Absolute measurement of spectral fluxes using simultaneous EIT/SOHO and SPIRIT/CORONAS-F data

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1. Introduction

SPIRIT EUV spectroheliographs built solar spectra in the spectral range 176-207 and 280-330 A with spatial resolution in one direction. It operated from 2001 till 2005 onboard CORONAS-F satellite. The **SPIRIT** EUV spectroheliographs are excelent tools for flare investigation. Sadly, this instrument was not calibrated before the launch, and the lack of the absolute calibration cripples spectroheliograph diagnostics capabilities.

The **SPIRIT** spectral ranges overlap with **EIT** 195 and 304 A bandpasses. In this work we use simultaneous **SPIRIT** and **EIT** data to obtain absolute spectral fluxes.

2. Cross-callibration

$$S\,[abs] = k \cdot S\,[DN]$$

$$F\,[dn] = \int b(\lambda) S[abs] d\lambda = k \int b(\lambda) S[DN] d\lambda$$

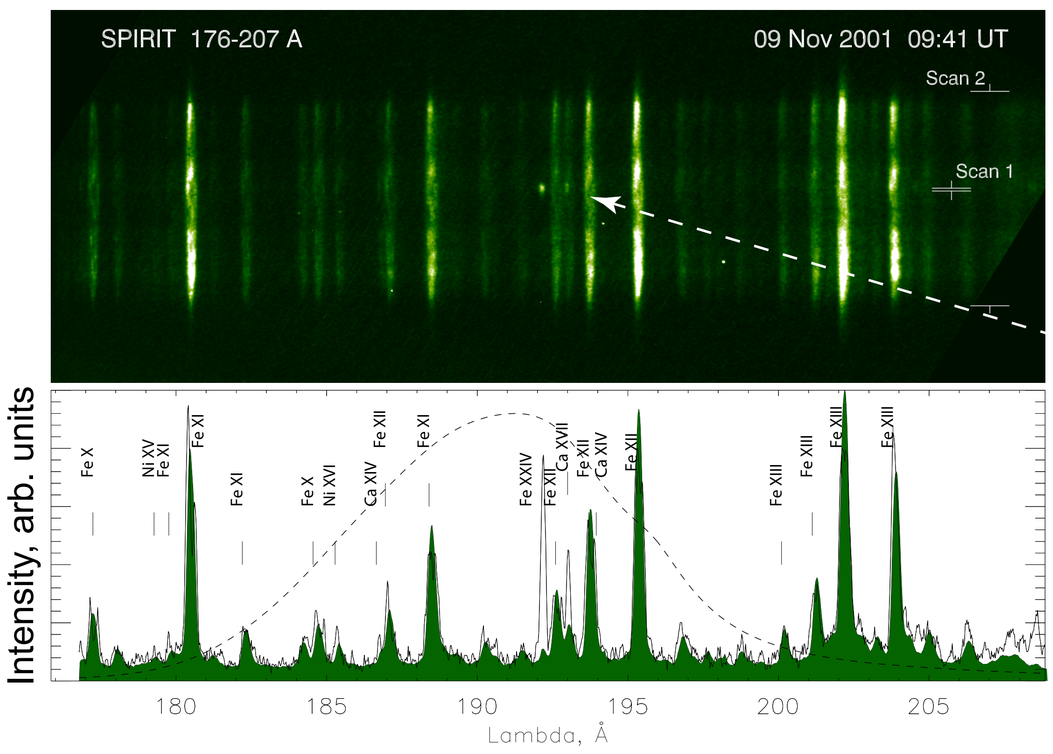
$$k = \frac{F[dn]}{\int b(\lambda) S[DN] d\lambda}$$

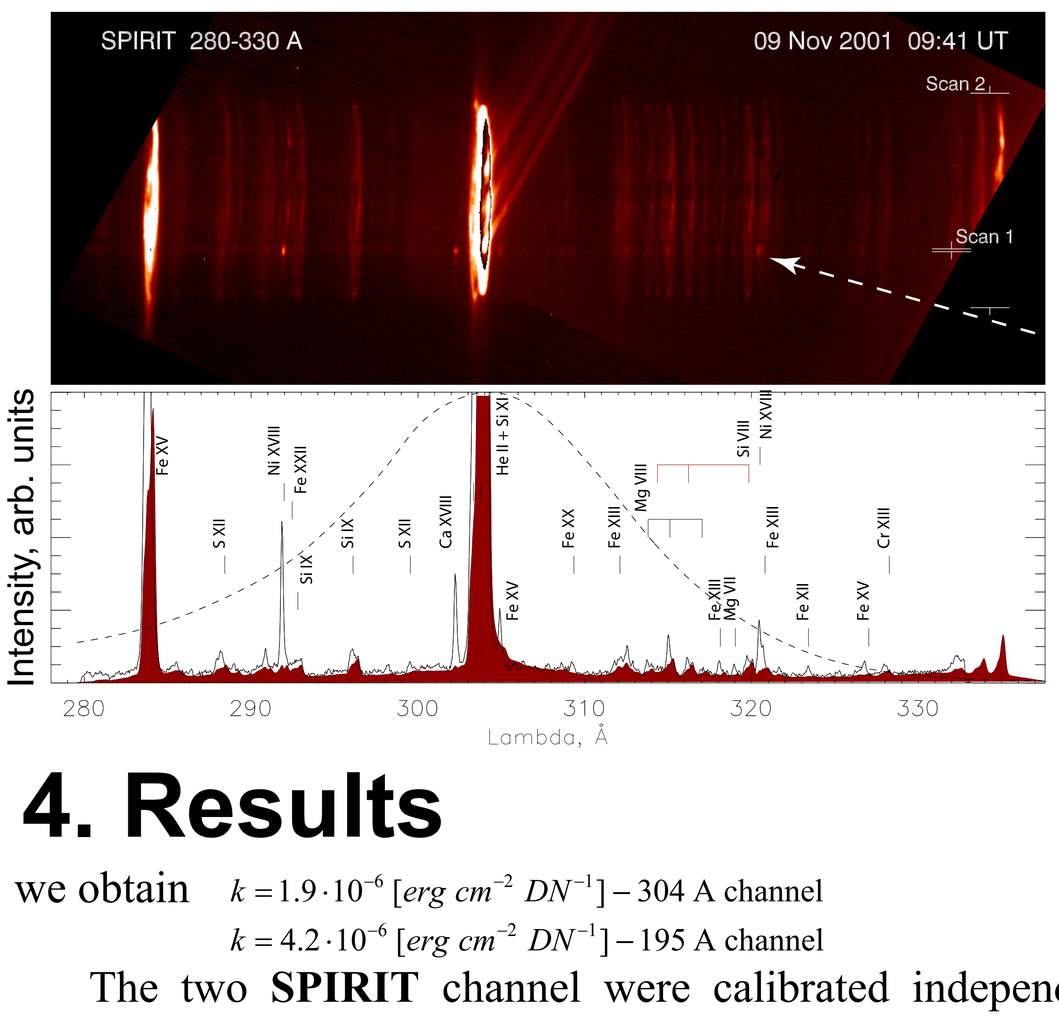
where:

$S[abs]$ – real spectral flux in absolute units;
$S[DN]$ – spectral flux measured by SPIRIT in DN;
k – callibration coefficient, which we want to find;
$F[dn]$ – flux, measured by EIT in dn;
$b(\lambda)$ – EIT bandpass;

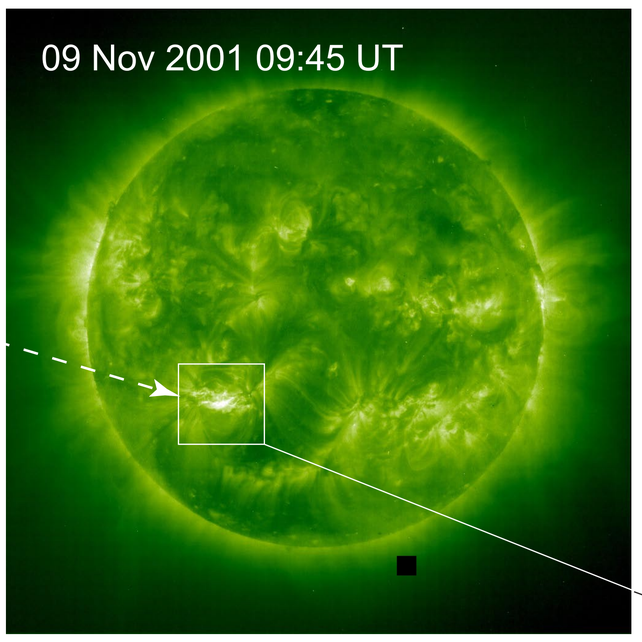
3. Data

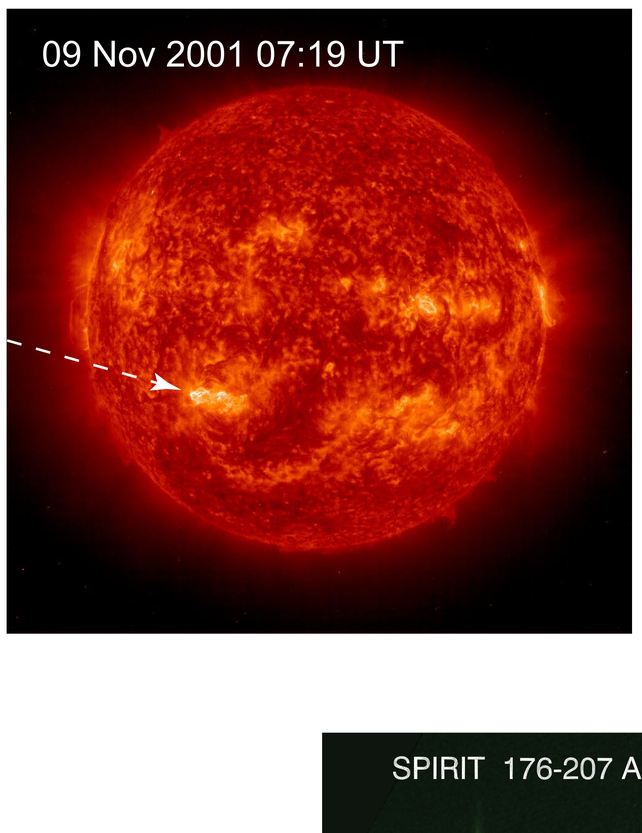
SPIRIT data



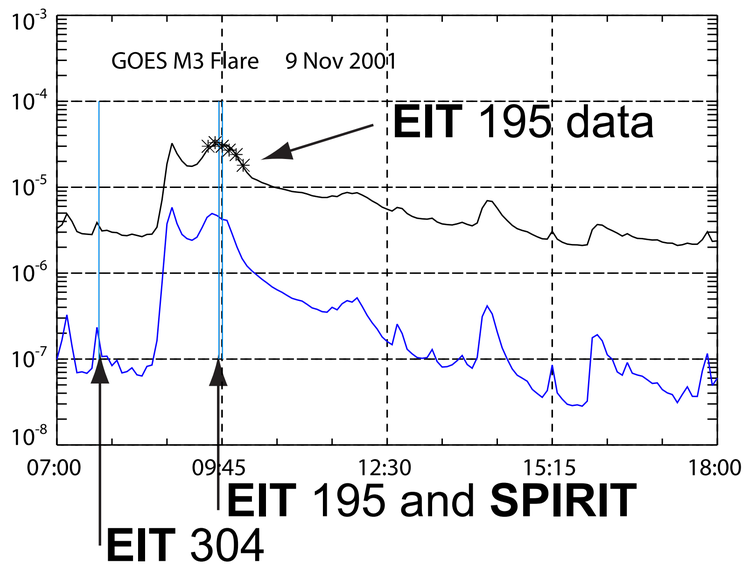


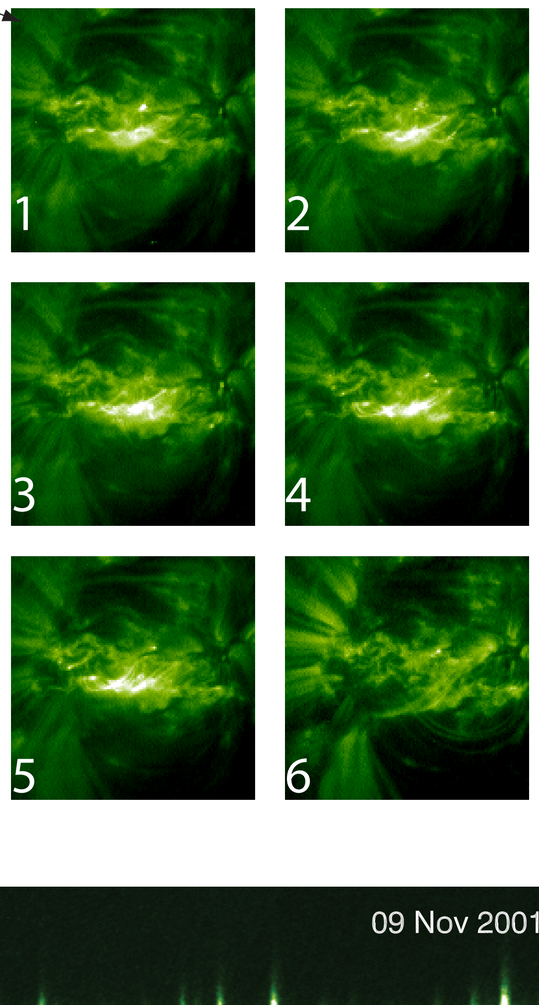
EIT data





GOES lightcurve





4. Results

we obtain $k = 1.9 \cdot 10^{-6}\,[erg\ cm^{-2}\ DN^{-1}]$ – 304 A channel
$k = 4.2 \cdot 10^{-6}\,[erg\ cm^{-2}\ DN^{-1}]$ – 195 A channel

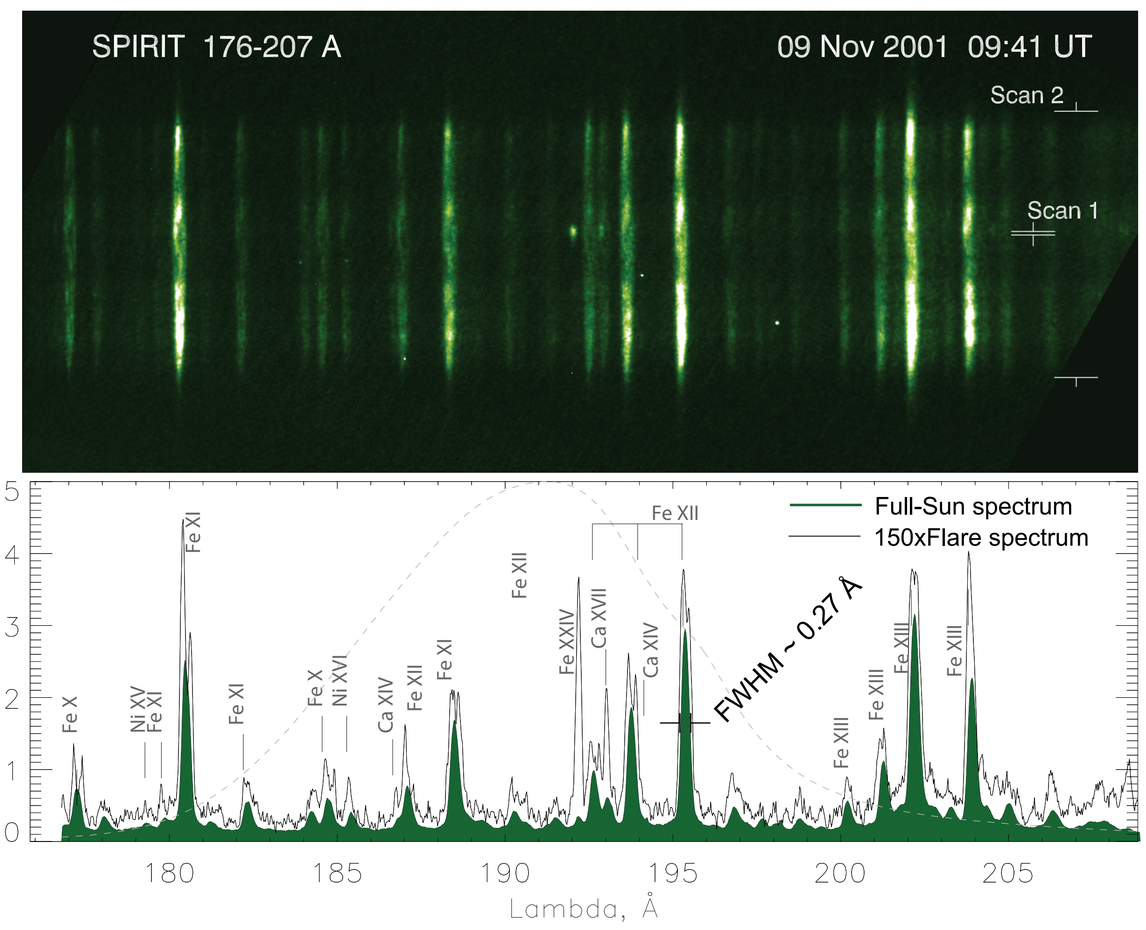
The two **SPIRIT** channel were calibrated independently, but spectroscopic analysis (we calculated DEM using ~50 lines) show a good agreement betwee the two channels.

Now we can:

1. Assess contribution of each spectral line to the **EIT** 195 image
Main contributors:

Fe XI 188.23+.29	~	0.05 erg s-1 cm-2
Fe XII 192.39	~	0.025 erg s-1 cm-2
Fe XII 193.51	~	0.05 erg s-1 cm-2
Fe XII 195.11	~	0.08 erg s-1 cm-2

2. Analyse spectra of the flare (with all the spectroscopic advantages): flare spectrum is given on the figure.



5. Instead of a conclusion

Spectroscopic observations considerably enhance informational content of telescopic data. The same technique is applicable any combination of instruments - like EIS & EVE & AIA and future space missions (common spectral ranges are required).

In Lebedev Physical Institute future spectroscopic experiment is planned: KORTES complex of instrumentation aboard International Space Station is scheduled on 2015. Spectroscopic channels will ragne from 170 to 330 A.

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