Karachanskaya E. V. (Khabarovsk, Russia) **On the content of a random signal**

The problem of Search for Extraterrestrial Intelligence (SETI) or Search for Alien Civilizations is one of the most interesting problems. Most often the signals received by radio telescopes are tried to be decoded. We propose and justify another approach, different from the traditionally used [1], which is the detection of a set of some invariants, constants $\{C_j\}, \quad j \geq 2$, the presence of which can mean that these signals are messages from an Alien Civilization (AC) [2]. It is reasonable to associate constants with universal concepts, for example, such as time and quantity. Since the Earthlings and the AC have different number systems and units of measurement, the constants should be dimensionless quantities, for example, ratios.

Let the radio telescope fixes during some period of observations signals of different durations. Statistical processing of the received signals will reveal that the signals with durations clustered near some values t_1 and t_2, with the highest frequencies of occurrence n_1 and n_2, have been received. If the signals arriving in the next observation interval have characteristics t_1^* and t_2^*, with the highest frequencies of occurrence n_1^* and n_2^*, respectively, then if the equations $t_1 : t_2 = t_1^* : t_2^*$ and $n_1 : n_2 = n_1^* : n_2^*$ (generally approximate), we can claim that a message from an Alien Civilization has been received. The constants $\{C_1, C_2\}$ are defined, for example, by the relations $C_1 = t_1 : t_2$ and $C_2 = n_1 : n_2$. If we consider these signal sequences over the entire observed time interval as Poisson flows whose parameters λ_1 and λ_2 can be statistically determined, then, for example, the relation $C_3 = \lambda_1 : \lambda_2$.

To obtain a statistical estimate of the ratio $C_3 = \lambda_1 : \lambda_2$ we use an algorithm similar to [3].

Let T be the total observation time, $T = \sum_{l=1}^{k} \Delta_l$, consisting of non-overlapping time intervals, $n_i(\Delta_l) = n_i(l)$ be the number of random signals (events) belonging to the group with mean duration t_i received in the time interval Δ_l, and $\kappa_j(l)$ be independent for any j, l random variables characterising the absorption capacity of the random medium: $P(\kappa_j(l) = 1) = P(l)$, $P(\kappa_j(l) = 0) = q(l) = 1 - P(l)$, $j \geq 1$, $\kappa_0(l) = 0$, and $(P(1), P(2), \ldots, P(k))$ be the sequence of signal absorption/distortion probabilities.

Theorem. Let λ_1 and λ_2 be the parameters of two independent Poisson flows of random events, and let $\eta(T) = \frac{Z_1(T)}{Z_2(T)+1}$, where $Z_i(T) = \sum_{l=1}^{k} \sum_{j=1}^{n_i(l)} \kappa_j(l)$, $i = 1, 2$, be a random function. Then, for any realisations of the sequence of signal absorption/distortion probabilities $(P(1), P(2), \ldots, P(k))$ it holds:

$$\underset{T \to \infty}{\text{l.i.m.}}\, \eta(T) = \frac{\lambda_1}{\lambda_2}.$$

REFERENCES

1. *Mazor Yu. L.* Radio contact with extraterrestrial civilisations: a monograph / Y. L. Mazor. – Kyiv: NTUU KPI, 2013. (In Russian)

2. *Dubko V.A.* Application of the method of bypass thinking / Theses of reports of the 3rd International Scientific and Practical Conference «Pedagogical process in the conditions of transition to a new state of society», Birobidzhan, 29-th November, 1994. – Birobidzhan : BSPI Publ., 1995. – P.69–70. (in Russian)

3. *Mezhueva T.I.* Investigation of stochastic models of interacting information flows : abstract of thesis ... Cand. of phys. and math. sci. : 05.13.18. – Tomsk, 2006. (in Russian)