COMPUTER SIMULATION OF THE SIMULTANEOUSLY FORWARD AND BACKWARD SCATTERED METEOR TRAILS

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The authors assume the existence of two-sided scattering meteor trails that simultaneously scatter radio waves forward to the receiver and backward to the transmitter. We named it as forward-backward scattering meteor trails or FBS trails. In our opinion, there are no scientific researches in which this type of scattering on meteor trails were previously studied.

FBS-trails are not just one of the interesting radio astronomy phenomena. The authors propose to create time marks transmitting through FBS trails and to use them to synchronize spatially separated time scales.

Let's consider the geometry of radio waves scattered on a FBS trail. Any meteor trail scatters radio waves at its part called a reflecting point. The place of the forward scattering points forms an ellipsoid with focal points in which the transmitter and receiver are located. The place of the backward scattering points forms a sphere with the center in which the transmitter is located. The FBS trail is tangent to the ellipsoid and the sphere (fig.1). Based on the geometry, each meteor trail could be FBS. But meteor heights (about 70-120 km) and the finite size of the meteor trails (10-30 km) do not offer the existence of FBS trails.

In this paper the authors prove the existence of FBS trails. It was necessary to obtain meteor trails with the FBS geometry on the meteor heights; to estimate the number of FBS trails on different radio links and to identify crucial parameters of FBS trail.

To solve the tasks, the authors used a computer simulation model of the meteor radio channel - «KAMET» [1, 2]. The KAMET model simulates the formation processes of a meteor trail and the scattering of radio waves from this trail based on the characteristics of receiving and transmitting equipment. The accuracy of the simulation was repeatedly verified by comparing with the results of field experiments [3].

The authors modeled FBS trails for various latitudes and radio link lengths, different seasons and hours. In all cases, there were FBS trails. The percentage ratio of the number of FBS trails to the number of all meteor trails varied from 0.1% on the radio link lengths up to 1200 km and 15% on radio link lengths less than 300 km. Thus, the percentage ratio of the number of FBS trails decreases with increasing radio link length. The daily variation of the percentage ratio of FBS trails varies little with latitude. It has a minimum at noon and a maximum in the evening hours.

It was necessary to identify the unique parameters of FBS trails for the further selection FBS meteors during observations. After comparing the various parameters of the FBS and all meteor trails, it turned out that sampling of the FBS trails and the sampling of all meteor trails have the most significant differences in values of the trail vector's direction cosine l for the x-axis. Therefore, the most FBS trails are almost perpendicular to the radio link. There is the possibility of its selection by the l.

In conclusion, the authors note that the development of FBS trail's computer model allowed them quickly and reliably study of a new type of scattering in meteor trails without real measurements.

References

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