Multi-Wavelength Investigations of Solar Activity
Proceedings IAU Symposium No. 223, 2004
A.V. Stepanov, E.E. Benevolenskaya & A.G. Kosovichev, eds.

DOI: 10.1017/S1743921304007008

Multy octave spectral-polarization observations of solar atmosphere at radiowaves.

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The wide range frequency observations at microwaves with high spatial resolution open new ways in developing the solar physics today. They may result in most sensitive diagnostics of the upper chromosphere, TR, and corona in respect to the following parameters: - magnetic fields strength and structure; - plasma density; - periodic oscillations of plasma structures; - plasma oscillations; - temperature. The situation has been demonstrated by using a number of modern radio telescopes of interferometer type: radio heliographs at Nobeyama and Badary (SSRT), multi-element interferometer VLA. Each of them has its own important parameters, but in limited sphere of applications. In this presentation we discuss some results obtained with the reflector type instrument RATAN-600 anf possible directions in developing its parameters. The parameters of the RATAN-600, used now at the solar observations are summarized below. The most important are:

- high collecting area (about 1000 m^2) and high flux sensitivity;
- wide wavelength range ($1.7 \div 30$ cm);
- high spectral resolution ($\sim 5\%$);
- high polarization sensitivity (better than 1%).

At the same time there are serious limitations of the parameters:

- one-dimensional resolution (about 15 arcsec at wavelength 17 mm);
- limited guiding system.

As a result of exclusively good spectral-polarization parameters several methods of measurement of the coronal (and CCTR) magnetic fields have been developed. The most effective are using:

- polarization of thermal bremsstrahlung emission;
- inversion of the sign of the polarization in the regions of the quasi-transverse propagation;
- spectral parameters of the sources of the thermal cyclotron emission.

As a result, a number of the original results on the magnetic field strength and structure have been found for the following plasma structures of the solar atmosphere:

- CCTR above sunspot;
- prominences;
- coronal holes;
- CME;
- coronal arches;
- faculae regions.

A lot of results in studying parameters of the solar atmosphere, based on observations

with the large modern radio telescopes (mentioned above) have shown high effectiveness of the radio diagnostics of the solar plasma. Some original methods of forecasting solar flares and other forms of activity were found. Nevertheless, no instrument adequate to use on proper level these new methods are available. In fact, one needs a combination of the following parameters:

- high spatial 2D-resolution (few arcsecs);
- high time resolution (msecs);
- wide field of view (about one deg);
- large daily time coverage;
- high flux/brightness sensitivity;
- high polarization sensitivity (much better than 1%).
- wide frequency range and spectral resolution (several octaves with 1% resolution).

Some of these parameters are expected to be realized in FASR project. The problems of sensitivity s the most difficult and needs further ways for its progress. Some possible direction to solve the problems shortly discussed below. Having in mind that multi element interferometers are not able to achieve the necessary sensitivity (due to the noise generated by the whole sun emission) and problems to obtain high 2D resolution with reflectors we propose to combine both types of antennae in one radio telescope. Experience of the RATAN type reflectors could be used for such combination. We suggest an instrument with the 2D resolution of few arcsec and collecting area of about $50000m^2$.

Acknowledgements

This work is partially supported by RFFI grants 02-02-16430, 02-02-16548, 02-02-17357, SSTP-16KI and OFN-16