Space INTELLIGENCE NOTES

SPACE SYSTEMS INFORMATION BRANCH, GEORGE C. MARSHALL SPACE FLIGHT CENTER

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FROM THE WORLD PRESS

FROM THE SEMITECHNICAL LITERATURE

FROM THE TECHNICAL LITERATURE

FROM THE WORLD PRESS

IS U.S. DESTRUCTION FROM SPACE PLATFORMS PLANNED? It was reported in SIN, Vol. 3, No. 9, September, 1962 that the Soviet Union was planning to build a space station and put it into orbit by 1963. At the time the Washington Daily News reported that these space platforms were to be used as launching and receiving pads for further peaceful exploration of space.

Mr. Kilsoo Haan recently released information gathered by his private spy organization which points in an entirely different direction. This is the same Mr. Haan who has made so many accurate predictions as was noted in SIN, Vol. 3, No. 10, October, 1962.

Mr. Haan reports that very reliable contacts to Red China's Ministry of National Defense learned that high level Sino-Soviet meetings had been held, on progress of Russia's ultimate nuclear space warfare program, during the first two weeks of June, 1962.

Lt. General N. A. Vassiliev informed Mao Tse-tung that Khrushchev and the Soviet High Command developed a three year crash space warfare program in November, 1961. They think a fleet of space platforms will be militarily operational by the winter of 1965.

The data on the space platforms as given by Mr. Hann is as follows:

1. It will weigh 10 tons, manned by three or four cosmonauts and will remain in orbit for two to three weeks per period.
2. Direction and speed can be controlled by a rocket propulsion unit.
3. It will be capable of delivering and detonating nuclear bombs from orbit.
4. It can launch and guide missiles to designated targets.
5. Anti-missile-missiles will be aboard capable of searching out and destroying any enemy missiles in the sky.

(Source: Space World, Vol. 3, October, 1962)

SOVIET COMMUNICATIONS SATELLITE TO BE ORBITED AT 40,000 KILOMETERS. In an interview marking the fifth anniversary of the first Soviet sputnik, Leonid Sedov, a leading Russian space scientist, predicted the launch of a Soviet communications satellite in "the not-too-distant future." He said one prospect was "the creation of a system of sputniks orbiting once every 24 hours---at heights of around 40,000 kilometers" (about 25,000 miles) to help "over-all communications and the rediffusion of radio and television transmissions." (Source: The Christian Science Monitor, October 4, 1962)

WEBB PREDICTS U.S. TO BE FIRST ON MOON. James E. Webb, NASA Administrator, said recently that he expects the U.S. to place the first astronaut on the Moon because he believes the Soviet Union cannot "match the major space effort of our government, industry, and scientific community."

Webb also predicted a United States lunar landing within the decade. (Source: The Huntsville Times, November 8, 1962)

AIR FORCE ASS'N CRITICIZES CIVILIAN SPACE PROGRAM. The Air Force Association stated, at its 1962 convention, its policy on the U.S. space program. It is as follows:

"Soviet space achievements, with their military implications, make it clear that we cannot satisfy the natural security requirement in space with by-products from our civilian space program.

"Space will provide the new pivot of military capability--between those who would use their power to defend and extend individual dignity and personal freedom, and those who would use power aggressively to expand a totalitarian system.

"Our present national space policy was born in a defensive climate, as a reaction against Soviet initiatives. We have a stated national goal of going to the Moon in this decade. But our goals for military space capabilities are not clear..."

"It is unthinkable to concentrate on space exploration if this means the abdication or loss of the military posture necessary to make our national policy of deterrence effective." (Source: NORAD News Service, Ent Air Force Base, Colorado Springs, Colorado, October 12, 1962)

FILM OF TWIN SPACE FLIGHTS SHOWN. The Soviet Union recently released a 65 minute color film of the space flights of the cosmonauts Andrian Nikolayev and Pavel Popovich in Moscow for the general public.

Titled "the Stellar Brothers," it follows similar documentaries released after the flights of Yuri Gagarin and Gherman Titov.

As could have been expected, the film carefully avoided complete views of the booster used to place the cosmonauts in orbit. (Source: Birmingham Post-Herald, November 5, 1962)

U.S. AHEAD IN SOME FIELDS, BEHIND IN OTHERS. On November 8 the Institute of Strategic Studies said in a report that the United States and its allies were far ahead of the Soviet bloc in long-range missiles.

The institute, an independent military study group, said this factor was balanced somewhat by the long lead the Communist bloc had maintained in medium-range ballistic missiles.

The report examined the military balance as it existed at the end of October, 1962. It was based on information supplied by various Western governments and on intelligence estimates.

The institute said it now appeared that the Soviet Union was concentrating on increasing the destructive power each missile could carry, while gradually increasing the number of these weapons.

The Soviet Union appears to be focusing on nuclear weapons and is starting to modernize its conventional forces, particularly its submarine fleet.

The institute sees no reason to dispute the Soviet Union's claim that it has now developed a Polaris-type missile that can be fired from a submerged submarine.

The institute said that the Soviet Union now had about 75 operational intercontinental ballistic missiles that could be fired a distance of more than 2,000 miles. The Western Allies have 450 to 500 such missiles.

The institute suggested that the Russian missiles carry a larger warhead and thus more destructive power than those produced by the United States.

The Russians now maintain about 700 medium-range ballistic missiles, with ranges from 700 to 2,000 miles. The West has 250 such missiles.

In many other respects the comparative strengths of the Communist bloc and the countries maintaining alliances with the United States were generally equal, the report said.

The institute estimated that the Soviet armed forces, counting only regular troops, now totaled about 3,600,000 men. Of these, about 2,500,000 were in an army of 160 line divisions.

The armed forces of the United States now total 2,815,000 men, with an army of 1,080,000 troops organized into sixteen combat-ready divisions.

The total of Western alliance ships far outnumber those of the Communist bloc. The Communist bloc's conventional submarine fleet, however, is twice the size of the Western alliance's, the institute said.

The report says the Soviet Union now has about ten nuclear-powered submarines designed for various types of duty.

The West now has nearly three times as many long-range bombers with ranges of more than 5,000 miles, the report asserted.

The report notes that the Soviet Union has built up a strong force of medium bombers suitable for use all over Europe and Asia.

The institute estimates the total Soviet military budget for 1962 at $33,000,000,000, including a large outlay for research and development.

The United States military budget is $52,000,000,000. (Source: New York Times, November 9, 1962)

RUSSIAN HEAT SENSING MISSILE DOWNED U-2. The Washington Daily News has received information which leads them to believe a Soviet infrared heat-sensing missile was used to down the late U.S. Air Force Major Rudolf Anderson's U-2 plane over Cuba.

Science Service stated that the U.S. has such weapons which can be launched from the ground, sea, or air. (Source: Washington Post, November 8, 1962)

MOSLEM SPEAKS OUT AGAINST RUSSIAN VIEWS ON RELIGION. Russia's atheistic astronauts received a sharp Islamic admonition about views on religion recently.

The chiding, in the newspaper Al Akhbar, named Yuri Gagarin and Andrian Nikolayev as examples; Anis Mansour, an editor of the paper and also a lecturer in philosophy at Cairo University, wrote:

"Whenever a rat or a dog or a man gets into orbit and returns safely to Earth, we hear the Soviet press boasting he was brought back due to the indescribably great efforts of the Communist Party. The scientists behind each great success are sacrificed to the desire to spread the fame of the party.... As for God, the Russians simply say they did not see him when they went into space.

"I say they (the astronauts) are naive, ignorant and influenced by a way of thinking which is other than their own... I say Gagarin and his friends did not alone achieve the orbiting of the Earth.... I am sure that while Gagarin and his friends deny the existence of God, the scientists who made the great achievement possible do believe in God.

"I want to ask the Soviet cosmonauts, 'how did you expect to see God? Sitting down? Standing up? Near something? Away from something?'"

This was indeed naive, Mansour said. He added: "If Gagarin and his fellow spacemen in the Communist Party are influenced, we should warn them against worshipping these machines." (Source: Washington Star, October 15, 1962)

MORE ON SOVIET SPACE FAILURES. On November 9 more information was received on Russian space failures as reported in the October, 1962 issue of SIN. The article, appearing in the Washington Post, claims far more failures than were revealed by the United States on September 4.

No specific failures were disclosed, but some are supposed to have occurred before the announcement of September 4 and some afterward.

The Post announced that a full disclosure of the record would show that the Soviets have failed as many times, if not more, than the United States.

The U.S. Government's reluctance to reveal all Soviet failures stems from a belief by intelligence experts that a nation should not reveal its intelligence capability.

The Soviets, who claim to have successfully launched a one ton probe toward Mars on November 1, have repeatedly denied that it has had any failures in its planetary program except for a partial failure of a Venus probe on February 12, 1961. (Source: Washington Post, November 9, 1962)

RUSSIAN LUNAR DISCOVERIES DISPUTED. American astronomers at the Lunar and Planetary Laboratory at the University of Arizona have made detailed studies of the photographs released by the Soviet Union of their new "discoveries" on the back side of the Moon.

The "Soviet Mountains" have been studied, and they were decided to be an elongated area of bright patches and rays. The area is believed to be quite flat and not mountains at all.

Another "discovery", identified in Moscow as being a crater and named for the pro-Soviet French physicist Dr. Frederic Joliot-Curie, who died in 1958, has been renounced as a dark patch on a smooth plain discovered near the turn of the century by Julius Franz, a German astronomer. It was named the Mare Novum, or New Sea, and listed in the 1935 catalogue issued by the Commission on Lunar Nomenclature of the International Astronomical Union.

Mr. Erven A. Whitaker, who published a report on the laboratory's findings, said, "Hastily assembled and retouched prints were released to the press at the end of that month, but these were not of the best quality, so that doubts as to their authenticity were expressed at that time."

One of the American astronomers who studied the pictures commented: "The Soviet photographs were better than their analysis of them." (Source: New York Times, November 22, 1962)

RED SPACE DOG REPRODUCES. The Russian space dog, Chernushka (Blackie), has given birth to a pair of black and white spotted puppies, the Soviet news agency Tass said October 3, 1962.

Chernushka, who orbited the Earth and was returned safely March 9, 1961, gave birth to the two pups, called Malyshka (Little One) and Zvezdochka (Starlet or Little Star), in the Moscow Zoo.

She is the second Soviet space dog to make a go of motherhood. Strelka (Arrow), who with another dog, Belka (Squirrel), was recovered April 20, 1960 after 18 orbits, has given birth to two litters. (Source: New York Herald Tribune, October 4, 1962)

USSR USES ROCKETS TO INSTALL CABLES. Rockets have been used for installing a high voltage cable in the mountain area of Ruzomberok (Vah River). A rocket with an attached light silon rope, which is described in Elektrie, No. 4, 1962, was shot to a pole 600 m away. Heavier ropes could then easily be installed. (Source: Current Review of the Soviet Technical Literature, August 10, 1962)

FROM THE SEMITECHNICAL LITERATURE

SOVIETS BELIEVE SUNLIGHT CAUSED ORIGIN OF LIFE. Academician A. I. Oparin suggested, in Zarya vostoka, the possibility that the first organic compounds on Earth were formed from atoms and radicals resulting from the splitting of ammonia, carbon oxide, methane, and water vapor under the effect of the ultrashortwave ultraviolet light of the Sun.

Experiments conducted by Academician A. N. Terenin at the Laboratory of Photocatalysis of the Physics Institute, Leningrad University, seem to confirm Oparin's assumption. These experiments showed that amino acids, urea, formaldehyde, and some other organic compounds are formed from the gases mentioned above under the effect of ultrashortwave ultraviolet light. They also indicated the possibility of the synthesis of organic substances and origination of protein life on Mars, Jupiter, Venus, Saturn, and Uranus, whose atmospheres have been found to contain methane, carbon oxide, and ammonia. (Source: Library of Congress, A.I.D. Press, No. 820, October 19, 1962)

IS THE 'SPACE GAME' DANGEROUS? A recent editorial by Nature magazine stated that the space research competition between the United States and the Soviets is viewed by the world as a 'space game' instead of as scientific achievements.

"The first immediate announcement that the two astronauts (Nikolayev and Popovich of the USSR) are to receive the highest Soviet awards as sportsmen gives the keynote to the world's attitude and reaction for this great feat--for the world looks on it as a game, a game in space. Sportsmen play games, and games involve competition. Players compete against their opponents."

It further remarks that the USSR is using these orbitings for communist propaganda and that science has become the tool of diplomatic or political intrigue.

The editorial further warns that we cannot afford to ignore this world reaction and that we are in great peril if we do. Because space research is a serious endeavor, it cannot be looked upon as a game in space nor be left in the control of political aims and objectives. (Source: Nature, Vol. 195, August 25, 1962)

RUSSIAN ANALYZES PROBLEMS OF SPACE-WEAPONRY DEFENSE. A tirade of anti-American and anti-western propaganda constitutes much of the article "Newtrons and Rays" appearing in the September 15, 1962 issue of Krasnaya Zvyezda. Nevertheless, the following excerpts were digested to present the technical considerations of the author--Engineer-Colonel M. Pavlov (a "Candidate of Technical Sciences"):

NEUTRONS AND RAYS

by Coloner M. Pavlov, U.S.S.R.

Never before in the history of warfare were the problems of anti-aircraft and cosmic defense so sharply defined as in the age of nuclear weapons. The mission of air defense is to prevent enemy aircraft or missiles from reaching their target. This is extraordinarily difficult, considering the tremendous speeds of bomb carriers, and progressing means for creating interferences to the air defense system.

Even more complicated is the interception of ballistic missile warheads. Quite recently the Americans claimed they succeeded in interception of one of their rockets by an anti-missile missile. However, the Secretary of Defense of the USA admitted this experiment was conducted under "controlled conditions, which differ essentially from ... real warfare."

These events explain the attempts to find new means for the destruction of aircraft and rocket warheads. One new means is considered to be a neutron bomb. The name is derived from the fact that the principal destructing factor in its warhead is a flux of neutrons and gamma rays. The detonation of a neutron bomb destroys living beings but always leaves buildings and structures intact.

Neutron bombs for air defense is explained by the fact that the destructive power of neutrons and gamma-rays is most effective at high altitudes. Scientists calculated that to obtain near the Earth's surface a neutron radiation dose of 400 roentgens, it would be necessary to explode a bomb at a level considerably higher than the aircraft. People

and objects located on the Earth's surface or flying at low altitudes would not be endangered. The air adjacent to the Earth absorbs the flux; the rarification of air at high altitudes prevents a powerful shock wave.

"How do the militarists abroad propose to use a neutron bomb for the defense against ballistic missiles? ... Here is where they gamble on the harmful effects which a flux of neutrons and gamma rays might have on the electronic equipment aboard rockets. Tests, which were conducted in the USA, have proven that during the explosion of a charge with a force of one million tons, the flux of neutrons is capable of knocking out electronic systems of rockets at a distance of 29 kilometers. It is now proposed to paralyze the guidance system of rockets by means of powerful thermo nuclear explosions." (Direct quote from Colonel Pavlov)

If an enemy rocket carries a nuclear warhead, it is proposed to cause an artificial nuclei-splitting reaction with the same neutron flux. The detonator would melt from the heat of such a reaction; without the detonator the warhead becomes harmless.

Other means for the destruction of rockets and airplanes were developed. To these belong devices which concentrate a beam of light -- a quantum generator, known as a "laser". A laser is a generator of light waves, capable of creating extraordinarily narrow rays of huge intensities. Experiments of these are still in the infant stage. Only experimental models, used in laboratory conditions, were constructed. Even these models are capable of creating a light ray equaling the brightness of "the central part of the Sun." With such rays, it is possible to cut openings in thin sheets of hardened steel and to melt diamonds.

"More than 400 private companies in the United States of America are presently engaged in the development of a new weapon based on the utilization of quantum generators. According to one American journal, the United States will have 5 types of 'ray' weapons by 1970." (Direct quote of Colonel Pavlov) One of these weapons is a powerful anti-aircraft "ray gun". A small "ray gun" might be installed aboard fighter planes and utilized in fights against enemy planes. Other possible forms will be developed for anti-rocket and anti-satellite defense. A powerful light ray should either damage the rocket body or warhead, or even knock the missile from its trajectory.

The road toward the creation of "ray" weapons is blocked by technical and "principal" difficulties. For instance, light energy is strongly absorbed and dispersed by clouds; the ray of a "ray gun" will weaken or disperse completely after passing through a cloud. Several methods were proposed to overcome this difficulty. One of these methods is the dispersion of clouds with special rockets; another proposes the burning of openings in clouds by directed rays to secure a free passage for following rays. Most promising is sending the guns above the clouds, placing them

on satellites. Then, the anti-missile and air defense system would be in constant preparedness, ready for action regardless of meteorological conditions. (Source: Russian News Briefs, Electro-Optical Systems, Inc., September 20, 1962)

COMMENTARY ON SOVIET PAPER. When reviewing papers professing to contain scientific or technical information, several criteria must be kept in mind: (1) does the paper follow its stated subject? (2) what proportion of the paper is relevant to the discussion? (3) how much new information does the paper present? (4) how accurate are the statements in the paper?

The paper, "New Scientific Theory about the Development of the Universe", by Soviet Academician, Professor B. Kukarkin, is a perfect example of a publication that does not meet the above criteria very well. The opening sentences demonstrate this clearly:

"Astronomy - the science of heavenly bodies - arose in connection with the direct needs of the material life of society. In the front rank of these requirements must be mentioned that of orientation in unknown lands and the open sea, and the definition and calculation of time (the calendar)."

Most historians of science would disagree sharply with these statements. The study of the skies originated with the necessity of observing planetary motions, for ancient religions. The early cultures of Egypt and Babylon are excellent examples of this.

Similarly, the necessity for an accurate calendar arose from the desire for determining exactly the holy days of ancient religions (from which is derived the modern word, "holiday"), a severely non-materialistic application of the art.

After a basic definition of cosmogony, Professor Kukarkin begins to utilize his paper as an organ for propaganda: "In the Soviet Union we have come very near to a solution of the tasks of transforming the Earth in the interests of Communism." It is almost superfluous to note that the above statement has nothing whatever to do with the stated subject of the article.

Professor Kukarkin continues his discussion about the problems of transforming the Earth, a survey of the qualitative (though not quantitative) aspects of the Solar System, and a tirade against what he terms "anti-scientific, idealist, reactionary theories and hypotheses" for several paragraphs, without coming to grips with his problem. As an example of this, we extract the following passage:

"At the basis of the religious world outlook is the dogma of the creation of the world by God and of the Earth as the center of the Universe. Science decisively rejects this doctrine. Religion and the church, being

instruments of the exploiting classes, in order to dim the consciousness of the working people, cling persistently to the religious ideas which were evolved in the primitive savagery of humanity and social oppression of the people existing in the capatilist world."

Without bothering to comment about this on theological and philosophical grounds, it must be noted that such statements have nothing to do with the topic in question, save indirectly. It is not until the third page of the paper that Academician Kukarkin manages to approach his subject.

Professor Kukarkin mentions the "tidal encounter" theory held by the British astronomer, Sir James Jeans, whom he refers to as an "idealist physicist." The reason, Professor Kukarkin goes on, that the Jeans theory was accepted by the Western countries is that the relative uniqueness of such an encounter would be most compatible with "the religious legend of the creation of the world."

He continues, "Only in the Soviet Union was Jeans' hypothesis subjected to systematic criticism. To Soviet science and Soviet scientists belongs the credit for the full refutation of Jeans' hypothesis." As the date of this refutation is not stated, this statement is open to question. From a suggestion of Henry Norris Russell, Lyman Spitzer proved that an encounter of the type Jeans suggested could not condense into anything, due to the sudden pressure difference between a 27-gravity condition and a zero-gravity condition. Certainly, however, the Soviet Union was not the only country where Sir James' hypothesis was being examined.

Before continuing with Professor Kukarkin's exposition, it might be well to note that he has not yet touched on his stated subject matter -- the development of the Universe -- save very indirectly, by examining one hypothesis on the formation of the Solar System, an event of a totally different order of magnitude.

After deriding "more than ten different hypotheses" developed in "capatilist countries" in supposed reaction to the Soviet refutation -- all without even mentioning these hypotheses by name -- he mounts an attack on one in particular.

"The British physicist Milne, for example, developed an absurd idea according to which the matter of the Solar System was formed from a gigantic 'first created atom' of light energy by the blow of a quantum which possessed tremendous energy."

This appears to refer to the cosmological hypothesis known as the "Big Bang" theory. This hypothesis grew out from observational data derived from the spectroscopic examination of the exterior galaxies. The doppler shift of exterior galaxies indicates the possibility that the Universe (Cosmos) is expanding, and each of its local matter groups (galaxies or

"island universes") is rushing away from all other such groups. If such is the case, a backward extrapolation indicates that at some time in the remote past, all these particles came from a single point of origin. Their radial dispersion from each other suggests the aftermath of a violent explosion; hence, the "Big Bang" theory. It will be noted that this is the first cosmological hypothesis mentioned in Professor Kukarkin's paper that touches directly upon the title of his work.

After a few paragraphs concerning the fact that a Soviet Acadamecian has "examined a number of possible paths for the solution of the problem of the origin of the Earth, planets, stars, and small bodies of the Solar System" by "...his constant care to link cosmogony closely with geophysics," without going into any details whatsoever, Professor Kukarkin speaks of the analysis of astronomical questions in the Soviet Union. He mentions that another Academy representative has determined that stellar evolution is still in process. The formation and development of stars in the present time, says Professor Kukarkin, "has immense significance for exposing pseudoscientific conclusions about the simultaneous origin of the stars in the struggle against idealist formulations in cosmogony, which try to show that the Universe came into being neither more nor less than ... two thousand million years ago."

While a statement that the stars were created no more ~~than~~ AND no less than two billion years ago would certainly be refuted by such proof, most Western cosmological hypotheses do not maintain that all stars were brought into existence at the same time. The two basic cosmological hypotheses currently operational are those of the expanding universe, and the steady-state theory. The expanding universe states that all matter (not all stars) were created at the same time, and that the constituant parts are rushing away from each other at high speeds (the "Big Bang" theory is an outgrowth of this hypothesis), and the steady state theory suggests that additional material is constantly appearing in space, offsetting losses by the expansion effect. In neither theory is it stated that all stars were formed in a certain era, nor does either preclude the formation of stars in contemporary times. The inclusion of such a statement therefore seems to demonstrate either (1) ignorance of non-Soviet cosmological theories, or (2) the establishment of a "straw man" to enhance the prestige of Soviet science.

Professor Kukarkin continues, "An important blow to the positions of bourgeois idealist scientists has been struck by the work of Academician O. Y. Schmidt and a whole group of scientists, begun in 1943, and devoted to the problem of the origin and development of the Earth and planets."

The "blow" in question was a description of the Dust Cloud hypothesis. A variation of this idea was presented as a mathematical model by the German astronomer C. F. von Weizsäcker in 1943, using a rotating dust

cloud with turbulence eddies. We therefore observe that one cannot give total credit in this matter to one source, especially since the first man to suggest that the Solar System might have originated from a dust cloud was Sir Isaac Newton.

After a statement of the Dust Cloud hypothesis, a relatively pointless section follows, discussing whether the planets were molten at any time in their past. By this it is indirectly suggested that if the planets were formed out of solar substance pulled from an "encounter", the surfaces would be cold (also not necessarily the case). Energy generated by kinetic collision of the dust particles on the surface of the protoplanets could raise their surface temperatures quite markedly.

An interesting and hardly relevant section follows, explaining the general composition of the Earth's interior, and mentioning a few points of geophysical significance. Only extremely indirectly has it any bearing, as presented, to the subject supposedly under discussion.

"By their work," Academician Kukarkin observes, "Soviet scientists have again dealt a blow at idealist theories denying the comprehensability of the world or attempting to substantiate nonsensical religious ideas about the finiteness of time and space." It would be interesting to his audience if the Professor would mention what "blow" he means, or at least would describe it.

The rest of the paper discusses a meeting that took place in 1951, and makes additional mentions of Soviet science. The paper ends with the following observation:

"There is no doubt that Soviet materialist science, based on the teachings of Marx, Engles, Lenin and Stalin, will make further progress in the solution of tasks facing it in the field of cosmogony, for the satisfaction of the interests of the practical construction of communism."

Upon review, it is readily seen that the paper does not achieve its stated purpose--a discussion of a theory of the development of the Universe. Unless we allow Academician Kukarkin to use the terms "universe" and "Solar System" interchangeably, the only statement in the whole paper concerning the development of the Universe occurs in the statement--almost exactly halfway through the article--that stellar formation is still going on at the present time. (Source: Based on a translation from the Office of Technical Services, Library of Congress)

FROM THE TECHNICAL LITERATURE

ASTRIONICS

NEW METHOD OF LASER MODULATION. A new method of utilizing the nonlinear properties of crystals to achieve amplification and modulation in lasers, which has been proposed at Moscow State University, was given recently

in Zhurnal eksperimental'noy i teoreticheskoy fiziki by S. A. Akhmanov and R. V. Khokhlov. The method states that given a medium whose polarization is a square-law function of the incident electric field intensity, it may be possible to obtain parametric amplification of traveling light waves in uniaxial crystals. The parametric amplification mechanism can thus be used in the design of frequency-tunable lasers. Such a system could be realized in practice by placing the laser crystal within two sets of parallel-mirror resonators. The system would control the dielectric constant of the material in various directions, utilizing the pumping field energy for this purpose. The conditions of energy exchange between fields could then be controlled in turn, making possible the modulation of amplified or generated oscillations. (Source: Current Review of the Soviet Technical Literature)

ASTROBIOLOGY

RADIATION DANGERS TO ASTRONAUTS. A. A. Gyurdzhian states in Akademiya nauk SSSR. Iskusstvennyye sputnike Zemli, that with the relative predominance of low-energy particles (slow neutrons having a relative biological effectiveness of 2-5 to 13 and even as high as 150) taken into account, the radiation to which an unprotected astronaut would be subjected outside an orbital spaceship can reach tens of thousands of rad/hr. This can affect the astronaut's central nervous system and the crystalline lens of the eye, and possibly damage the spacesuit and life-support systems. He recommends that every "new variant" of space flight be preceded by tests on animals to determine the effects of cosmic radiation. (Source: Library of Congress, A.I.D. Press, No. 830, November 2, 1962)

COSMONAUT AIR AND WATER REQUIREMENTS. An article appearing in Neues Deutschland said recently that a cosmonaut in space needs the following per day--900 grams of oxygen, 2,200 grams of water, 500 grams of food. It also describes how carbon dioxide is removed, and states that the size of air conditioners depends on the length of the stay in space. Four methods of insuring the oxygen supply are outlined, and the role of algae is discussed. The article also describes how to get water. It says that man can act as his own source of supply. The water originating from breathing, perspiration, and urine can be filtered or distilled. The operation of a spacecraft air conditioner is also described. (Source: Current Review of the Soviet Technical Literature, September 28, 1962)

ANTIBIOTICS USED TO PROTECT ALGAL CULTURES. I. V. Maksimova and M. N. Pimenova report on the use of antibiotics with algae work in the August 1962 issue of Mikrobiologiya.

Experiments with algal cultures of *Chlorella vulgaris*, *Scenedesmus obliquus*, and *Ankistrodesmus alcatus* have shown that certain antibiotics (penicillin, aurantin, levomycetin, colimycin, oxytetracyclin, tetracyclin, polymyxix, and nystatin) can be used to protect algal cultures from satellite microflora without damaging the algae. The sensitivity of the algae differs with species and the antibiotic used, is also affected by the composition of the culture medium. (Source: Library of Congress, A.I.D. Press, No. 798, September 19, 1962, p. 4)

ASTROGEOLOGY

FORMATION OF MOON CRATERS. M. M. Shemyakin recently gave his ideas on the formation of Moon craters in Akademiya nauk SSSR. He believes that definite geometric patterns have been detected in the distribution of parasitic crater chains in the area of the Clavius and Hipparchus cirques which indicate that the craters were formed as the result of a single endogenic process of long duration. Both the size of the craters and the distance between them increase in an approximately geometric progression. The age of the craters is believed to be in direct proportion to their size, i.e., the smaller craters are of more recent origin. (Source: Current Review of the Soviet Technical Literature, September 28, 1962)

ASTRONOMY

SOLAR FLARE DETECTION. At a meeting of the thirteenth annual Congress of the International Astronautical Federation, held in Varna, Bulgaria, Professor Prokofyev presented a paper on radiation dangers and solar flares. He reported that he had discovered a method of predicting the flares up to three days in advance. He found the main source of intensity, and therefore the main source of solar flares, to occur between the actual sunspots. By plotting the magnetic fields, obtained by the use of wide band observation equipment at the Crimea Observatory, and examining the trends, Prokofyev claims to be able to make predictions with reasonable confidence. (Source: Flight, October 11, 1962)

ASTROPHYSICS

METEOR DUST CLOUD DISCOVERED. According to Candidate of Physics and Mathematics T. Nazarova, writing in Izvestiya, cosmic-rocket investigations have revealed a dense cloud of dust (one particle every 10 sec per square meter) at an altitude of 100 to 300 km. At altitudes of 400 to 2000 km the density of meteoric matter is about 100 times less.

The weight of the particles is $1 \cdot 10^{-8}$ g. Moving at very high speeds, these particles bombarded the shells of space probes, and during long exposure can damage them. The probability of a wall-piercing hit is about one per year.

Soviet designers have taken meteorite danger into consideration in building space probes; the suits of the cosmonauts in Vostok 3 and Vostok 4 would provide full protection even in the case of a wall-piercing hit. During future flights of long duration special suits will be used which will enable the crew to leave the spaceship and spend some time outside the cabin. (Source: Library of Congress, A.I.D. Press, No. 784, August 31, 1962, p. 6)

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SOVIETS WORRIED ABOUT WEIGHTLESSNESS. Even though neither of the two latest cosmonauts apparently suffered from the nausea which bothered Titov, the Russians still fear that prolonged weightlessness may produce harmful effects.

Dr. Eugene Konecci, chairman of the International Aeronautical Federation Bioastronautics Committee, told about these Red reservations during the recent committee meeting at Varna, Bulgaria.

Dr. Konecci said the Soviets programmed a number of violent heat maneuvers in their recent flights to see whether this caused the nausea Titov suffered. Neither cosmonaut apparently became ill.

A number of rotating and tumbling devices were employed to accustom the cosmonauts to these movements as training.

The U.S. delegate said that Titov possibly had some individual peculiarity which caused his sickness. He also said it might have been caused by random tumbling of Vostok 2, or what Vostok 2's stabilization system was compensating.

During the dual flights Major Andrian Nikolayev was chosen as the subject of medical research, and Lt. Col. Pavel Popovich was the control. Soviet biomedical measurements included electrocardiograms, respiratory rate, pulse, body temperature, galvanic skin reflex (ankles), nystagmus, and electroencephalogram.

Nikolayev wore a little scull cap under his leather helmet to which surface electrodes apparently were attached. The nystagmus experiment, or measurement of the eye movements, was conducted with an electrode over the corner of his eye. Eye rolling is associated with nausea and vestibular illness, but apparently none occurred.

Soviet Academician V. I. Yazdovsky told the meeting that he was concerned with the problem of a space pilot's return to Earth after prolonged flight. Although no pathological changes appeared during the recent two flights, he stated that "the biological action of zero gravity on more delicate processes in cellular and subcellular structures, blood production and tissue regeneration and many other intimate processes, is not clear." He added that clinical investigations had caused some apprehension.

The two recent flights differed little from earlier Soviet flights in physiological reaction. Heart rate during boost was 120 pulses per minute for Nikolayev and 130 for Popovich. Respirations were 10 and 20 per minute respectively.

As they went into orbit, Nikolayev's heart rate was 100 per minute, Popovich's 90, and respiration 10 and 16. By the sixth orbit, heart and respiration rates returned to "values recorded several hours before the beginning of their flight."

Average pulse rate for the four-day Nikolayev flight and three-day Popovich trip was about 60 to 70 per minute; respiration was 10-15.

Yazdovsky indicated that the Soviets are pursuing their research in three main lines:

—Influence of factors of outer space on living organisms and man.

—Biological and medical foundations of providing conditions necessary for life throughout space flights.

—Investigation of forms and conditions of extraterrestrial life.

He said that at present the most pressing problem is "development of the principled foundations of providing conditions necessary for life and security of a cosmonaut in space flight." (Source: Missiles and Rockets, October 29, 1962)

EFFECTS OF WEIGHTLESSNESS ON COSMONAUTS. Both Pravda and Investia have given reports recently on work done on the effects of weightlessness on their cosmonauts.

One of the tasks of the Soviet group-flight program was to ascertain the feasibility of direct radio communication in space. The positive effect of such direct communication on the cosmonauts' morale was evident.

Studies of the effect of weightlessness were also carried out and the following results noted. A. S. Povitskiy has computed the velocity at which cosmonauts can move inside the spaceship under conditions of weightlessness to be only 23 cm/sec. All objects inside the cabin move under the influence of centrifugal and low-gravity forces at 14 cm/sec. The cosmonauts can turn on their own axis easily, but movement is very slow and a little difficult.

The first time Popovich unstrapped himself and left his seat, he did it too eagerly; he instantly floated upwards and his head hit the ceiling of the cabin.

Once Nikolayev and Popovich had mastered weightlessness they performed various exercises while floating freely in space: they ate, drank, communicated with the Earth and with each other, took motion pictures, and

made visual observations. They also made sharp movements, turned their heads with their eyes open and closed, etc., and felt no adverse effects.

The cosmonauts also conducted an experiment to determine the behavior of water under weightless conditions. It was noted that the air in a flask partially filled with water always formed a spherical bubble in the center, completely surrounded by water. Vigorous shaking caused the bubble to burst, after which it formed again, still in the center of the liquid. Drops of water, spilled from the flask, floated in the cabin and adhered to various objects and to the cabin walls. (Source: Current Review of the Soviet Technical Literature, September 28, 1962)

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MOON PHOTOGRAPHED. Izvestiya reported, on September 9, that the Soviet astrophysicist, N. F. Kuprevich, has photographed the Moon with infrared light in the range 0.9 to 2.3 μ. The lunar image was received by an infrared-sensitive television apparatus, transformed into visible light on the TV screen, and photographed. The region around the crater Tycho, as seen by visible light, is covered with bright rays; in the infrared photos these rays have disappeared and a mountainous area is seen. Kuprevich explains that this phenomenon is due to photoluminescence on the lunar surface caused by the action of solar ultraviolet radiation on lunar rocks, which are not protected by an atmosphere. This photoluminescence, visible to the eye, does not affect infrared-sensitive apparatus and is therefore absent in IR pictures. (Source: Current Review of the Soviet Technical Literature, September 28, 1962)

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SOVIET ESTIMATE OF HYDROLOGIC CYCLE ON MARS. The total amount of water in the free state during the yearly hydrologic cycle on Mars has been estimated on the basis of (1) the upper limit of ice crystals in the Martian atmosphere as reflected by the degree of turbidity, and (2) the amount of water in the solid state in the polar regions. This method is described by A. I. Lebedinskiy and G. I. Salova in Astronomicheskiy zhurnal, Vol. 39, No. 3, May-June 1962.

It is assumed that most of the snow in the polar zones is either on the ground or in the form of semitransparent low-lying clouds of ice crystals created by wind. The mean thickness of the snow cover on the polar caps is 0.1 g/cm^2. Since in winter the polar caps occupy about 20 million km^2, the total amount of water present is placed at $2 \cdot 10^{15}$. The results are in general accord with those obtained by Dollfus, but disagree with those of Vaucouleurs and Janesley. (Source: Current Review of the Soviet Technical Literature, August 24, 1962)

OVERCREEP PHENOMENON STUDIED BY RUSSIANS. A detailed study was made of the overcreep phenomenon, caused by gold dissolved in silicon, discovered by Dash (Journal of Applied Physics, 31, 2275, 1960).

L. S. Milevskiy reported in an article appearing in Fizika tverdogo tela that silicon crystals grown by Czochralski's method were doped with copper and gold and investigated by the method of optical polarization. Photographs show that regional and stationary dislocations in the crystals creep after heating and tend to increase atomic plane dimensions. Under the influence of dissolved gold they become fixed in these new positions. (Source: Library of Congress, A.I.D. Press, No. 831, November 5, 1962)

AL-CU-MG-MN ALLOY WELDING. Ye. I. Shilova and coauthors recently wrote an article on the study of the weldability of Al-Cu-Mg-Mn alloys in the Avtomaticheskaya svarka. They reported on the effect of chemical composition and initial grain size (prior to solution heat treatment) with respect to weldability of Al-clad sheets of the Al-Cu-Mg-Mn alloys Д 16 and Д 19 (two heats with, respectively, 4.0 and 3.4 percent Cu, 2.0 and 2.72 percent Mg, 0.73 and 0.80 percent Mn, both 0.07 percent Ti, 0.0013 and 0.001 percent Be, both 0.20 percent Si, 0.20 and 0.30 percent Fe) and on the properties of welded joints.

The alloys were supplied in conditions T (cold rolled, solution annealed, and stretch leveled with 2 percent elongation) and M (cold rolled and annealed); the latter were solution annealed prior to welding.

Weldability tests showed that susceptibility to hot cracking depends mainly on the Mg content. The Д 19 alloy, which has a higher Mg and lower Cu content than Д 16, is much less susceptible to hot cracking. The T-sheets crack mainly in the weld-adjacent zone, the solution-annealed M-sheets in the welds. As revealed by microscopic examination, the latter sheets had a grain size ~ 4 times larger than the former. This appears to be the main factor determining the crack location.

The mechanical properties of the welded joints (determined for Д 19 only) at room and elevated temperatures are not significantly affected by chemical composition or the conditions of the sheets, except that at 250°C, welds of the coarse-grained M-sheets with low Mg content tested under a stress of 10 kg/mm^2 had a rupture life of 64 to 91 and 137 to 219 hrs in the as-welded and heat-treated conditions, respectively, compared with 12 to 78 and 36 to 56 hrs for T-sheets tested under the same conditions. (Source: Library of Congress, A.I.D. Press, No. 833, November 7, 1962)

OPTICS

KINETICS OF LUMINESCENCE IN THE RUBY CRITIZED. The Soviet physicists N. A. Tolstoy and Leu Shun-fu report that Deutschbein's hypothesis of a "main level" to which the electron drops after shortwave excitation and from which it either radiates an R-line or undergoes nonradiative transition to another level from which it radiates the corresponding line is criticized as being an insufficient explanation for the "relaxation paradox" of some lateral lines (i.e., the N-line) which have smaller relaxation times than R-lines.

It is believed that the "paradox" is due to the presence of two types of centers--"monomers" (Cr ions distant from other Cr ions) and "dimers" (those close to other ions)--characterized by different relaxation times, with the observed relaxation time of R-lines being intermediate. This thesis also explains the concentration and temperature variations of luminescence spectra. The results apply equally to the ruby and to chrome-doped gallium oxide.

Mr. Tolstoy and Mr. Liu Shun-fu comments were made public in the September 1962 issue of Optika i spektroskopiya. (Source: Library of Congress, A.I.D. Press, November 5, 1962)

PHYSICS

PHOTOVOLTAIC EFFECT AT HIGH LIGHT INTENSITIES STUDIED. L. A. Dubrovskiy and P. I. Knigin state in Akademiya nauk Uzbekskoy SSR. Izvestiya. Seriya fiziko-matematicheskikh nauk that the photovoltaic effect at light intensities up to 100 times higher than the average intensity of sunlight have been studied theoretically and the results verified experimentally in water-cooled silicon cells equipped with a lens-type diaphragm-controlled light concentrator.

By taking into account the distributed character of the series resistance in the cell's surface layer, a new expression for the optimum power output at high illumination levels was obtained in the form

$$P_{opt} = \left\{ \frac{I_\Phi}{R} \left[1 - \left(\frac{dV_0}{dV} \right)_{opt} \right] \right\}^{1/2} \left[\frac{2V_0^{opt}}{3 - \left(\frac{dV_\theta}{dV} \right)_{opt}} \right]^{3/2}$$

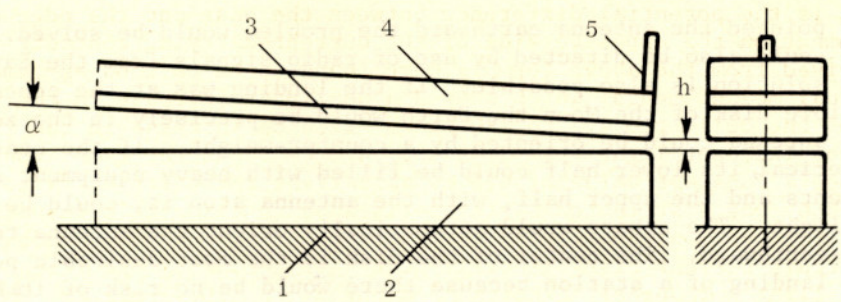
where V_0 is the potential difference between the base and the edge of the photoelement on the opposite side of the current-carrying contact. Figures derived from the above formula were found to be in good agreement with actual measurements, which showed a nonlinear increase in the power output of the cell from 4.7 to 190 mw/cm^2 with an increase in the intensity of incident light from 0.08 to 7.4 w/cm^2. In the same experiments V_0 reached a constant value of 635 mv at a light intensity characteristic, explained by the distributed series resistance in the cell's output layer, accounts for the nonlinearity of the power output curve, even though the short-circuit current rises linearly with an increase in the intensity of incident light. (Source: Library of Congress, A.I.D. Press, No. 834, November 8, 1962)

SOVIETS BUILD LARGE ATOM POWER PLANTS. An article appearing in Berliner Zeitung reports that Professor Morokhov, Deputy Chairman of the State Committee on the Use of Atomic Energy, has announced the construction of large atomic power plants with fast reactors. The first plant of this type will have a capacity of one million kw, while others with capacities of several million kw are planned. Since Siberia is still rich in coal reserves and waterpower, and since natural energy sources are limited in European Russia, the first power plants will be built in the Western part of the country. (Source: Current Review of the Soviet Technical Press, August 24, 1962)

PRODUCTION ENGINEERING

NEW SOVIET WELDING METHOD. The Institute of Hydrodynamics of the Siberian Department, Academy of Sciences USSR, has been experimenting with solid-state welding of metals by the pressure exerted by an explosion. This method is discussed by V. S. Sedykh writing in Svarochnoye proizvodstvo, No. 5, May 1962.

Strong joints are obtained in welding steel "3" (0.30 percent C) to steel "3," steel "3" to steel 1X18H9T (AISI 321), copper to copper, OT-4 titanium alloy (2.0-3.5 percent Al, 1.0-2.0 percent Mn) to OT-4, OT-4 to copper, and 1X18H9T to aluminum. No brittle intermetallic compounds are formed in the weld. Of the explosives tested loose trimethylenetrinitramine ($C_3H_6O_6N_6$) produced the best results. More powerful explosives cause considerable damage to the metal. Specimens to be welded must be positioned at a certain angle and distance (see illustration). Depending on the metal, α varies from 2 to 7° and the depth of the explosive layer from 5 to 20 mm. The optimal distance h was found to be 2 mm. (Source: Current Review of the Soviet Technical Press, August 24, 1962)



1. Rigid base
2 and 3. Specimens to be welded
4. Explosive charge
5. Detonator

PROPULSION

MEASURING METHODS FOR THE EVALUATION OF COMBUSTION CHAMBER EFFICIENCY. Errors in applying existing methods of measuring combustion chamber efficiency are analyzed by J. Jarosiński in Technika lotnicza, No. 7, July 1962. The following methods for approximate evaluation of the degree of efficiency are proposed:

1. Definition of the combustion efficiency by an approximate value of the temperature of combustion gases.
2. Definition of the coefficient of pressure recovery by an approximate value of mean dynamic pressure.
3. Definition of the relative impulse and of the coefficient of impulse by measuring static and dynamic pressures in the inlet and outlet cross sections of the combustion chamber.

These methods are claimed to eliminate the necessity of measuring high temperatures of combustion gases. (Source: Library of Congress, A.I.D. Press, No. 800, September 20, 1962)

RADIO COMMUNICATION

THE PROBLEM OF ORIENTATING AN ANTENNA ON CELESTIAL BODIES. Docent P. Makovetskiy said in Direction: Space - Earth recently that antennas on the Moon can be directed earthward by using a photoelement which would be sensitive to the light from the Earth. An automatic lunar station would be landed at the time of the new Moon when the Sun would be absent from the lunar sky and the Earth would be the largest light source; the Earth would then be at the "full-earth" phase. Once the photoelectric

eye had pointed the antenna earthward the problem would be solved. The antenna could also be directed by use of radio signals from the Earth. Another solution is also possible. If the landing was at the center of the visible disk of the Moon the Earth would be precisely in the zenith and the antenna could be oriented by a counter-weight. If the station was spherical, its lower half could be filled with heavy equipment and instruments and the upper half, with the antenna atop it, could be relatively light. The sphere would automatically orient the antenna to the zenith--earthward. The center of the disk is the most desirable point for the landing of a station because there would be no risk of its being screened by lunar mountains from the Earth because the latter will be in the zenith.

The earthward orientation of an antenna on Mars is difficult because the Earth is only visible as a bright star and a photoelectric eye could not be used. Moreover, Mars rotates on its axis independently of the Earth. One of the few ways to direct an antenna is by powerful radio signals from the Earth. There is an indirect method also. At the time of an opposition the Earth is in the direct vicinity of the straight line Mars - Sun. A photoelectric system could orient the antenna on the Sun and it would also be oriented on the Earth. With a beam width of 30° signals could be received on the Earth for approximately 40 days. (Source: Soviet Bloc Research in Geophysics, Astronomy, and Space, No. 45, October 15, 1962)

SPACE FLIGHT

VENUS SPACE FLIGHT PROBLEMS DESCRIBED. Recently Ye. Grebenikov and V. Demin wrote in A Spaceship Flies to Venus that in a spaceship flight to Venus the passive sector of the trajectory would begin at a distance of several hundred kilometers from the Earth. Over a period of 2 to 3 days the ship would move in the sphere of attraction of our planet. The radius of this sphere is 900,000 km. Solar attraction would then become greater. Toward the end of the flight, when the spaceship enters the Venusian sphere of attraction, the attraction of that planet would become decisive. But other forces cannot be completely ignored. The attraction of the Moon, Mars, Jupiter and other bodies, must be taken into account. Lunar attraction may be particularly important if the spaceship passes near it.

The selection of a suitable trajectory to Venus is highly complex, but can be solved by an approximate analysis of the problem. In this method it is assumed that movement occurs under the influence of only a single body: first Earth, then the Sun, and finally Venus (the sphere of attraction of the latter is about 650,000 km).

The following requirements must be considered in selecting the trajectory:

1. The spaceship should have the least possible velocity at the end of the active sector.

2. Flight time should be as short as possible.

3. The trajectory should be the least sensitive to errors in velocity at the end of the active sector and height or orbiting.

4. The spaceship should not encounter Venus at the time of its conjunction with the Sun, due to intensified solar radio emission which would cause radio interference.

5. Venus should be as close as possible to the Earth.

6. The location of meteor streams in space must be taken into account.

7. Solar activity should be minimum.

But no selected trajectory could satisfy all these requirements. Minimum flight time is 25 days, but such a trajectory would be completely unsatisfactory because the spaceship would have to have a velocity of 42 km/sec at the end of its active sector, and the craft would pass by Venus at such a velocity that little time would be available for observations. Such a trajectory would also be extremely sensitive to errors, such as in initial velocity. (Source: Soviet Bloc Research in Geophysics, Astronomy, and Space, No. 45, October 15, 1962)

FUTURE OF SPACE FLIGHTS. It was theorized in Multiflight Spaceships, by Karl Gil'zin, recently that flights in space in the future will be unlike those at the present time. Instead, flights will be from space station to space station. These "cosmoports" will be reached by rocket "taxis." The stations will be at a height of about a hundred kilometers from the Earth's surface. A still greater difference will be in the character of the rocket engines, which will probably be electric; these engines will create a jet of electrically charged particles which will be ejected at immense velocities by electromagnetic forces. These ions or plasma engines will ensure a relatively low consumption of energy in flight. However, spacecraft with such engines will be unsuitable for takeoffs and landings and will therefore fly only from one cosmoport to another. (Source: Soviet Bloc Research in Geophysics, Astronomy, and Space, No. 45, October 15, 1962)

THEORETICAL PHYSICS

GRAVITATIONAL FIELD RELATIVELY LOCALIZED. Yu. A. Rylov, in Akademiya nauk SSSR. Doklady, Vol. 144, No. 5, 1962, writes on work being done relative to the Earth's gravitational field. He states that an invariant method is used to show that the condition that the gravitational field at point x' be equal to zero will completely determine the gravitational field at point x. Such a two-point description makes it possible, in a certain sense, to localize the gravitational field at all points in respect to an arbitrary point x' (where the field is equal to zero) without contradicting the equivalence principle. This principle is reconciled with the transition from Riemann to Euclidean space by introducing a continuum of Euclidean spaces depending on the coordinates of point x'.

It is shown that even such a relative localization of the gravitational field makes it possible to introduce the following quantities, which obey the laws of conservation: energy, momentum, and moment of momentum. (Source: Library of Congress, A.I.D. Press, No. 788, September 7, 1962, p. 2)

SOVIET ANTIPARTICLE RESEARCH. K. Portsevskiy writes in the August issue of Molodezh' Gruzii of experiments on the second Soviet spaceship which was launched in August, 1960. It carried a stack of photographic emulsion films comprising 489 layers, with a total thickness of 400 μ, for the purpose of recording nuclear events involving antiparticles. Subsequent examination of the tracks of the stopped multicharged nuclei, and the stars they formed revealed 422 nuclei that came to rest, producing a taper and 320 stars. None of the latter, however, showed properties characteristic of an antiparticle.

It is concluded that the number of antinuclei in cosmic rays does not exceed 0.23 percent of their counterparts, ordinary nuclei. Current studies are treating the possibility of detecting antimatter if it is scattered in the Solar System. Contact with the atmosphere should result in its annihilation anywhere from 100 to 1000 km above the Earth's surface, releasing energy of the order of 100 Mev which can be detected by spaceship instrumentation. (Source: Library of Congress, A.I.D. Press, No. 785, September 4, 1962)

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Barashkova, Ye. P., V. L. Gayevskiy, L. N. D'yachenko, K. M. Lugini, and Z. J. Pivavarova, The Radiation Regime of the Territory of the USSR.

The book was published at Leningrad in 1961 by the Hydrometeorological Publishing House. It has 528 pages.

This book represents a study of the radiation regime of the USSR, based largely on observational data collected by the stations of the Hydrometeorological Service. The network of actinometric stations in the USSR has been greatly expanded in recent years, and there has been much work on the perfection of observational methods. The network of stations at the beginning of 1958 consisted of 176 stations. A full program of observations, that is, total, scattered and reflected radiation and the radiation balance, was conducted at 43 of these stations. In 1959, 100 stations conducted the full program. Radiation was measured by thermoelectric actinometers, pyranometers, and balance meters. (Source: Soviet-Bloc Research in Geophysics, Astronomy, and Space, No. 40, 1962)

Yanishevskiy, Yu. D., Actinometric Instruments and Observational Methods. This is a book giving a description of instruments and methods used to obtain data for radiation observations. It was published in Leningrad in 1957.

It covers the history of observations at the majority of the stations in the network and covers three to nine years (the longest is twenty years). The authors have used data from 98 stations with observation periods of four years or more. Data for stations with a shorter history of observations were used for certain areas. Data were used only for those stations located at elevations not exceeding 850 meters.

A map of the network of actinometric stations and a list of the stations are given in Appendix II.

Chapter I. Survey of the literature and methods of processing observational data. 1. Brief survey of the literature; 2. Methods of processing data; Estimating the accuracy of the totals computed from regular observational data.

Chapter II. Total radiation. 1. Total radiation for a cloudless sky; 2. Possible totals; 3. Total radiation for actual cloud cover conditions; 4. Diurnal course and hourly and diurnal radiation totals; 5. Monthly totals and annual course of total radiation; 6. Distribution of total radiation over the territory of the USSR.

Chapter III. Scattered radiation. 1. Scattered radiation in a cloudless sky; 2. Scattered radiation under actual cloud conditions; 3. Diurnal and hourly and diurnal totals of scattered radiation; 4. Monthly totals and annual course of scattered radiation; 5. Distribution of scattered radiation over the territory of the USSR.

Chapter IV. Direct radiation. 1. Direct radiation in a cloudless sky; 2. Diurnal course and diurnal totals of direct radiation under actual cloud conditions; 3. Monthly totals and annual course of direct radiation; 4. Distribution of direct radiation over the territory of the USSR.

Chapter V. Albedo of the underlying surface. 1. Factors which determine albedo; 2. Albedo as determined by ground observations; Albedo determined by aircraft observations; 3. Absorbed radiation.

Chapter VI. Effective radiation of the underlying surface. 1. Factors which determine effective radiation; 2. Diurnal and annual course of effective radiation; 3. Monthly and annual totals of effective radiation.

Chapter VII. Radiation balance of the underlying surface. 1. Radiation balance for a cloudless sky; 2. Radiation balance for actual cloud conditions; 3. Diurnal and annual course of radiation balance; 4. Diurnal and monthly totals of radiation balance; 5. Distribution of the radiation balance over the territory of the USSR.

There is a bibliography and two appendices with 38 tables. (Source: Soviet-Bloc Research in Geophysics, Astronomy, and Space, No. 40, 1962)

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