	<90000	<4 arcmin	>1 arcsec	<240	0.064
C/P	4448-6543 Å	<20	1.6-6 solar radii	6-13 arcsec	72	72
ACRIM	UV-IR	N/A	Full Sun	N/A	N/A	120

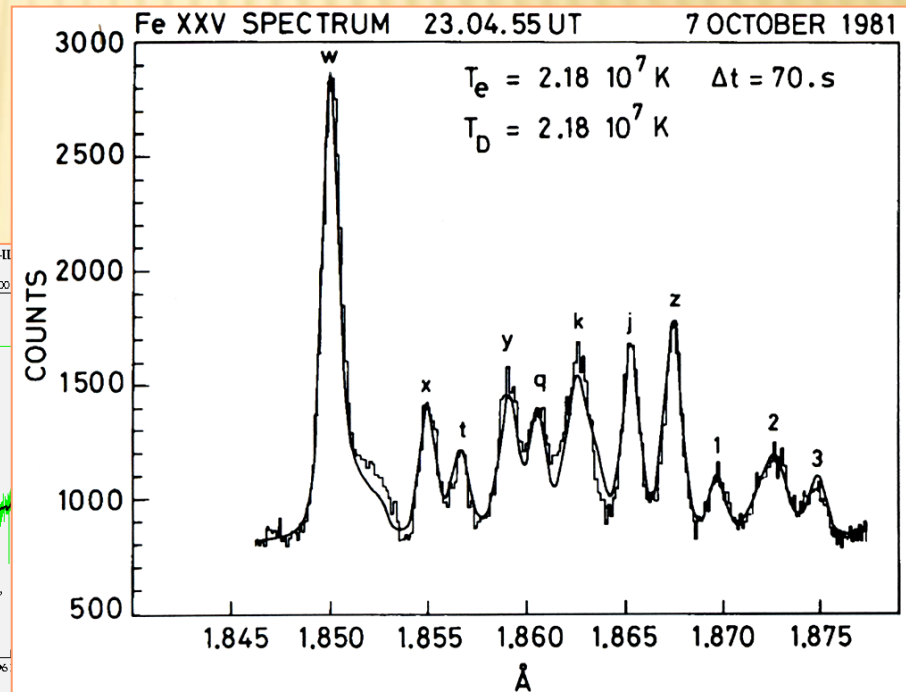
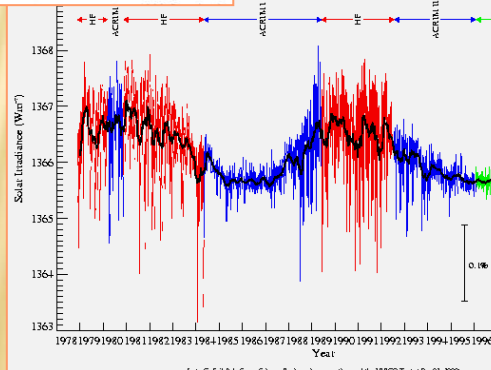
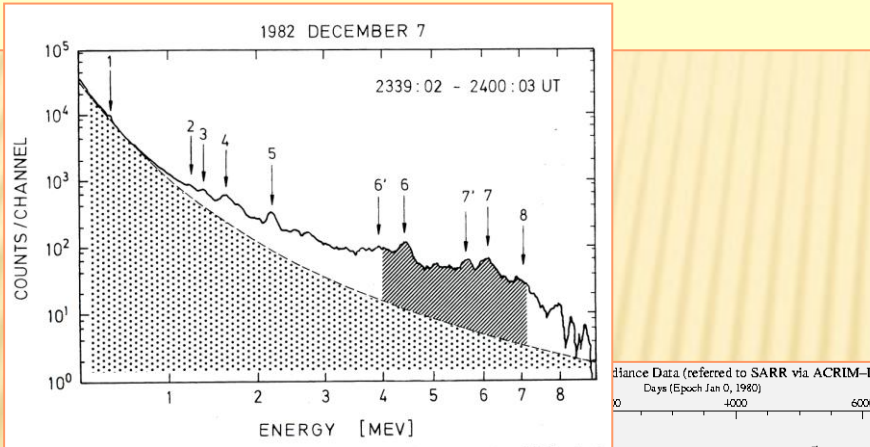
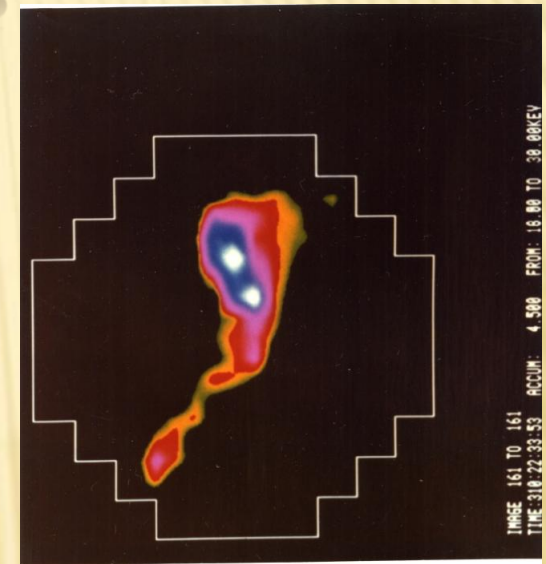
THE SOLAR MAXIMUM MISSION FIRSTS

First images in hard X-rays up to 30 KeV

First γ line spectra

Discovery of the variability of the solar constant

First spectra of the highly ionized heavy ions 1–22 Å



FLARE SOFT X-RAY SOURCES DIAGNOSIS

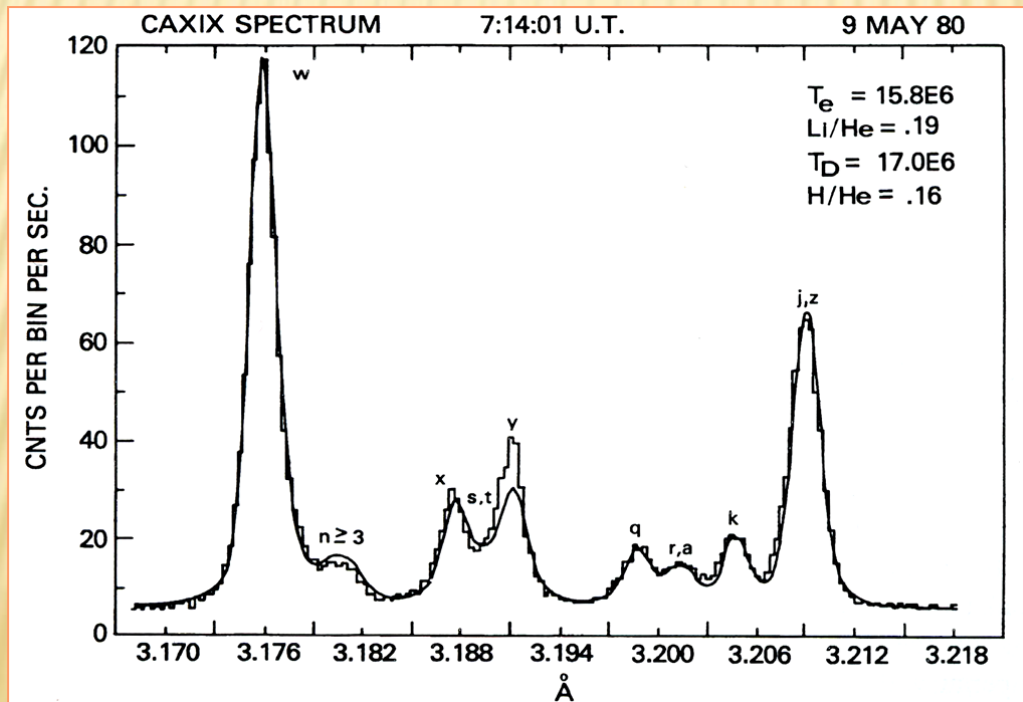
Electron temperature and ionization conditions

di-electronic recombination and inner-shell excitation satellites of H-like, He-like, Li-like ions

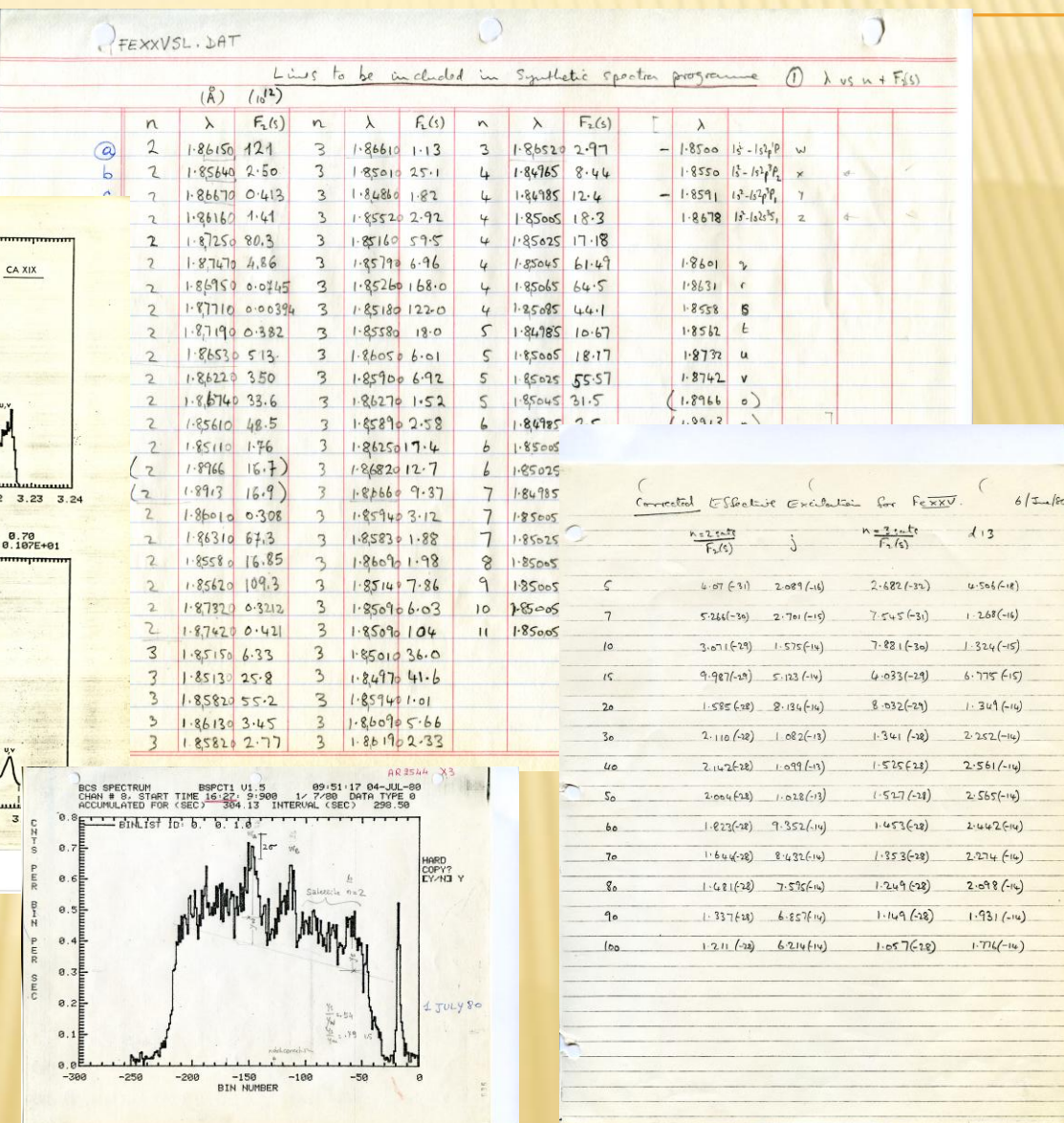
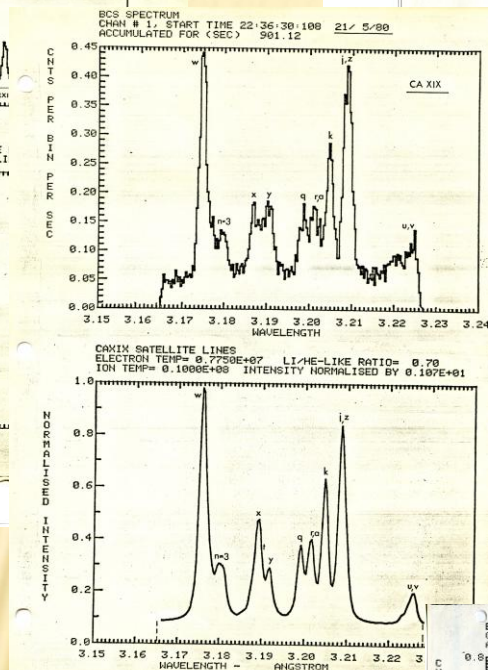
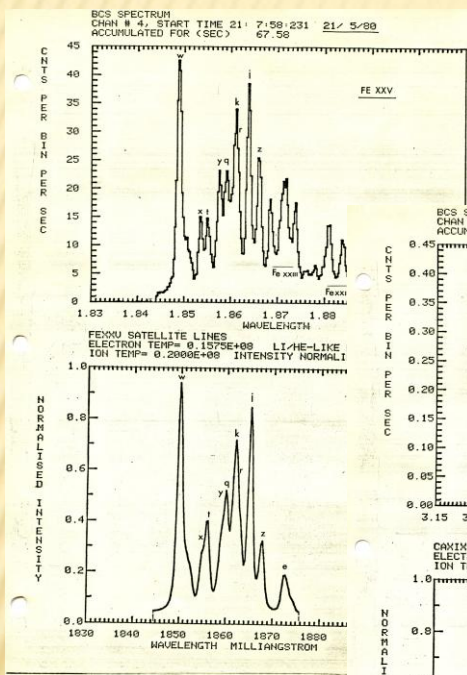
Electron density

forbidden end intercombination lines of He-like ions (Mg XI, Ne IX, S XV)

Bent Bragg crystals (BCS) allowed **simultaneous** detection of wide spectral regions covering the line emission of highly ionized heavy ions (Ca XIX, FeXXV, Fe XXVI)

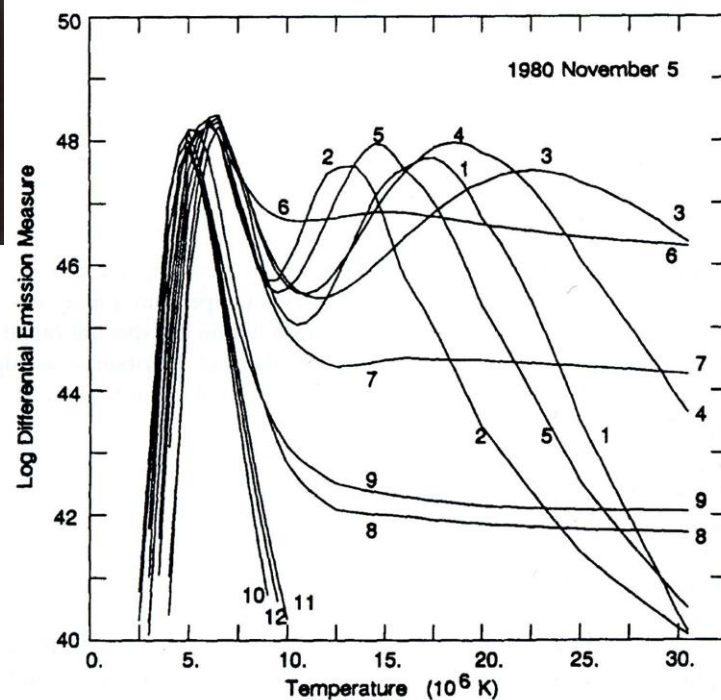
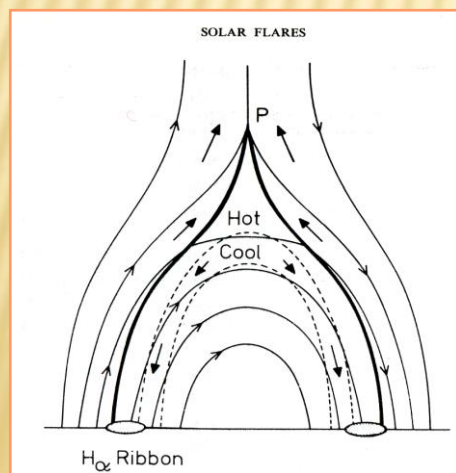
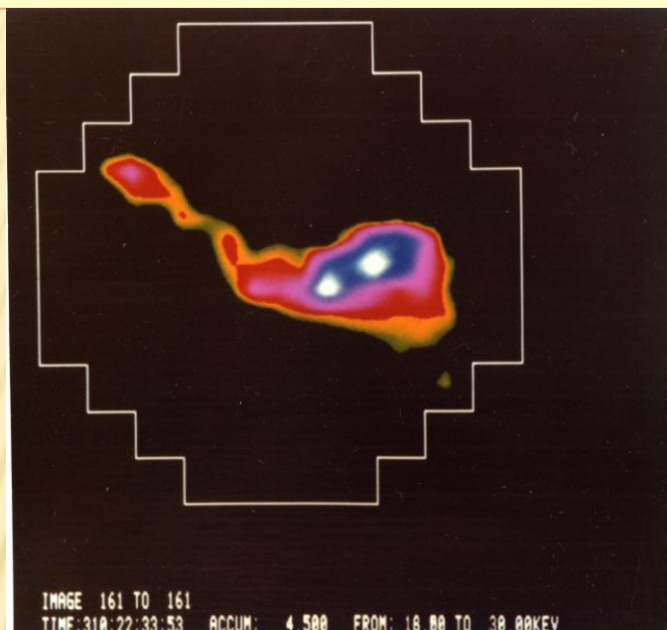


FLARE SOFT X-RAY SYNTHETIC SPECTRA



XRP SCIENTIFIC RESULTS

Discovery of chromospheric evaporation as origin of the coronal soft X-ray sources created during flares



BLUE SHIFTS DURING THE IMPULSIVE PHASE

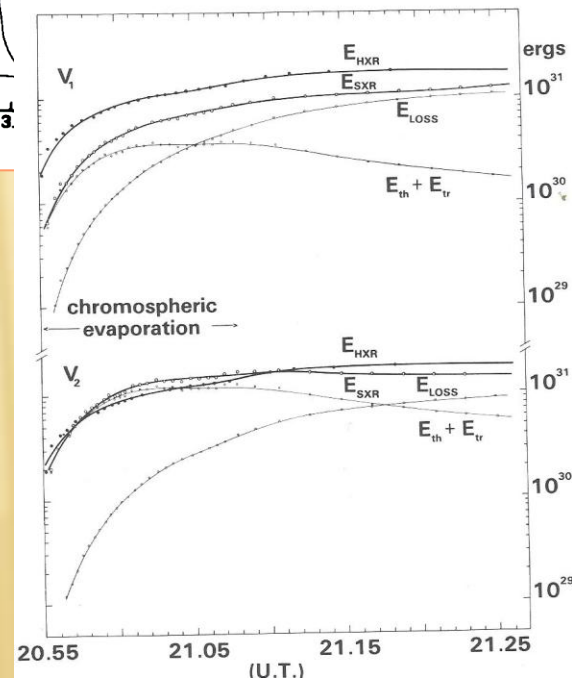
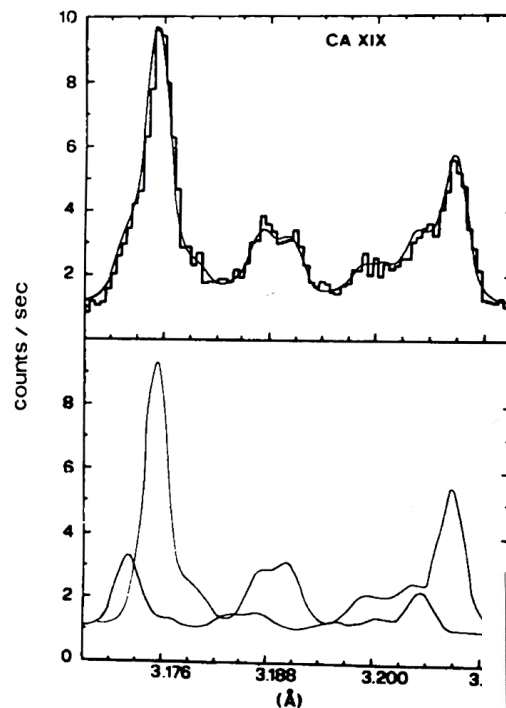
29th March 1980.

Ca XIX

	λ_w	$T_e(\times 10^4 \text{ K})$	$\frac{E_w}{E_c}$	T_e	$T_{10A}(\times 10^4 \text{ K})$	$E_{\text{HXR}}(\text{ergs s}^{-1})$	$E_{\text{SXR}}(\text{ergs s}^{-1})$
9:18:02	.40	9.5	.28		60.0	142.0	137
18:17	.372	9.8	.227	$\rightarrow 6.7 \times 10^6 \text{ K}$	81.0	169.0	165
18:32	.208	13.0	.152		76.0	159.0	156
19:00	.185	13.7	.131		60.0	130.0	131.0
19:30	.180	14.0	.14	$\rightarrow 8 \times 10^6 \text{ K}$	35.0	92.0	84
20:00	.224	12.5	.115		31.0	86.0	76.0
20:30	.247	12.0	.156		28.0	80.0	71.0
21:00	.280	11.2	.187		23.0	69.0	58.0
21:30	.272	11.3	.166		27.0	79.0	70
22:00	.272	9.8	.252		27.0	83.0	74
22:30	.327	10.2	.217		23.0	72.0	61.0
23:00	.56	8.2	.220	$\rightarrow 7 \times 10^6 \text{ K}$	30.0	93.0	86
23:30	.412	9.3	.262		24.0	77.0	67

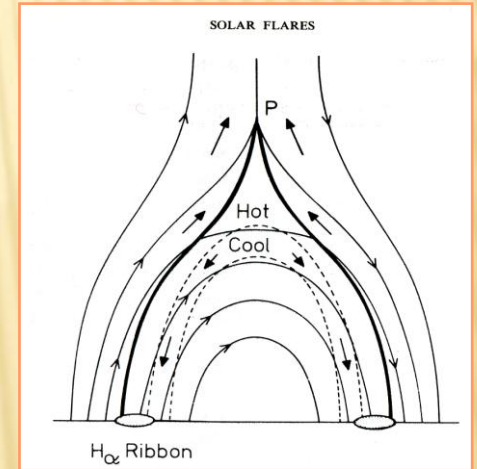
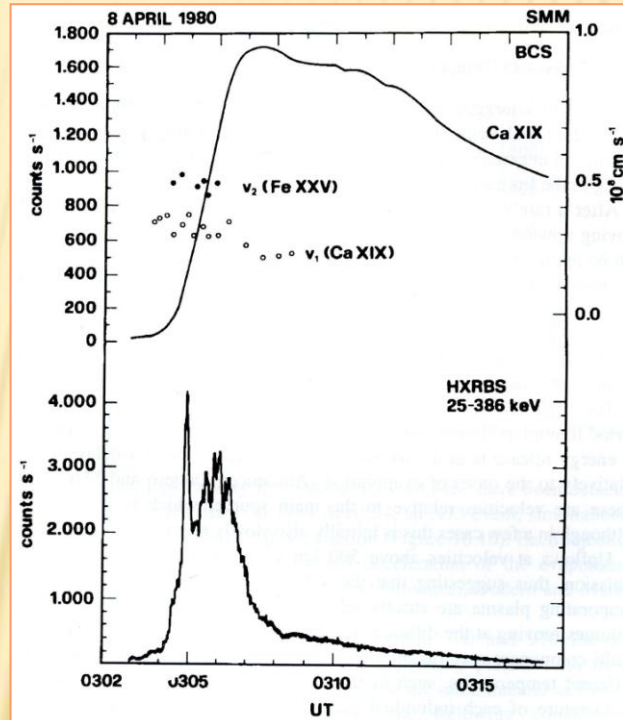
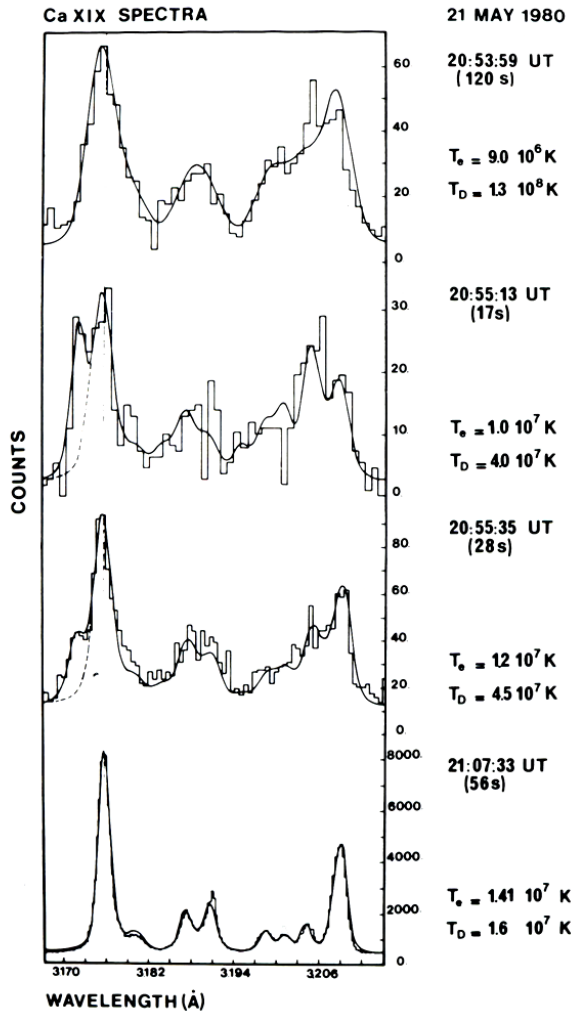
For spectra at 9:18:02 \rightarrow 18:17, a blue-shifted component appears on the blue wing of the Ca XIX resonance line, assuming a Gaussian profile we obtain a velocity of $\approx 300 \text{ km s}^{-1}$

for spectra at 9:18:02 \rightarrow 18:17 a blue-shifted component appears on the blue wing of the Ca XIX resonance line, assuming a Gaussian profile we obtain a velocity of $\approx 300 \text{ km/s}$



XRP SCIENTIFIC RESULTS

Discovery of non-thermal motions in corona during energy release due to magnetic reconnection



First observation of the H-like Fe XXVI

SMM EXPERIMENTER OPERATIONS FACILITY – EOF AT GSFC



Nicknames

So Many Meetings
Solar Max

Application of Multi-Mission S/C, to be serviced by the Shuttle

S/C to be pointed at active regions/flares

Inter-instrument flags

EOF at GSFC/NASA

EXPERIMENTER OPERATIONS FACILITY EOF

DAILY PLANNING MEETING



Date	1980	Chief	Group	Plan	BGS	Evaluate	Plan	FMS	Evaluate	Comments
1	Tu	19	Feb							
2	Fr	12								
3	Sa	13								
4	Su	14								
5	Mo	15								
6	Tu	16								
7	We	17								
8	Th	18								
9	Fr	19								
10	Sa	20								
11	Su	21								
12	Mo	22								
13	Tu	23								
14	We	24								
15	Th	25								
16	Fr	26								
17	Sa	27								
18	Su	28								
19	Mo	29								
20	Tu	30								
21	We	31								
22	Th	1								
23	Fr	2								
24	Sa	3								
25	Su	4								
26	Mo	5								
27	Tu	6								
28	We	7								
29	Th	8								
30	Fr	9								
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35	We	14								
36	Th	15								
37	Fr	16								
38	Sa	17								
39	Su	18								
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56	We	5								
57	Th	6								
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86	Fr	4								
87	Sa	5								
88	Su	6								
89	Mo	7								
90	Tu	8								
91	We	9								
92	Th	10								
93	Fr	11								
94	Sa	12								
95	Su	13								
96	Mo	14								
97	Tu	15								
98	We	16								
99	Th	17								
100	Fr	18								



THE XRP TEAM AT EOF



THANKS ALAN

