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PRELIMINARY RESULTS OF INVESTIGATION OF SOLID INTERPLANETARY MATTER IN THE VICINITY OF THE MOON

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SUMMARY

On the basis of a hypothesis brought forth that the increased density of the matter in the vicinity of the Moon may be explained by the fact that the Moon itself is their source, the authors conclude that the instrumentation aboard LUNA-10 must register particles of lunar origin, as well as the meteoric particles, of which the number is small. The conclusion is derived also that the density of the matter in the vicinity of the Moon differs from the average for the interplanetary space by more than 4 orders.

* * *

The investigation of meteor matter on the AMS "LUNA 10" was carried out with the help of piezoelectric sensors sewn on the lining of the probe, and sensitive to meteor particle impacts with masses of $7 \cdot 10^{-8}$ g and more for a particle velocity of 15 km/sec. The surface sensitive to impacts constituted 1.2 m^2 .

Between 3 April and 12 May 1966, 198 particle impacts were registered for the time of 11 hours and 50 minutes, which constitutes $4 \cdot 10^{-3}$ impacts per 1 m^2 per second, and exceeds by 2 orders the average for interplanetary space.

It is well known that in interplanetary space meteor particles are mostly agglomerated in separate clusters of which the extension varies within broad limits; the spatial density of particles in them is irregular and may exceed by 1—2 orders the average value. However, the registration of increased density of particles in the vicinity of the Moon for as prolonged a time as that of LUNA-10 experiment, provides the basis to assume that this condensation has a local character and is related to the Moon.

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* PREDVARITEL'NYYE RESUL'TATY ISSLEDOVANIYA TVERDOGO MEZHLANETNOGO VESHCHESTVA V OKRESNOSTI LUNY.

The observations encompassed a region constituting a sheath surrounding the Moon, and having a thickness of about 650 km and distant from the surface of the Moon by 355 km. Only a small part of this sheath, invisible from Earth, constituted an exception.

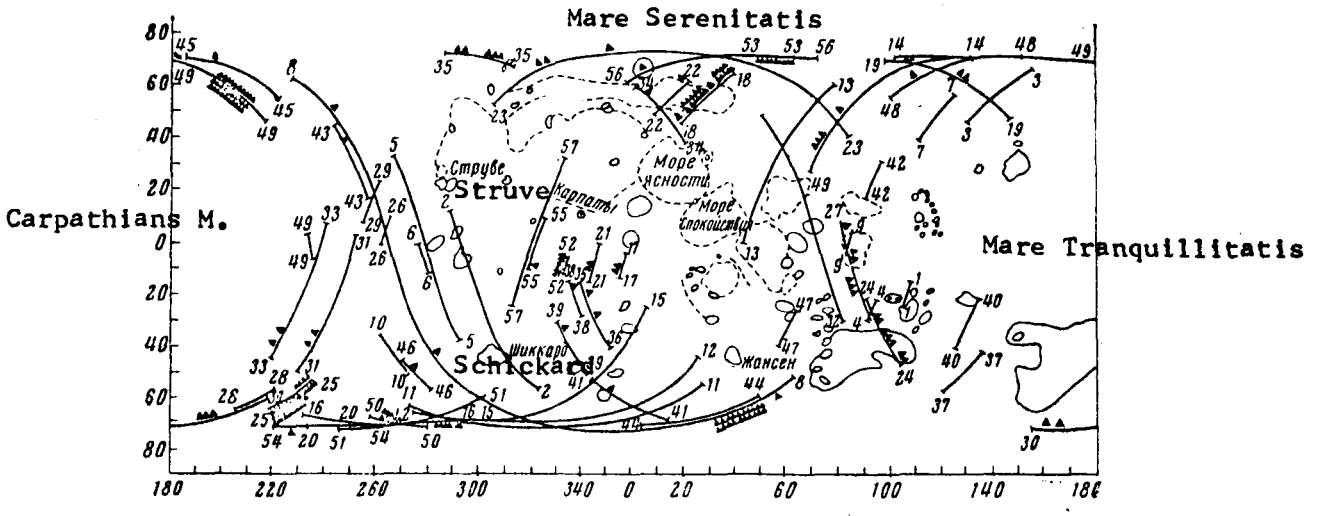

Fig. 1. Projection on the surface of the Moon of satellite trajectories over which was conducted the registration of particle impacts. The registered particle is marked by black triangles

The registered particles were observed at various heights from 355 to 1050 km, and were mostly agglomerated into clusters of extension from ~ 100 to ~900 km whereupon no dependence of spatial density of particles on the distance from the Moon was revealed.

The increased density of matter in the vicinity of the Moon may, in our opinion, be explained by assuming that the Moon itself is the source of particles. During the collision of meteor bodies with the surface of the Moon there takes place an explosion with ejection of a mass of lunar rock, exceeding by many factors the mass of the impacting particle. At the same time, the degree of fragmentation of the ejected matter depends on the composition and the structure of lunar surface. The particles thus ejected have a broad spectrum of velocities with maximum in the region $v = 1-3$ km/sec. After the explosion part of the matter returns on the Moon's surface, another part leaves the neighborhood of the Moon and departs into interplanetary space and still another part, under the combined action of the terrestrial and lunar fields of solar pressure, may exist a certain time on orbits around the Moon. The possible number of such particles is still unknown to us, and special computations will be required for their quantitative estimates.

If our hypothesis is correct, the apparatus installed aboard LUNA-10 must register the particles of lunar origin (departing into interplanetary space and those over orbits around the Moon), and also meteor particles, of which the number is small by comparison with lunar particles.

In this case, for most of particles the value of velocity must not be assumed to be 15 km/sec, as is done by us for sporadic meteor particles in the near-Earth space, but within the 1–3 km/sec range mentioned above. Since, as previously, we utilized during the interpretation of data the dependence $I \sim E$, where I is the pulse registered by the sensor, and E is the energy of the particle, in this case the value of the limit registered mass of the particle increases to $\sim 10^{-6}$ g, and the spatial density of dust matter in the vicinity of the Moon will differ from the average for interplanetary space already by more than 4 orders.

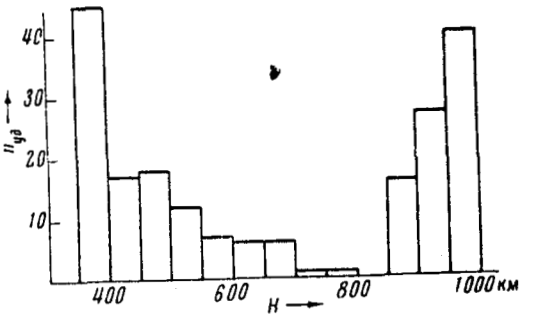

Fig. 2. Distribution in height of registered particle impacts

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**** THE END ****

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