THE 22nd CYCLE PROGRAM OF MODERNIZATION OF THE RATAN-600 FOR SOLAR OBSERVATIONS

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The program intends to improve significantly all the parameters of the radio telescope RATAN-600 to gain better spectral, temporal and spatial resolution of the instrument. The program includes 3 main project: ICAR-32, PAS and Radioheliograph.

ICAR-32. A new system of registration (Intellectual Complex of Automatic Registration, 32 channels) is used in the mode "South sector + periscope" of the antenna. It is installed on the feed system # 3 which is moved along the arc railway track and allows about 4 hours of observations per day (+ 2 hours around local meridian i.e. ~9 hour UT). One dimensional scans of the Sun can be made at least each 10 minutes on up to 16 frequencies in the wavelength range from 8 mm to 75 cm with registration both intensity and circular polarization (I and V Stokes parameters). At present we have 12 frequencies at disposal (1 0.8, 2.0, 2.3, 2.7, 3.2, 4.0, 6, 8, 11.7, 21, 32 cm) and one observation per day at the meridian. The reconstruction of the arc railway track and south sector of the main reflector are under way.

The example of the records of the whole Sun and an active region are shown on Fig. 1 - 3. Optimum amplification for each of 32 channels is controlled every 0.1 sec.

PAS. Panoramic Analyser of the Spectrum (PAS) is intended to gain full continuous coverage of the main part of the wavelength band of the RATAN-600 (2 - 20 cm). It is supposed to be mounted on the feed system # 6 which is capable for usage both with radial and arc railway tracks of the telescope. The PAS consists of 6 wide-band receivers which cover wavelength range from 1.7 cm to 21 cm (see Fig. 4). Each of the receivers has 8 channels with relative wavebands about df/f = 5%. So the full number of channels used in parallel is 6X8X2=96 including registration both left and right-handed circular polarization (I and V Stokes parameters). A more detailed spectral analyser with the resolution up to 1 - 2 MHz may be used with one of the receivers above. At the present stage of

construction one receiver with 8 bands, covering 8 - 12 GHz has beer completed. The receivers for 4 -8 GHz and 12 - 16 GHz are expected to be at work at the end of this year. The system PAS is supposed tc be applicable also for study milisecond processes on the Sun. An example of using PAS for Solar eclipse observation is given in ~~Fig. 5.~~

Radioheliograph. The radioheliograph of the RATAN-600 is to use feed system # 6 which is normally works with the full ring of the main mirror while the beam is directed to near the zenith. For solar work, however, only about 2/3 of the main reflector is attainable. To this end the feed systen # 6 is placed about 130 m to the North of the antenna center. The size of the aperture is about 600m X 400m (corresponding resolution 10 X 15 arcsec at l = 4 cm). Three modes of observations have been proposed for radioheliograph.

Mode A. Synphase aperture and one-main-beam diagram is used. To attain synphase apertura the separate reflecting elements (full number in this mode is about 600) are shifted on the (digital X wavelength). The observation on a set of discrete frequencies can be used such as e.g. 12, 6, 4, 3 and 2 cm. To obtain a two-dimensional map of an active region one needs to make a dozen or more scans with intervals say about 6 minutes at different declinations. Owing to strong side-lobes (see Fig. 5) a cleaning procedure to improve a map is desirable.

Mode B. Asynphase aperture diagram-pattern consisting of large number of comparable in intensity lobes is used (see Fig. 6). This diagram pattern is strongly frequency-dependent. Using a spectro-meter with large number of channels we can get enough information tc restore the radio map of the whole solar disk providing the source has not a very complecated spectrum. This mode can be applicable even for mapping some bursts of solar radio emission.

Mode AB. This mode is a combination of the two previous ones. For a single frequency we use a single beam synphase diagram and on other frequencies of a spectrograph we register the Sun with multi-beam diagram pattern (~~see Fig. 7~~).

At present all three modes of the radioheliograph of the RATAN-600 are being modelled with the computators. The necessary parameters of the receiver system has been found.

The above program of modernization of the RATAN-600 is carried out by combined efforts of the Special Astrophysical Observatory and the Central (Pulkovo) Astronomical Observatory of the Academy of Science of the USSR.

REFERENCE

V.M.Bogod, G.B.Gelfreikh, A.N.Korzhavin, L.A.Pustilnik (1988).

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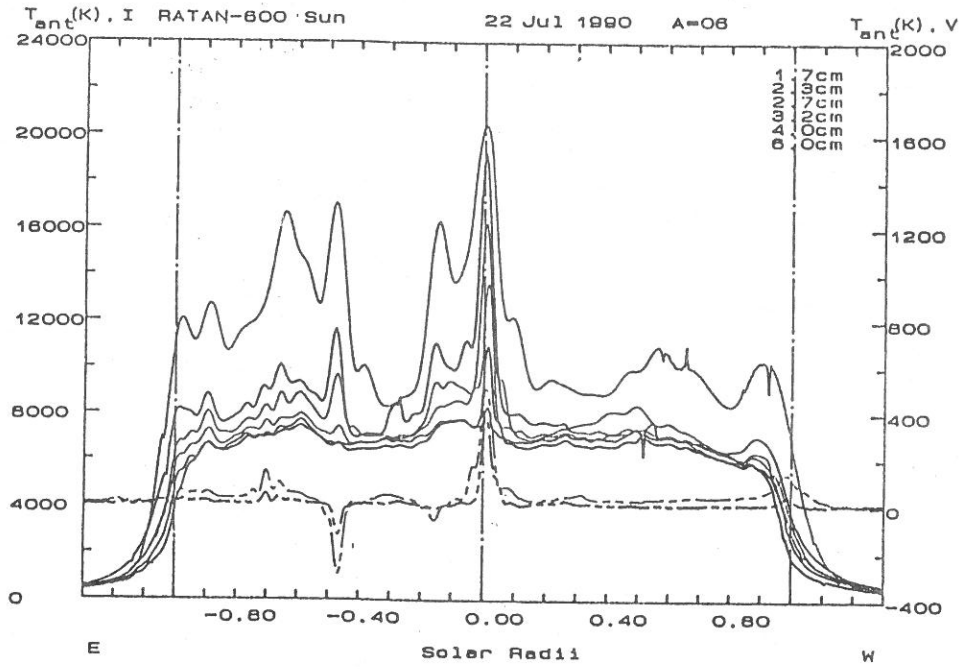
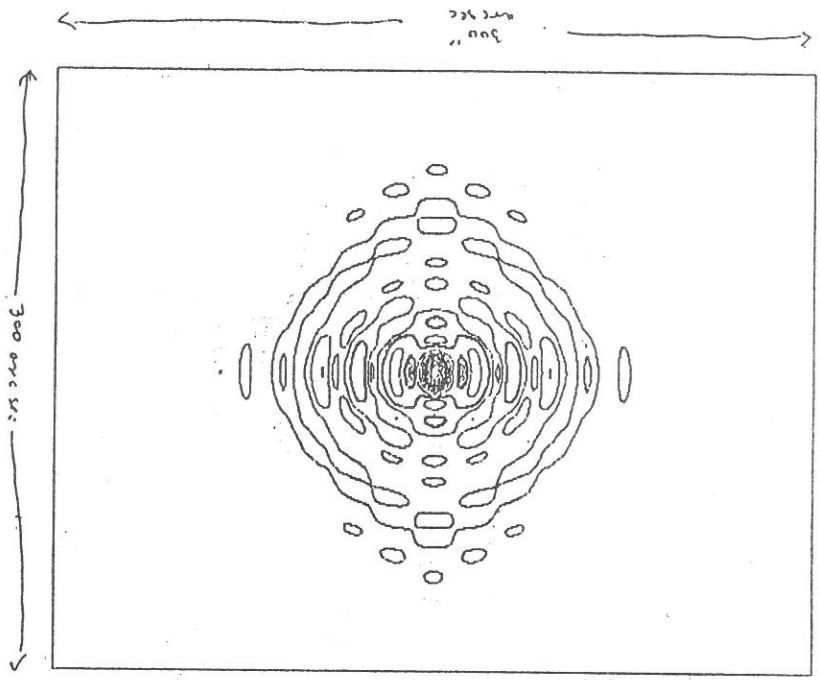
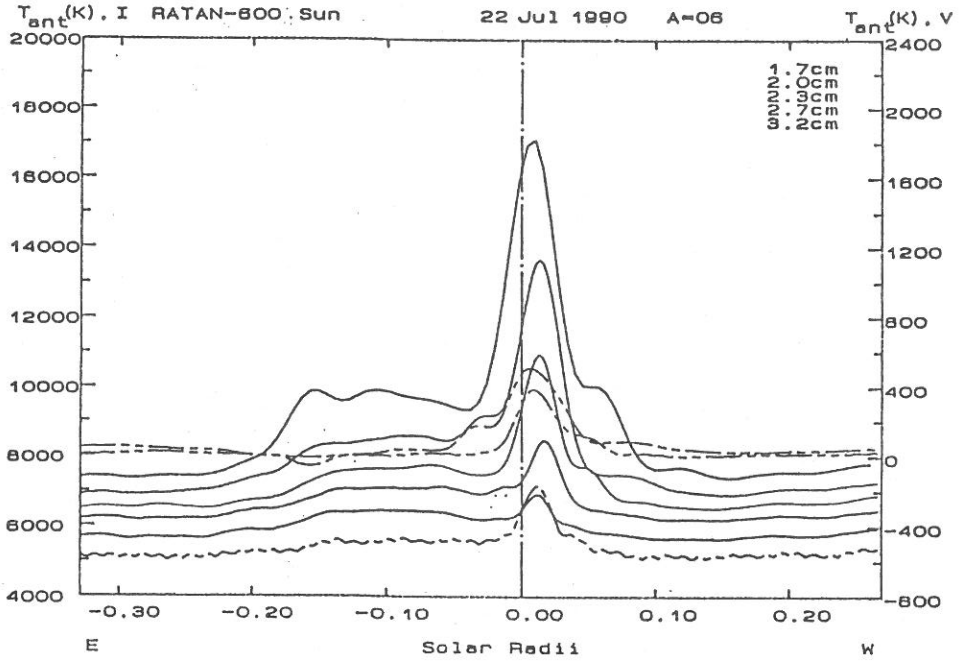

T_{ant}(K). I RATAN-600 Sun
22 Jul 1990 A=06
T_{ant}(K). V
1.7cm
2.0cm
3.7cm
7.2cm
14.0cm
24000
20000
16000
12000
8000
4000
0
2000
1600
1200
800
400
0
-400
-0.80
-0.40
0.00
0.40
0.80
E
Solar Radii
W




T_{ant}(K). I RATAN-600 Sun
22 Jul 1990 A=06
T_{ant}(K). V
1.7cm
2.0cm
3.9cm
7.7cm
9.2cm
20000
18000
16000
14000
12000
10000
8000
6000
4000
2400
2000
1600
1200
800
400
0
-400
-800
-0.30
-0.20
-0.10
0.00
0.10
0.20
E
Solar Radii
W

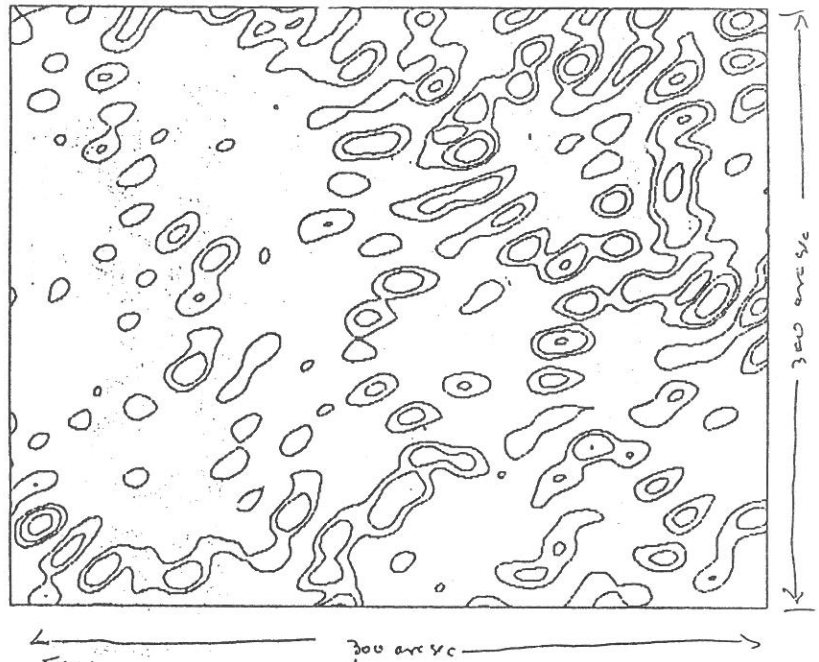


Fig.6

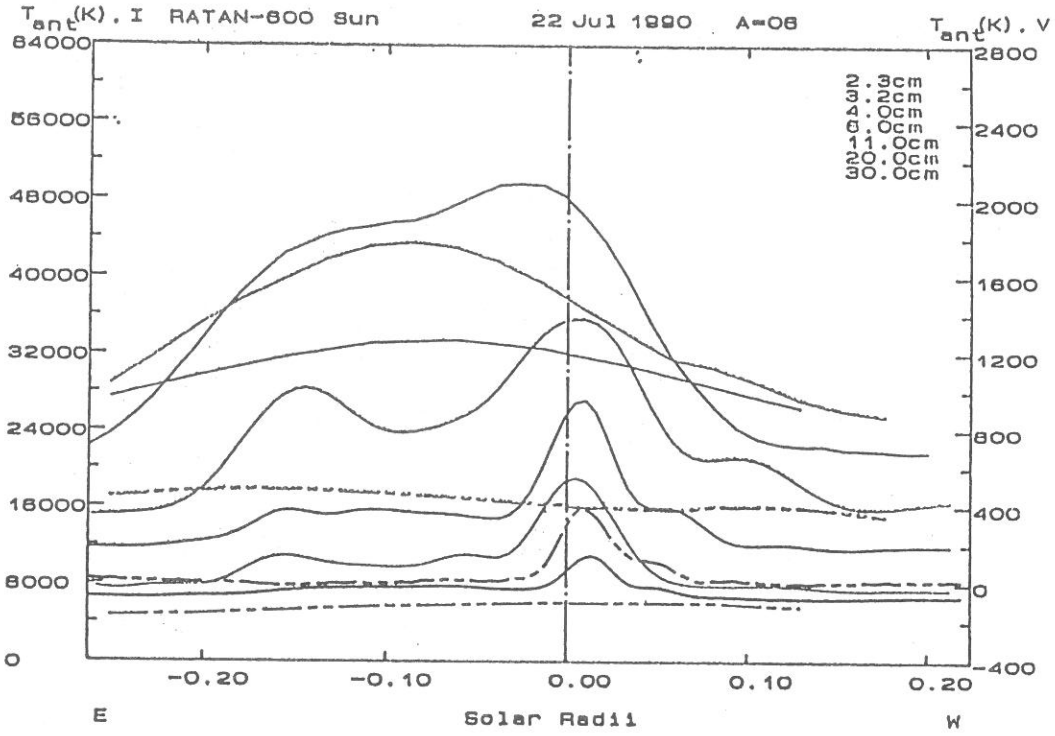

T ant (K). I RATAN-600 Sun
22 Jul 1990 A=08
T ant (K). V
2.3cm
3.2cm
4.0cm
6.0cm
11.0cm
20.0cm
30.0cm
64000
56000
48000
40000
32000
24000
16000
8000
0
2800
2400
2000
1600
1200
800
400
0
-400
-0.20
-0.10
0.00
0.10
0.20
E
Solar Radii
W

Fig 3