REDUCTION OF THE PARASITICAL SIGNAL OF CIRCULAR POLARIZATION ON AN ANTENNA OF VARIABLE PROFILE WITH THE HELP OF A GRATING

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Abstract. A method of reducing circular parasitical polarization in the antennas of variable profile with the help of a grating of curved wires is reported. The experimental verification of the method shows that the parasitical signal practically vanishes. It was established that using this method, simultaneous observations at three or even five wavelengths can be made.

It is well known that the diagram of an antenna of variable profile has parasitical lobes of cross polarization (Esepkina *et al.*, 1961; Kuznezova and Soboleva, 1964). The maxima of these lobes are situated in one of the main planes. The cross-polarized lobes are displaced in phase by 90° with respect to the main polarization, therefore it is difficult to study the circular polarization of the radio sources. In particular it is important in the case when solar magnetic fields are studied by radio methods.

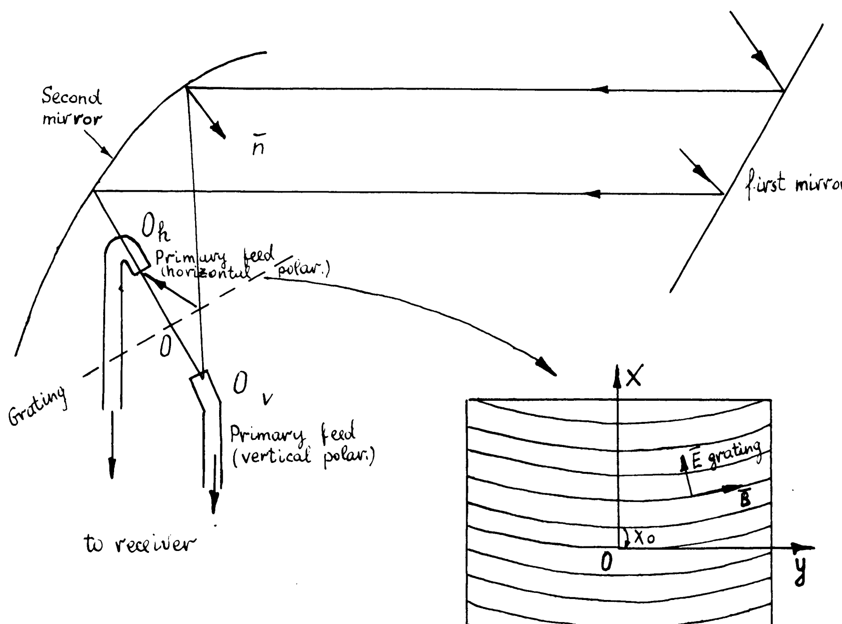

Fig. 1. The method of measuring circular polarization by means of a grating.

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To overcome these difficulties in observations of circular polarization, the installation of a grating of curved wires was suggested (Esepkina *et al.*, 1969). This grating is placed in front of the primary feed. The method of measuring the circular polarization by means of a grating is shown in Figure 1.

The scheme (Figure 2) comprises two feeds of different polarization (horizontal and vertical), the grating being inserted between them. The signal with vertical polarization from the celestial source passes completely through the grating, however only the useful part of it (without cross polarization) is received by the feed. The same effect takes place when we deal with the horizontal polarization, which is reflected from the grating.

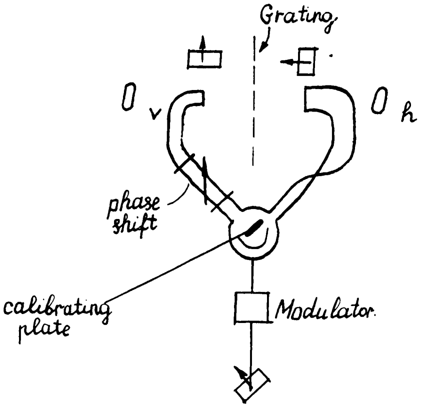

Fig. 2. The scheme of the feeds.

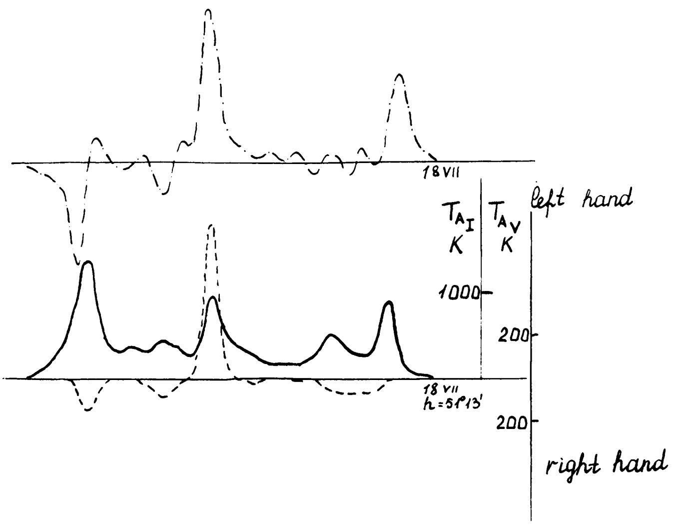

Fig. 3. Scans of circularly polarized and unpolarized emission from the slowly varying component of the Sun. The upper curve is without compensation of the parasitical signal. The lower curve (dashed) is the same polarized signal with compensation.

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One of the polarizations is then phase-shifted and added to another in a cylindrical waveguide. After this the signal is modulated with the ferrite modulator. The shape of the wires was calculated with the aid of a Minsk 22 computer.

To check this method, observations of radio source Tau-A were made. The source Tau-A has no circular polarization. After this experiment it was proved that a circular parasitical signal can be reduced by more than a factor of 10–20.

Observations of the circular polarization of the Sun by the proposed method were commenced with the Pulkovo large radio telescope in July 1968 (Esepkina *et al.*, 1968). The scans of circularly polarized and unpolarized emission from the slowly varying component of the Sun are shown in Figure 3. Circular polarization without compensation of parasitical signal is depicted by the upper curve. The next (dotted line) is the same polarized signal with compensation of parasitical signal using the grating.

Regular observations of circular polarization with the Pulkovo large radio telescope started in March 1969 simultaneously at three wavelengths. The results will be published in the bulletin *Solnechny Dannye* (Russian *Solar Data*).

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