

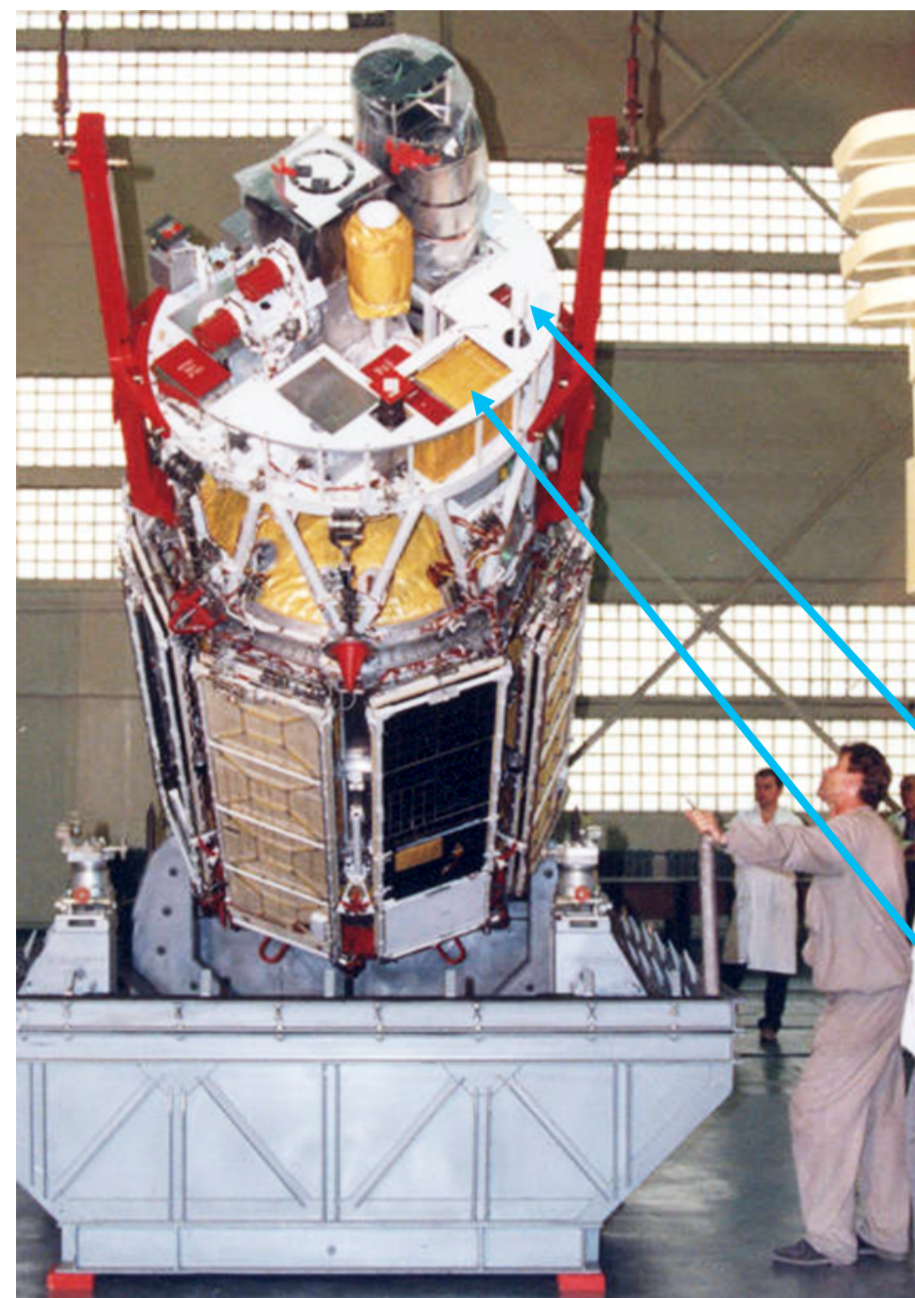
Analysis of selected solar flares soft X-ray spectra from Diogenes observations

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Diogenes was the uncollimated scanning flat crystal spectrometer observing flare X-ray spectra in four narrow wavelength bands in vicinity of Ca XIX, S XV and Si XIII He-like line 'triplets' around 3.18 Å, 5.04 Å and 6.65 Å. In the two spectral channels, the same emission lines around Ca XIX 3.178 Å resonance are scanned in opposite directions, being diffracted from precisely adjusted identical Quartz crystals mounted on the common shaft in so-called Dopplerometer (tachometer) configuration. The observations of the solar X-ray spectrum made by Diogenes provides a direct diagnostic information on plasma characteristics during the impulsive flare energy release. We present a selected events which occurred during the Diogenes operation time from August 16, 2001 to September 17, 2001.

CORONAS-F launch, orbit & pointing



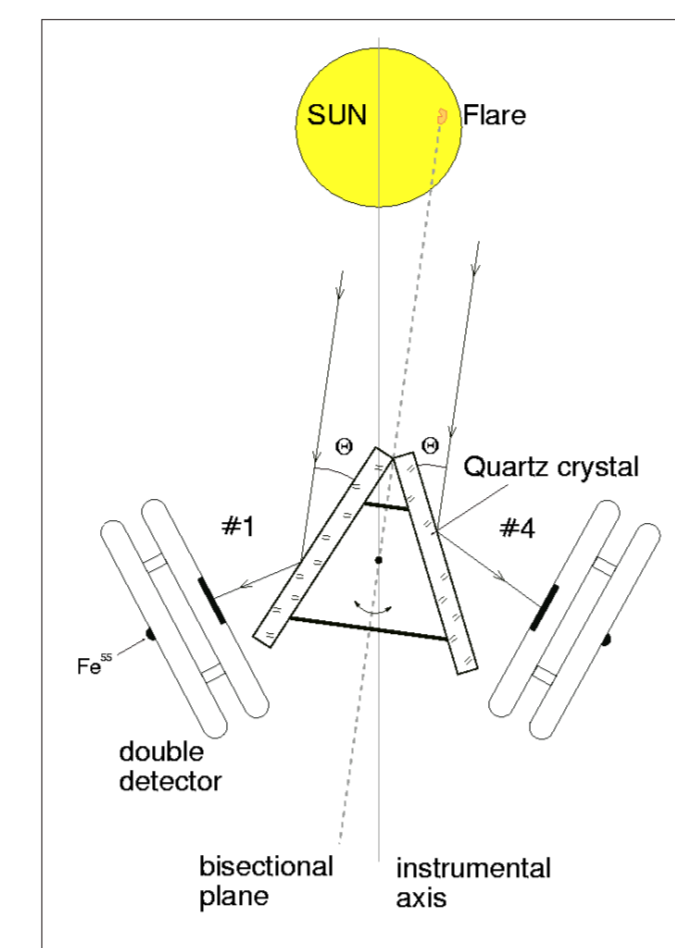
Launch: **31 July 2001**

Orbit:

- Polar (i=82.5),
- 95min period,
- Altitude ~500 km
- semi-sun-synchronous

Diogenes: scanning **Flat Crystal Spectrometer** like on P78-1 (Solwind)

RESIK: **Bent Crystal Spectrometer** like on SMM and Yohkoh



Diogenes scans

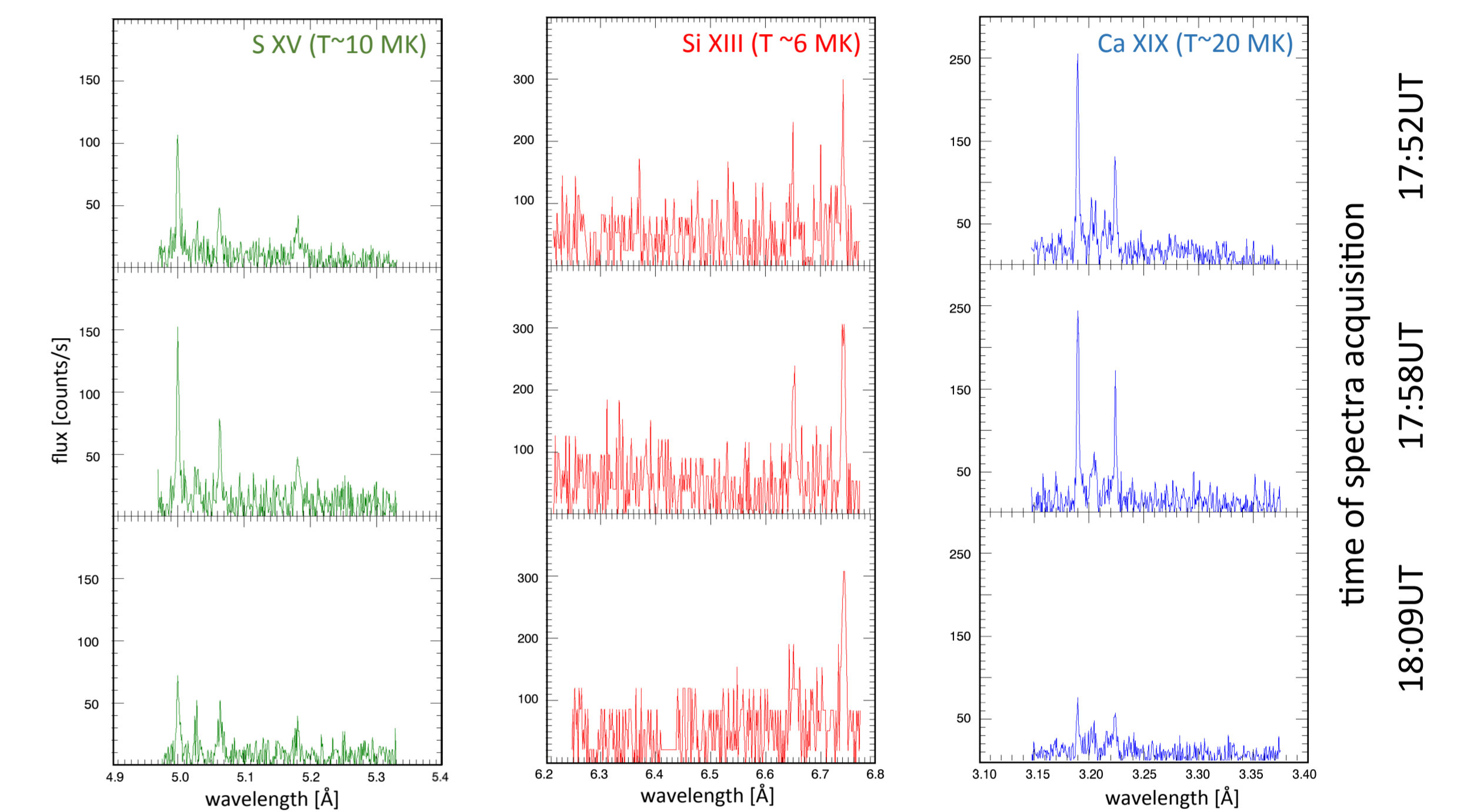
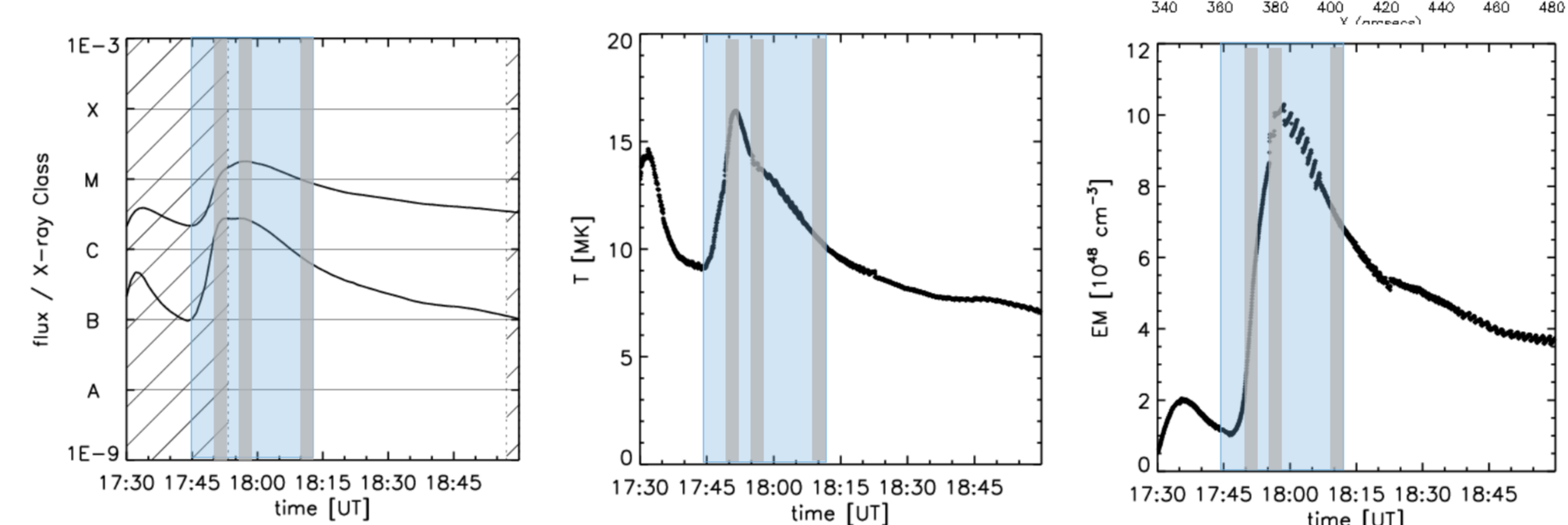
Contain: **triplet lines** (Resonance, Intercombination, Forbidden + satellites) in **He-like ions of Ca, S and Si**

Scanning ranges: ~140 arcmin back/forward mode, **duration ~120 s**

	1	2	3	4
Crystal	Quartz	ADP	Beryl	Quartz
2d [Å]	6.6865	10.5657	15.9585	6.6865
Observed lines	Ca XIX	S XV	Si XIII	Ca XIX
λ_{\min} [Å]	3.14	9.98	6.60	2.96
λ_{\max} [Å]	3.39	5.37	7.18	3.22
R _c [μrd]	91	91	15	90
FWHM [arcsec]	24.1	68.1	94.1	25.6

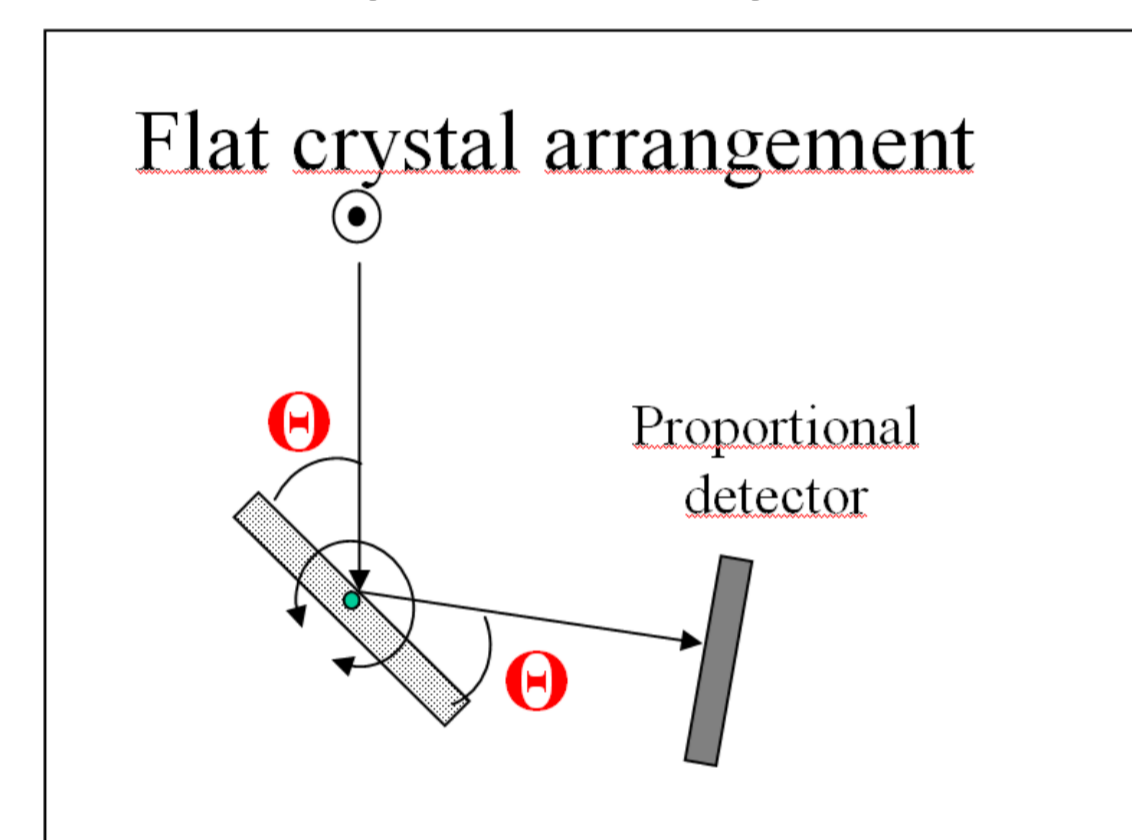
August 30, 2001

GOES class: **M1.5** AR: **9591**
start: **17:45 UT** peak: **18:11 UT**



Bragg Spectrometers

perfect crystals used as diffraction elements

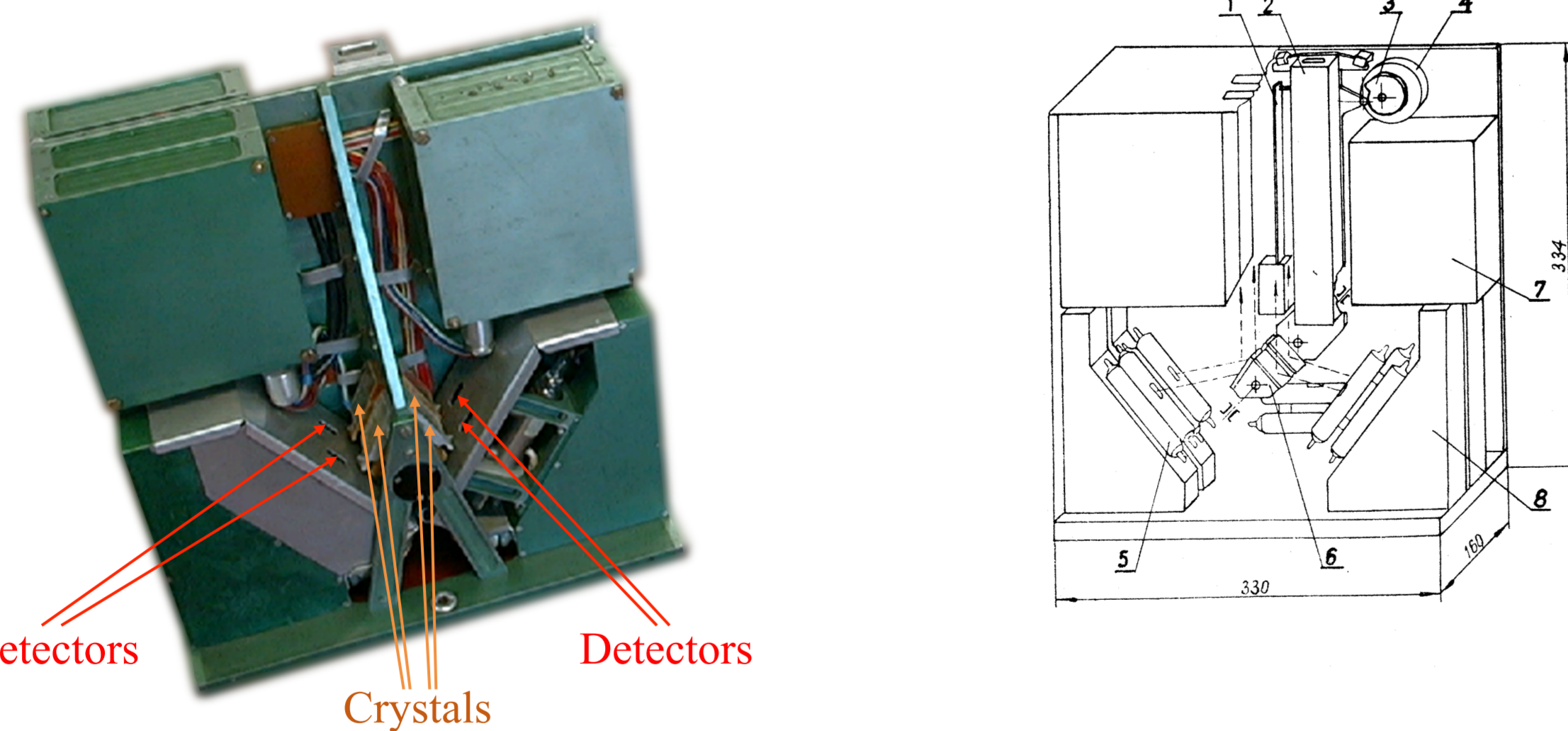


$$k\lambda = 2d \sin \Theta$$

- Θ - angle of incidence
- $2d$ - crystal spacing [Å]
- λ - 'reflected' wavelength
- k - order of reflection

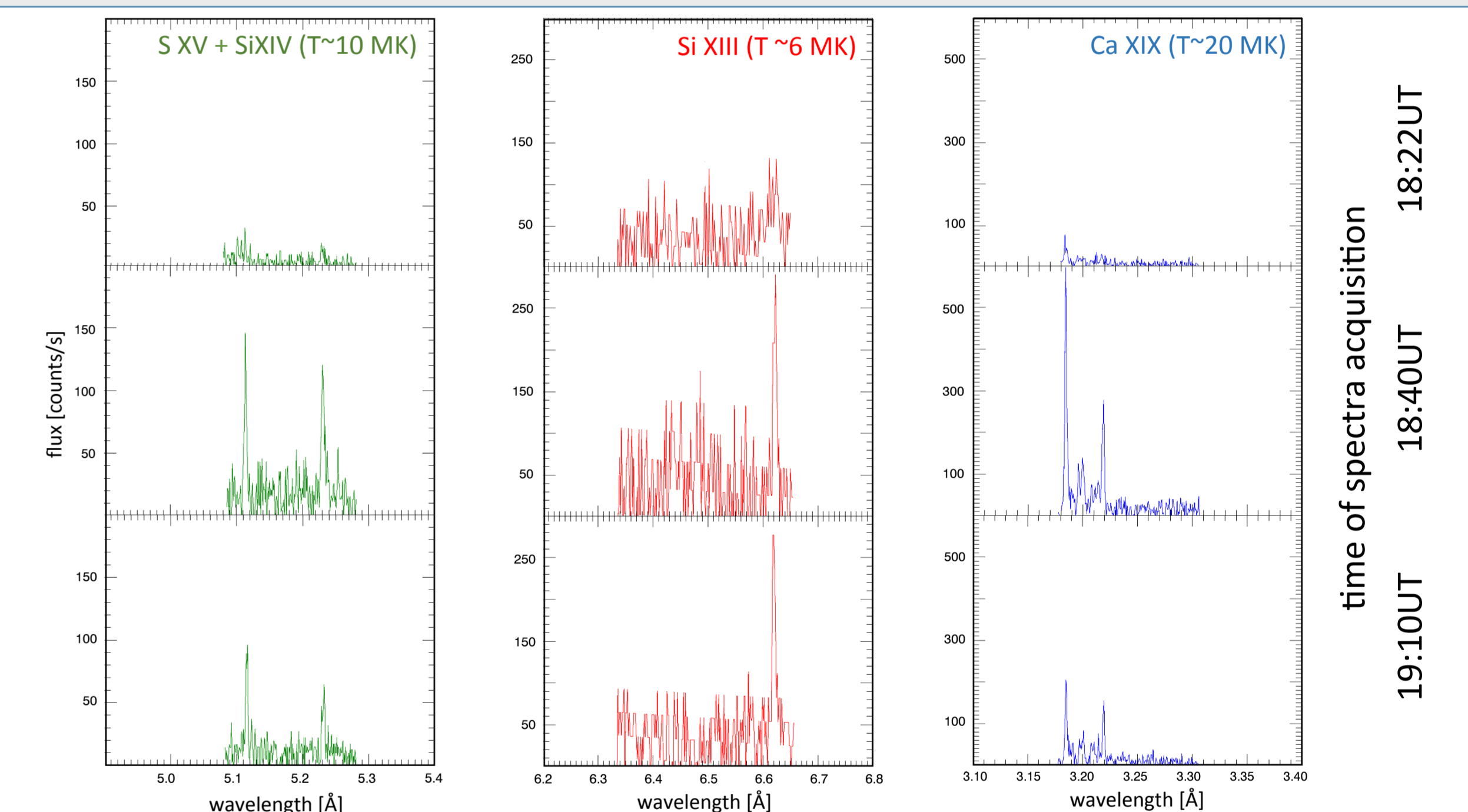
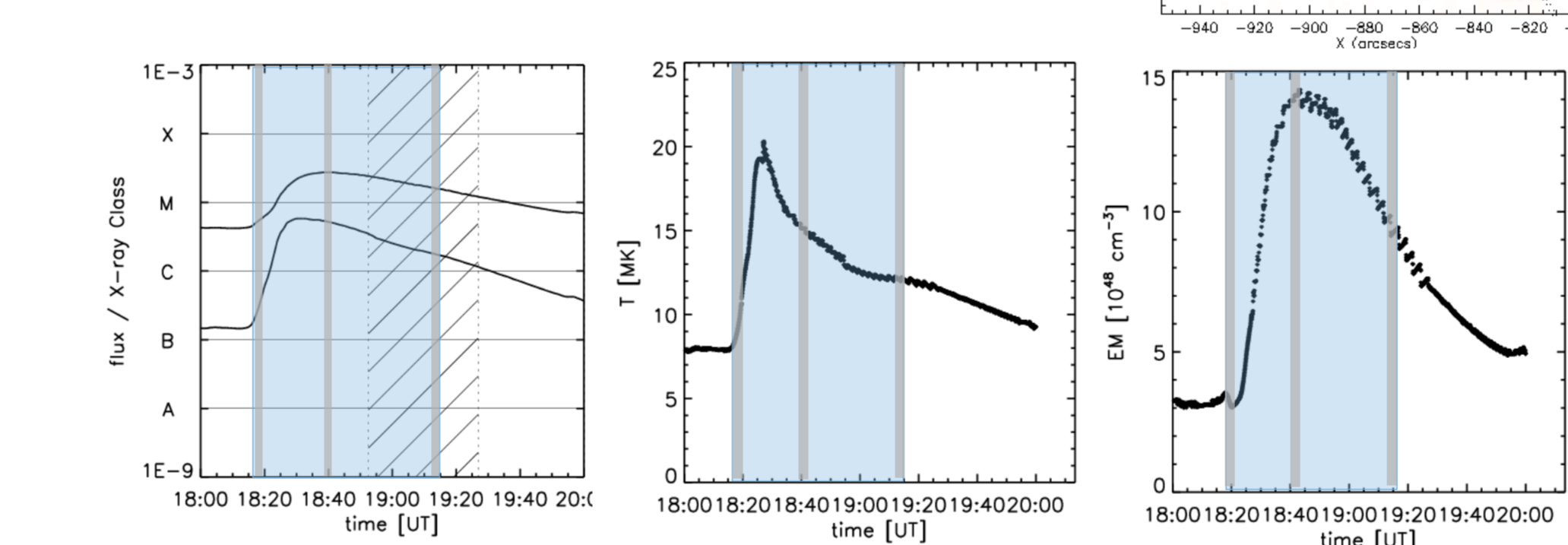
Diogenes objectives

- Obtain **high-resolution spectra** in „wider vicinity” of **strong He-like triplets** (to extend spectral database of Interkosmos-4,-7,-11 & 16, P79-1, and more recent: SMM & Yohkoh) owing to their diagnostic importance
- Study **X-ray Dopplershifts** in „absolute terms”, previous velocity measurements were defined relative to the decay phase line positions. Increase the accuracy of Dopplershift measurements substantially



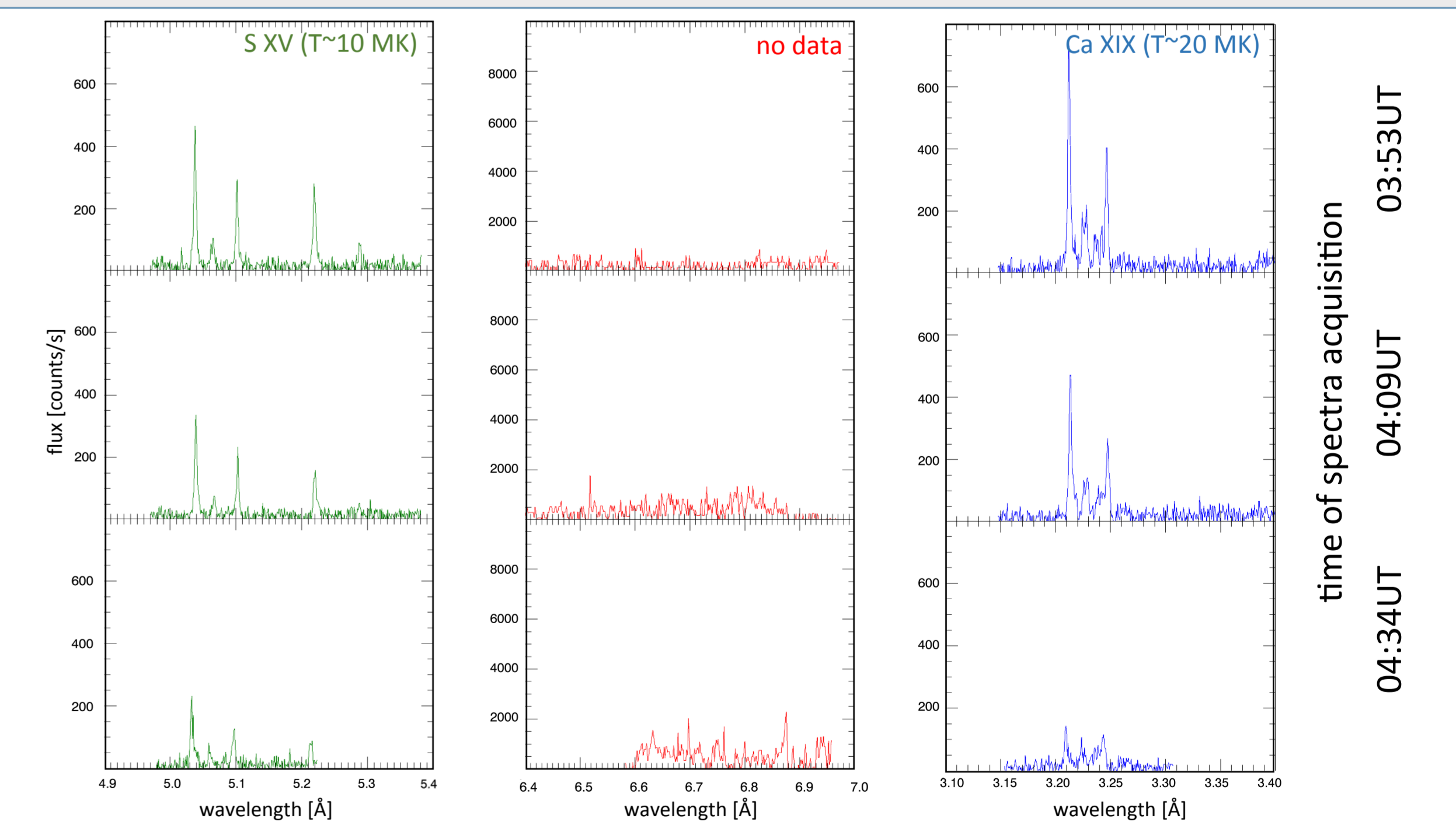
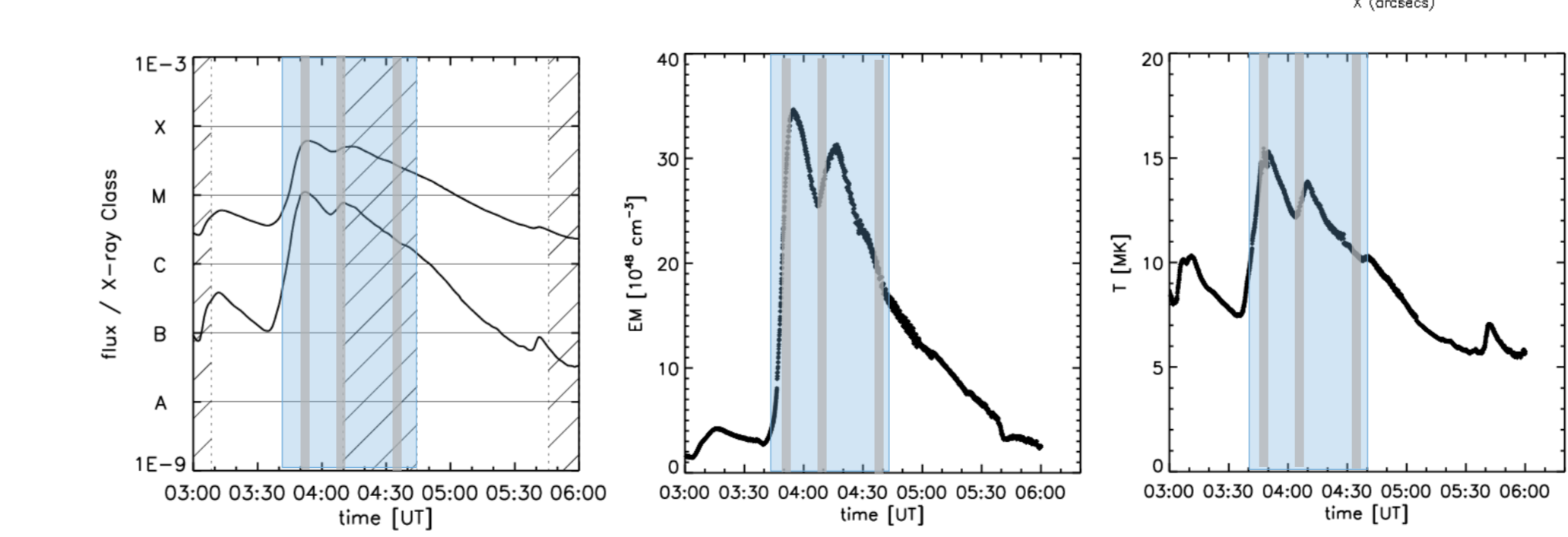
September 03, 2001

GOES class: **M2.5**
start: **18:21 UT** peak: **19:10 UT**



September 16, 2001

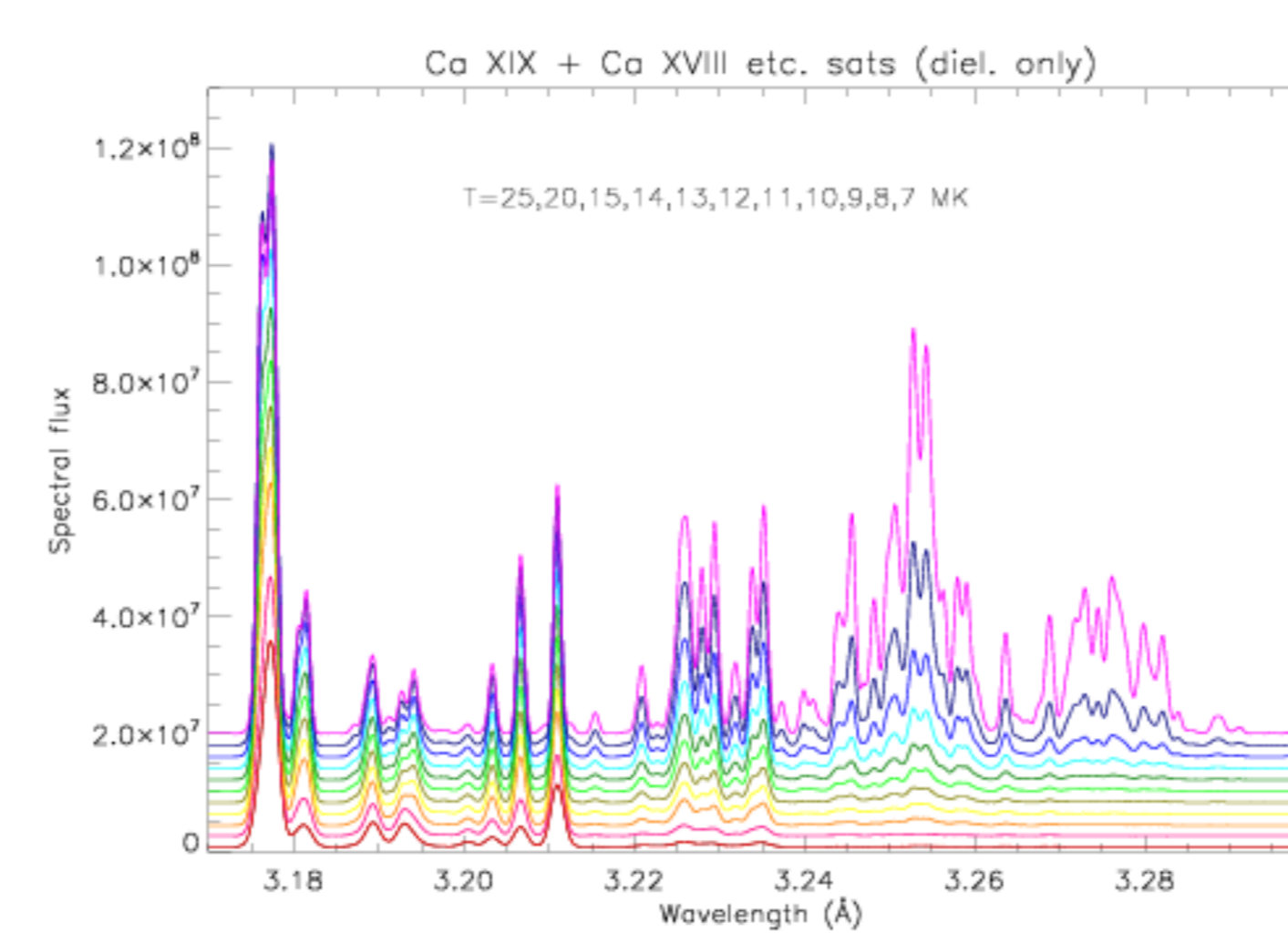
GOES class: **M5.6** AR: **9608**
start: **03:39 UT** peak: **04:18 UT**



Flares observed by Diogenes

	Flare	GOES	H α	Location
1	SOL2001-08-25T09:28	M1.2	-	S18E31
2	SOL2001-08-25T16:45	X5.3	3B	S17E34
3	SOL2001-08-30T17:57	M1.5	2N	S21W28
4	SOL2001-09-02T06:02	M1.3	1F	S17W66
5	SOL2001-09-02T13:48	M3.0	2N	S21W56
6	SOL2001-09-03T01:58	C9.0	-	~E90S15
7	SOL2001-09-03T17:16	M1.1	-	N10W06
8	SOL2001-09-03T18:41	M2.5	-	~E90S28
9	SOL2001-09-16T03:53	M5.6	2N	S29W54

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Conclusions

- Spectra obtained using Diogenes have unprecedented resolution and cover wider ranges of spectra than other crystal spectrometers. Figure on the left shows synthetic spectra of Ca created with Cowan code with more than 600 satellites included. It clearly indicates that spectra around the strong He-like triplets can provide important information about the flaring plasma.
- More than 200 spectral scans available for the analysis for 8+ flares.
- Such X-ray spectrometer/dopplerometer concept is worth further experimenting → ChemiX on IHP (J. Sylwester talk)