# RADIO EMISSION OF THE SUN AT DECAMETER WAVELENGTHS

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Radio astronomical study of the solar corona and radio emission of the Sun at decameter wavelengths (12 − 30 m) have been carried out in Ukraine at the largest decameter UTR-2 radio telescope since 1972. The aims of this study are thermal and sporadic radio emission of the Sun and the scattering of radiation by the solar corona. The main aims of the theoretical research is to study various properties of the radio emission of the Sun. The particular interest of this study is construction of physical models for solar Type III bursts. The drift rate, observed time profile, brightness temperature of F– and H–components, *etc.* are explained in the framework of these models.

The scattering properties of the solar corona in the range from $5\,R_\odot$ to $25\,R_\odot$, the thermal emission of the quiet Sun, as well as the local sources of Slowly Varying Component (SVC) of the solar radio emission and sporadic decameter radio emission of the Sun are investigated with UTR-2. The principal results can be formulated as follows:

1. The extended radio sources occultation by the corona was observed by Bazelyan *et al.* [7]. For the first time the two dimensional images of these sources were obtained. The angular width of the observed power spectrum at $\lambda > 10$ m increases with $\lambda$, somewhat less rapidly than $\lambda^2$. This fact can be explained in a non-uniformity solar corona [7, 8].

2. Two-dimensional brightness distribution of the quiet Sun is observed within decameter wavelengths for the first time. It is shown that variations of these distributions have a solar origin [3].

3. Observations of the quiet Sun [1] and the extended radio sources better agree with a corona model with radial prolongated structures.

4. The enhanced radio emission of the quiet Sun is usually observed for tens of minutes after intensive Type III bursts. In our opinion this is an effect of isotropization of one-dimensional Langmuir waves generated by electron streams [11].

5. In spite of some reports there is no convincing evidence for the existence of local SVC sources at decameter wavelengths [6].

6. Observations of Type IIIb-III bursts at 25, 12.5, and 6.25 MHz support a fundamental–harmonic burst pairs interpretation [5].

7. Observations of solar storms of Type III bursts show that

a) the F–harmonic takes place when the emitting region is at the disc center and

b) the H–harmonic is realized [2] when the region is near the limb.

8. Deceleration of fast electron streams responsible for Type III bursts has been investigated at decameter wavelengths. This phenomenon is due to a collissionless mechanism [10].

9. Diffusive stria bursts and their chains of Type IIIb have been searched for. It can be shown after observations of stria burst position that they are superposition of ordinary H–harmonic stria bursts and their echoes [9].

Type III bursts are the most bright manifestation of a solar sporadic radio emission in the wide frequency range from $100 - 300$ MHz to $20 - 30$ kHz with the most pronounced peculiarities at decameter wavelengths ($10 - 25$ MHz). The fast electrons propagating along magnetic field lines with velocities about 0.3 c are considered to be responsible for their radio emission. To the last time there is no satisfactory Type III burst theory for lack of theory of the electron propagation through the coronal plasma [15]. Recently, the gas-dynamic theory of propagation of electron beams in plasma was proposed [13, 14]. According to this theory fast electrons move in coronal plasma as a beam-plasma structure that consists of electrons and Langmuir waves. The structure velocity is constant that explains an invariability of drift velocity of Type III bursts. The nonlinear processes ($l + i = l + i$) of scattering Langmuir waves on plasma ions are turned out to limit the maximum velocity of beam-plasma structure that equals to approximately 0.3 c. This is the cause of Type III burst drift velocity. Langmuir waves of beam-plasma structure taking into account in processes ($l + i = t + i$) and ($l + l = t$) give emission at fundamental and harmonic frequencies. In these cases the brightness temperatures of radio emission of beam-plasma structure $T_{bps}$ are equal to $10^{13}\,K$ and $10^{15}\,K$, respectively. As Type III burst seems to consist of large number of separate microbursts for the brightness temperature of the burst we have $T_{III} = fT_{bps}$, where $f$ is the filling factor [16]. For $f = 10^{-2} - 10^{-3}$ [16], at decameter wavelengths we derived values $10^{11} - 10^{12}\,K$ closed to the observed ones. So, the gas-dynamic theory of electron propagation in plasma allows to explain the main properties of Type III bursts [12].

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