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Solar flares observed by AVS-F instrument onboard CORONAS-F satellite during 2,5 year of it's operation

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Abstract. AVS-F instrument (Amplitude-Time Spectrometry of the Sun) is the system of an electronics engineering for onboard data gathering from two detectors: scintillation (CsI (Tl)) detector SONG-D (SOlar Neutrons and Gamma quantums) of complex of detectors SKL (in low and high gamma-band) and from semiconducting detector (X-ray semiconducting spectrometer) XSS-1 (in X-ray band). The experiment is carried out on the satellite CORONAS-F launched on July 31 2001. During more than 2,5 year of apparatus operation more than 30 of solar flares were detected. Characteristics of observed solar flares are presented in this article.

The AVS-F (amplitude-time Sun spectrometry) instrumentation (description see Arkhangelsky et al (1999))is intended to study characteristics of fluxes of hard X-rays, γ-rays and neutrons from the Sun and solar flares and to detect and record events like γ-ray bursts (non-stationary fluxes of γ-rays from space). The experiment is conducted under the CORONAS (Complex ORbiting ObservatioNs of the Active Sun) international project and carry out onboard CORONAS-F special-purpose automatic station (NORAD catalogue number 26873, International Designator 2001-032A) that had been launched from Russian kosmodrom Plesetsk at 11:00 UT of 31 July 2001 into a circular orbit oriented towards the Sun with inclination 82.5° and altitude $\sim$ 500 km.

A function diagram of the AVS-F instrumentation is shown in Figure 1.a. The instrumentation consists of two detectors and AVS-F hardware unit. The AVS-F apparatus use signals produced by the SONG-D detector (energy deposition ranges of $0.1 \div 17.0$ MeV and $4.0 \div 94.0$ MeV by up to date calibration data (Arkhangelskaja et al (2002)) based on the CsI(Tl) crystal Ø 20 cm and height of 10 cm with electronics unit SONG-E (Devicheva et al (1999)) for γ-rays and neutron measurements, semiconductor detector XSS-1 ($3 \div 30$ keV energy deposition range) and the AC is the anticoincidence signal generated by the plastic scintillation counter of the SONG-D.

Above 30 solar flares with class M2 and higher in GOES classification were registered during 2.5 year of AVS-F device operation. It was observed 14 flares with class X and 9 flares with class higher than M5.0 (see Table 1). It is seen that in most part of flares cases gamma-emission interval is shorter than X-ray one. The examples of solar flares temporal profiles are shown in Figures 1.b,c. At present (at the moment of writing this article), the AVS-F instrument successfully operates onboard CORONAS-F satellite during period above 2.5 year. Total amount of the received information is about 6.5 GB. The apparatus works from launching up today′s without any malfunctions accordingly to telemetry test information.

Table 1. The characteristics of solar flares with class > M5.0 observed by AVS-F

day	AVS-F time∗	class	active region	coord.	GOES time
25.08.2001	16:28:06-16:38:44	X5.3	9591	S17E34	16:23-17:04
05.09.2001	14:27:06-14:30:01	M6.0	9601	N15W31	14:25-14:34
19.10.2001	01:20:45-01:37:01	X1.6	9661	N16W18	00:47-01:13
19.10.2001	09:33:54-09:38:26	M5.7	9658	S14W47	09:35-09:55
19.10.2001	16:15:00-ERB	X1.6	9661	N15W29	16:13-16:43
23:10:2001	02:15:16-02:16:52	M6.5	9672	S18E11	02:11-02:34
04.11.2001	16:06:00-16:14:00	X1.0	9684	N06W18	16:03-16:57
07.11.2001	19:33:03-19:34:40	M5.7	9690	S17E44	19:30-20:26
25.11.2001	BTG-09:56:38	X1.1			09:45-09:54
04.04.2002	15:28:53-15:31:03	M6.1			15:24-15:38
21.04.2002	BTG,BRB - 02:33:00	X1.5	9906	S14W84	00:43-02:38
11.07.2002	14:47:24-14:49:49	M5.8	0030	N21E58	14:44-14:57
17.07.2002	07:11:11-07:14:39	M8.5	0030	N21W17	06:58-07:19
20.07.2002	TG,21:27:49-21:35:25,ERB	X3.3			21:04-21:54
26.07.2002	22:06:22-22:09:57,ESH	M5.3			22:03-22:32
24.08.2002	00:57:00-01:06:16,ERB	X3.1	0069	S02W81	00:49-01:31
17.03.2003	18:57:35-ERB	X1.5	0314	S14W39	18:50-19:16
11.06.2003	20:06:15-20:08:54	X1.6	0375	N14W57	20:01-20:27
26.10.2003	21:35:20-21:37:56	M7.6	0484	N01W40	21:34-21:48
29.10.2003	20:40:00-21:01:00	X10.0	0486	S19W09	20:37-21:01
04.11.2003	19:33:01-19:34:00; 19:37:35-20:23:25	X17.4	0486	S18W88	19:29-20:06

∗ BRB (ERB) — flare's begin (end) in radiation belt, ESH — flare's end in the Earth shadow, BTG — flare's begin in telemetry gap

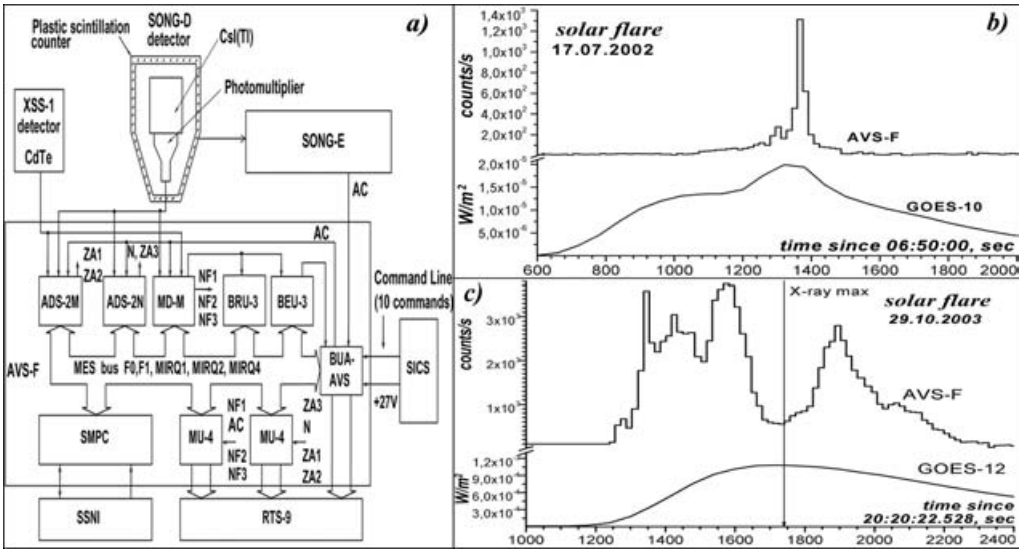

Figure 1. The functional diagram of AVS-F apparatus (a) and examples of solar flares temporal profile on AVS-F and GOES data (b,c)

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