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HIGHLIGHTS OF A PRESS-CONFERENCE AT MOSCOW
HOUSE OF SCIENTISTS *

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A press-conference was held at the House of Scientists on 10 February to climax the "Moon Week", that engulfed the entire Universe, starting from that faithful evening of 3 February 1966, when LUNA-9 accomplished according to schedule its soft landing on the Moon at 21⁴⁵ hours and 30 seconds.

The conference was presided by M. V. Keldysh, currently President of the USSR Academy of Sciences.

After the customary introductory address, Academician Keldysh told the audience the exact sequence of events, giving the already well known particular stages having led to soft-landing and subsequent sessions of radio-communications and transmission of pictures back to Earth.

At the same time, history of previous lunar probes was retraced, involving the "lunniks", Luna-2, Luna-3, Zond-3 of July 1965, having hardly left on the far side of the Moon any "white spots". The speaker referred also to photographs obtained on the visible side of the Moon by "Ranger" in 1964 and 1965 with great resolution. He said, however, that such characteristics of the Moon as the chemical and mineralogical composition of its surface, the structure of its interior, the Moon's seismicity etc.. still bear the character of hypotheses.

Those physical conditions of the Moon, totally unusual from terrestrial representations, that is, the deepest vacuum, the action of Sun's active radiations during billions of years, the continuous falls of meteorites, the low gravitational force, must create very peculiar surface structural conditions, entirely unknown on Earth.

Various hypotheses have been proposed in regard to either dust cover or pumice and even slaggy structure, to lava flows, to peculiar skeleton mineral structures on account of conglomeration of tiny particles of lunar soil, not known to exist on Earth.

The realization of soft landing opens new highways for the study of these properties. The first thing that was evident is the sufficient hardness

* Press-konferentsiya v Moskovskom dome uchenykh.

of the lunar ground, preventing the probe from sinking at landing, and the practical absence of any dust cover. Obviously, subsequent lunar probes will be providing more valuable data on the lunar surface, its mechanical and physico-chemical properties and so forth.

Then, the chairman declared the press-conference open. Follows the statement by Professor Lebedinskiy:

Luna-9 had a look on the lunar landscape by the astronaut's eyes. The height of its television camera is near 60 cm, which assures a visibility of about 1.5 km, as compared to average man's height with its circular range of vision of 2.3 - 2.5 km. The resolution of the "television eye" of the probe is near 3' of arc, whereas for average man it is near 3' of arc. The automatic astronaut examined the surrounding landscape several times at various heights of the Sun above the lunar horizon. While on the first photos even the most slanting inequalities of the soil are noticeable owing to the low height of the Sun, with many details being lost because of their concealing in the shadows of prominent objects, subsequent sessions, particularly the third one, when the Sun was at 27° above lunar horizon, offered panoramic photos with less fulgurations, while the shadows still were sufficient to bring forth the cavities and hollows. Then, as the Sun rose, the photos became of lesser value. The series of panoramic photographs at various heights of the Sun provided the possibility of molding a dummy of the landscape surrounding our probe; only the deepest hollows failed to disclose their real depth, for during the probe's effectiveness, the Sun never rose high enough to light their bottoms.

The objects' remoteness could^{be} ascertained from their angular distance from the horizon. For a precise measurement dihedral mirrors were used, which reflected six narrow bands of lunar landscape. Pair of stereoscopic photos were obtained for these bands, with a base near 50 cm.

A shift of the probe took place between the 2nd and 3rd session, as a result of which the inclination of the television camera changed by a few degrees, while the camera itself shifted by several centimeters. This created the additional possibility of using the stereo-effect for the determination of the distance of the objects near the probe.

The landing near the morning part of the terminator was appropriate from the standpoint of selection of the thermal regime for the probe. As is well known the noon temperature of the lunar soil reaches 120°C near the equator, while in nighttime it drops to -150°. Thus the most favorable operation time is the morning which lasts several terrestrial days.

The station's efficiency was determined by its energetic resources and, according to the program, it ought to have ceased after the 3rd session. However, there still^{was} left a reserve of power after that, which allowed a last transmission 75 hours after landing.

Attention is called to the photometric scale on the left-hand side of the panorama. Its dimension is no greater than a box of matches and it is painted in various colors with known reflection factors. It helped to determine the resolution of the camera at close distances.

The landscape around the probe was found to be hilly with separate craters, possibly of meteoritic origin and of diameter from one to a few meters. The entire surface is covered with a multitude of small hills and hollows, including the most minuscule with dimensions in millimeters. It is my personal opinion that at first sight, the material of the lunar surface at place of landing has been subject to multiple reworking. It was broken as a result of meteorite bombardment, then it was agglomerated into a solid formation by diffusive vacuum adhesion, again split on account of sharp temperature variations from night to daytime, and more particularly during solar eclipses, when it again was broken down, agglomerated and split. All this must have recurred many times in the course of millions of years. The final product emerged as a yellow "yevpatorian-type" * sandstone, or in truth, as an even more porous, but hard, and breakable formation.

Luna-9 allows not only to visualize, but also to estimate the solidity of the lunar ground; it was found to be solid enough to prevent the probe from sinking on landing.

During the flight itself measurements were performed of radiation doses existing in the interplanetary space and on Moon's surface. As was shown at deciphering the signals received, the radiation intensity on the lunar soil is mainly determined by cosmic rays. The dose is of 30 millirad/day. It is revealed, however, that there exists an additional radiation from the Moon, which apparently is caused by nuclear reactions taking place in the superficial layers of the Moon under the action of cosmic rays. We are hopeful that subsequent investigations of this radiation may reveal the secrets of the chemical composition of lunar rocks.

Statement by Academician VINOGRADOV: HILLY STONE DESERT.

This interlocutor stated first of all that the character of the surface of such small planets as the Moon is determined beforehand by the dimensions of the planet itself. As a consequence, there is absence on its surface of water and gas shells on the account of the losses of water and gas sustained in a weak gravitational field.

It was shown by us experimentally that the outer shells of planets, the is the earthy crusts, are formed by way of extraction of low-melting substance on planet's surface. This matter differentiation of the Moon and other terrestrial planets toward the surface (shell) takes place under the heating by radioactive heat; as a consequence, the primary meteoritic matter is splits into high- and low-melting phases. The latter constitutes a basaltic substance, flowing on the surface in the form of lava. The rise of the basaltic magma to planet's surface takes place according to zonal melting, that is, the process is rather the consequence of its low-melting properties than its dependence on a lower density. This basalt extraction is attended by degassing of water and of the acid smokes of volcanic eruptions. It might perhaps be interesting to recall that the basalt flows on Earth are accompanied by a concomitant degassation of 5 to 10 percent of water vapor, in which there is up to 10-15% of acid smoke, that is carbon dioxide and other aggressive gases. The landscape of the Moon points to the same process. Here too the small dimension of the Moon is manifest. While the maximum diameters on Earth are of

* for Yevpatoriya — resort town of the West coast of Crimea.

30 km, they reach on the Moon up to 300 km, due to the weak gravitational field. The basaltic lava flow on the Moon takes place in vacuum. That is why its release from the gaseous phase and water vapors took place somewhat differently from what is known on Earth. By the strength of the same circumstances gases and water flew from the Moon, passing into the outer space and it must be noted, for instance that gas bubbles in the lava and the gas cavities might here be substantially greater than in the course of analogous process on Earth. Certain more volatile products of volcanic character might enter into the chemical composition of the lava, for example under the effect of the solar wind.

Returning now to the lunar landscape in the maria region, as shown by the photographs retransmitted by Luna-9, we may easily visualize a highly-hilly stone desert, with stones and hollows of various sizes, lying on the surface and not having sunk. The most interesting feature is the uniform microsculpture of rock surfaces of the lunar maria.

A multilateral examination of the pictures provides the evidence of area effusions of basaltic lava, and not of tuffs, which are formed from rock fragments, of pumice, of the volcanic glass, ash, and so forth. These would have had a more block structure. The hollows are possibly reliquats of the primary relief, for example, as remnants of gas bubbles in the lava and so forth. The rock fragments, that is, the stones were thrown upon lava surface after its cooling, as a result of volcanic eruptions or as a consequence of meteoritic impacts. But how did the fine sculpture of lunar maria form?

The uniformity of the microsculpture points to regulating factors, acting upon the surface of lunar maria. It may be guessed, however, that the relief that we can see is actually a secondary picture, having emerged on the surface of the Moon under the influence of various factors and processes on the flowing lava, for example, of significant temperature fluctuation from $+100^{\circ}$ to -150° C, of action from meteorite impacts. Then the corpuscular, X- and UV- irradiation from the side of the Sun. Finally, under the influence of chemical reactions of water and gases with the solid rock, by oxydizing them and so forth, which unquestionably must have taken place if only at time of water and other volatile substances' liberation from lava. It may be assumed, that because of this peculiarity of processes, we are likely to encounter minerals entirely new and heretofore unknown to us. Therefore, a macro- and meso-relief of lunar maria must have formed as a result of sedimentation, that is, of precipitation of these substances on the surfaces of maria. Finally, the cementation processes of rocks with the residues of salts, volcanic ashes, meteoritic dust, would have achieved the porous, but hard surface of lunar maria, after the above-described mechanical erosion had given the microsculpture process a certain uniformity.

STATEMENT by A. A. MIKHAYLOV : LUNAR MATTER ? THE ANSWER IS NEAR !

After enumerating the various achievements have permitted to so ration the fuel that a deceleration from the speed of 2600 km/sec could be realized in accord with the advance calculations, to a few meters per second at the exactly given moment of time, this speaker stressed the analogy between the microstructure of the relief as it appears from the photographs transmitted and the macro-structure of the Moon as we are seeing it.

Such an analogy speaks of the generality of the factors having created the various formations on the Moon's surface.

Arguments about whether or not the Moon is covered by a thick layer of tiny and porous dust, having formed as a result of bombardment of the Moon surface by meteorites and its surface is hard, have been going on till very recently. This question had a decisive significance for the question of landing on the Moon. I remember well the demonstration performed by our famous and deceased specialist planetologue Vsevolod Sharonov six years ago at the International Symposium on the Moon held in Leningrad and Pulkovo. It consisted of an artificially obtained specimen of matter according to his photometric and polarization properties that would correspond to the substance of lunar surface. It was a rather dark, spongy or blistered light stone reminding^{one} of a piece of tuff or slag and sufficient hard and capable to sustain a rather substantial pressure without falling apart. Now we know that this prognosis has been upheld, so that the Sharonov sample is fairly close to the real matter by both, its mechanical and physical properties.

Then the speaker developed the question of the impact of the presence and future findings on astronomy, meteorology, cosmogony etc. by means of an observatory on the Moon, with all the advantages it may contribute.

* * *

After these three speakers, following the chairman of the conference, there was a period of questions and answers, of which only the more important will be outlined here.

Question: What were the causes of the change of probe's position between the second and the third sessions?

Answer: The cause lies in the deformation of the lunar surface. But as to what induced that deformation is still difficult to ascertain. It may be that either the ground has settled after landing or that may be the probe was in unsteady equilibrium at time of landing, on a loose rock, which then settled. Some small deformations might be ascribed to temperature changes and also to some mechanical actions on the part of the probe.

Question: Were there solar batteries (cells) on Luna-9?

Answer: No. This was not prerequisite, for the aim of the probe was actually to take pictures of the surface and to perform an experiment on cosmic radiation, for which no solar cells are needed.

Then follow a series of questions and answers of a general nature concerning the impact of the present achievement on the future manned flights to the Moon etc.. Among the various arguments given in answer to the various questions, one is to note in particular: One important problem is on the return from the Moon will arise and that is the realization of reentry at 11 000 m/sec (2nd cosmic velocity) instead of 8 000 m/sec. On the question "what do you think of Lovell's opinion that USSR is to send at the beginning of 1967 a manned flight to orbit around the Moon?" it was answered "I am unaware on what basis this opinion is founded".

Question: Could you indicate the weight of the control compartment (steering cabin) and of the deceleration device?

Answer: The entire installation placed to the second cosmic velocity on the way to the Moon weighed near 1.5 tons, and the probe (station) itself weighed 100 kg. I must say that in this flight there was no attempt to make the guiding and deceleration installations as light as possible. First priority was given the guarantee of achieving a reliable solution of the problem.

Question: Do you exclude the possibility that a probe, analogous to Luna-9 may in the near future effect a soft landing on, say, Venus?

Answer: While in principle I do not exclude such a possibility, the problem is difficult. I must say that landing on Venus has its own specific difficulties, for apparently, the surface temperature of this planet is near 400°C, and the atmospheric pressure is there very high.

Question: Do you anticipate new stations of the Luna-9 type to be launched this year?

Answer: I do believe that this would be interesting. One of the correspondents remarked that the Moon has for some time become the object of theoretical research from the standpoint of international law and relations. The soft landing of Luna-9, which unquestionably opens a new era in the relation of mankind to the Moon, shortens the time within which the Moon is to become an international legal object not only theoretically, but also entirely concretely practical. Here Academician Keldysh added: It is time that jurists concentrate on the problems of space law. I would forbid outright any warlike acts on the Moon. Our country is against armaments on Earth, and a fortiori on the Moon.

Newspapermen were also interested in the following problem: In the manned flight to the Moon what is more complicated — the sojourn on the Moon or the return journey to Earth?

Answering this, ac. Keldysh stressed, that the question of a brief sojourn is easier than that of the return journey.

Follow some exchanges relative to possibilities of contamination by terrestrial bacteria and so forth. Then,

Question: What are the assumed delays in receiving from the Moon samples of soil and atmosphere, of lunar seismograms, of the temperature of the lunar soil etc. Are these expressed in terms of months or years?

Answer: I think months or tens of months.

Question: What television transmission methods were used?

Answer: It was the standard frequency modulation method which is often applied in ground transmissions.

Question: Is the publication of the photos transmitted by Luna-9 anticipated, as was done for previous probes?

Answer: The USSR Academy of Sciences expects to issue a special edition devoted to the launching of Luna-9, with the photographs released. Anything that can be obtained from the information transmitted will be the object of publications in scientific journals.

On the question as to whether or not, Luna-9 sent other information besides transmitting pictures, it was answered that this question was dealt with by Lebedinskiy during his statement (lunar background, radiation doses etc.). Moreover, detailed data as to the thermal regime of the various systems of the probe were regularly transmitted.

Question: How long will the probe remain under Moon's conditions and what are the possibilities of its retrieval?

Answer: It will most certainly lie there millions of years. Possibly, at a later date, when manned flights to the Moon and return have become routine, we may bring the station (probe) back to be exposed in a museum as a historical exhibit.

Follow a series of rather silly questions having caused laughs in the hall..

Question: Was there any thought of naming the landing spot for historical records? If yes, what is it?

Answer: I think we should. Americans called the place of Ranger-7 impact "More poznannoye"*. However, astronomers have their own international regulations; they do not allow any appropriation of names without their ratification by the International Astronomical Union. Thus, any talk to that effect is premature.

Question: Is there any possibility to obtain, in principle, permanent radiosignals from Luna-9 after the main part of its program is completed?

Answer: Signals could be received to the extent allowed by batteries foreseen for the mission.

Question: What be a total payload able to deliver a manned spacecraft to the Moon and back to Earth.

Answer: It is well known that the initial weight of the rocket with such aims would be measured in thousands of tons.

Question: Is it possible to obtain on Earth a sample of lunar soil for its study prior to the manned flight?

Answer: Luna-9 could not do it, but in principle, a rocket system may be conceived and created to complete that sort of mission. However, a great deal can be done by simpler means, by merely sending a type-Luna-9 probe to the Moon, with instruments on board allowing such an analysis to be performed in situ and transmitted to Earth.

Question: When could we expect answers from the probes Venus-2 and -3?

Answer: These probes fly according to plan; communications with them are regularly maintained, and it is known that they will approach Venus by about the first of March.

Question: How did the separation of telemetric devices take place from the Luna-9 itself?— At what distance from one another were the measurement complex and the station's Luna-9 frame?

*[Recognized name]

Answer: We call "Luna-9" the compartment containing the measurement apparatus and the lunar teletransmitter. The guidance installation and the devices required for landing were separated from the station and dropped on the Moon. They cannot be seen on photographs. However, the precise distance cannot be stated, inasmuch as after the completion of their mission, there was no need of tracking them.

Question: What conditioned the sharpness of the images transmitted?

Answer: This was assured by the airborne devices. There are 6 000 lines in the full panorama of pictures and it was transmitted in 100 minutes. The television pictures were transmitted in the course of four sessions.

Question: Are there on the Moon if only remnants of atmosphere?

Answer: It all depends of what one means by "atmosphere". From the terrestrial viewpoint there is practically no atmosphere. There are, however, some particles in a strongly rarefied medium near the Moon. They egress into interplanetary space and, to the contrary, continuously hit from it the sphere of lunar attraction. So that, I repeat, there is no atmosphere near the Moon.

Question: Does the USSR have any claim on the landing territory of Luna-9?

Answer : NO

Question: How will the territorial questions be settled on the Moon?

Answer: Let the jurists (lawmakers) resolve this question. I estimate that these questions should be so resolved, THAT THERE BE NO SUCH QUESTIONS IN GENERAL.

THE END

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