Space INTELLIGENCE NOTES

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FROM THE WORLD PRESS

SOVIETS SCORE ANOTHER FIRST. At 12:30 P.M. Moscow time on June 16, Jr. Lt. Valentina V. Tereshkova became the world's first woman cosmonaut, when the Soviets launched Vostok-6. She followed Lt. Col. Valery F. Bykovsky into space. Their orbital planes were some 30 deg apart, although the two spaceships managed to approach within 5 km (3 mi) of each other. Col. Bykovsky had been launched earlier in his Vostok-5 at 3 P.M. on June 14.

According to the official Soviet information agency (TASS) announcements, the flight objectives included a continuation of the study of the surface of the Earth and its cloud cover; observation of the Moon and the stars; observations of human life during extended space flight, including the study of female capabilities; and the continued development in the reliability and capability of the various rocket components and systems for piloting future spacecraft.

Lt. Tereshkova was born in 1939, and followed her mother's example by working in the textile industry. Following her secondary education, she completed a special textile course in an evening school in Yaroslav. Starting in 1959, she became active in parachute jumping and made 126 jumps. Inspired by the Soviet space achievements, she volunteered for cosmonaut training and was selected from the group of Soviet women participating in the tests.

Her space companion, Col. Bykovsky, a 28-year-old pilot, is also active in parachute jumping, having made some 72 jumps before becoming an instructor in that sport. Col. Bykovsky received special military training and was decorated with the Order of the Red Star, which is rarely awarded during peace time. He was promoted to his present rank prior to his space flight and became a Communist Party member while in flight. Lt. Tereshkova, on the other hand, was already a Communist Party member, but her military rank of a junior lieutenant was based strictly upon her successful completion of the cosmonaut training course.

Vostok-5 orbited the Earth initially in 88.4 min with a perigee of 181 km (120 mi) and an apogee of 235 km (190 mi) at a 65 deg inclination from the equatorial plane. The sister craft, Vostok-6, had an initial orbit of 88.3 min, a perigee of 183 km (125 mi), apogee of 233 km (170 mi), and a 65 deg inclination from the equatorial plane. These orbital parameters led to speculation by Western observers that the Soviets were unsuccessful in an attempt to achieve a rendezvous and therefore would make a second attempt later this summer.

When Col. Bykovsky communicated with the ground and with his space companion, he used the code name "Hawk" on frequencies of 20.006 and 143.625 megacycles. His transmitter "Signal" operated on a 19.948 megacycle frequency. Lt. Tereshkova, under the code name of "Sea Gull," used the same frequencies with the exception of the "Signal" transmitter, which operated on 19.995 megacycles.

Soviet television and telemetric coverage demonstrated that the entire operation had proceeded faultlessly from launch to descent according to plan. An intercepted radio message from Col. Bykovsky indicated that he had sufficient reserves of food, water, and air and desired to continue his flight. Although the Soviets normally did not publicize the fact that their cosmonauts parachuted to Earth, a Soviet report described Lt. Tereshkova as descending in a red and white parachute 630 km (400 mi) NE of Karaganda at 11:20 A.M. after completing 48 orbits and 71 hours in space. Col. Bykovsky completed 81 orbits and 119 hours in space at 300,000 km (186,411.6 mi), before landing at 450 km (360 mi) NW of Karaganda at 14:06 P.M. Moscow time. Both landed within the 53° latitude.

Dr. Eugene B. Konecci, director of biotechnology and human research for NASA, indicated in a talk given to the American Rocket Club that the Soviets were determined to establish bases on the Moon and to explore the nearby planets. Thus the flight of Lt. Tereshkova had demonstrated the ability of man to fly into space without flight training and hastened the day when scientists would embark on celestial journeys. (Source: The New York Times, June 19, 1963; Pravda (Truth), June 20, 1963 and June 16, 1963)

SOVIETS LAUNCH COSMOS-18. On May 24, 1963, the Soviets launched the latest, number 18, in the Cosmos series, which was initiated in March 1962. According to TASS, the satellite had these parameters: 89.44-min orbit; apogee, 301 km (180 mi); perigee, 209 km (130 mi); and angle of inclination to the equatorial plane, 65°01".

The satellite carried scientific apparatus, including a radio transmitter operating on a frequency of 19.996 megacycles, and a radio telemetry system to transmit data to Earth concerning the functioning of the devices on board. This satellite, carrying a Vostok-type capsule, was brought down after almost nine days in space, which is similar to the duration in space of several other Cosmos vehicles. It was the fifth satellite launched within six weeks and number 7 for 1963. (Source: Red Star, May 25, 1963; The New York Times, June 20, 1963)

SOVIETS SCORE EARLY SUCCESSES IN PACIFIC TESTS. On May 28, the Soviet government announced that the highly successful firings of several "improved versions" of the multi-stage rockets 12,000 km (7500 mi) into the Central Pacific had led to the lifting of travel restrictions from one of the restricted areas. Its boundaries are defined as latitude 10° North, longitude 170° West, and about 1600 km (1000 mi) southwest of Hawaii. (Source: The New York Times, May 29, 1963)

US ASSIGNS A SCIENTIFIC REPRESENTATIVE TO THE AMERICAN EMBASSY IN MOSCOW. According to a news item in the April 19, 1963, issue of Science magazine, the State Department has tentatively assigned a Foreign Service Officer, Glenn Schweitzer, as a scientific representative at the American Embassy in Moscow.

Mr. Schweitzer, a 1953 West Point graduate, studied nuclear engineering at the California Institute of Technology. He has served in the US Foreign Service for several years following his resignation from the Armed Forces.

The State Department noted that his functions will include assistance for American scientists in exchange arrangements with their Soviet colleagues. (Source: Science, April 19, 1963).

WHO'S AHEAD? This question is often asked and answered without proper consideration being given to the facts. Most people believe that Russia's spectacular ability to launch huge rockets [up to 6350 kg (seven tons) of satellite weight] is proof of Soviet scientific superiority over the United States. Many prominent US scientists just won't buy this idea.

Dr. Philip H. Abelson, a geophysicist and editor of Science, the journal of the American Association for the Advancement of Science, is one of these. He has stated, "Despite their ability to place large pieces of hardware in orbit, their contributions to space research have been meager."

Their scientific records have not matched the discoveries made by Mariner II as it flew past Venus, nor have their satellites compared with US vehicles in highly intensive space explorations.

Abelson also contends that American science, outside space, is so superior to Russian science that the latter ranks only as a third rate power. American scientists are unmatched in nuclear physics, biochemical genetics, and in practical areas of science.

Abelson has stated a grievance at US persistence to threaten American prestige by engaging in a "Propaganda Contest" with Russia. He feels that Russia and the US might still be heckling over space science while Western Europe is forging ahead in "real" science.

Another American scientist, Dr. Mason Benedict, Chairman of the General Advisory Committee of the Atomic Energy Commission and head of the nuclear engineering department at Massachusetts Institute of Technology, has just completed a tour of 11 Soviet installations along with 8 other American scientists. He stated upon his return that most of the Soviet electronic equipment was very good, but "most of it is similar to what we had five or six years ago." On the other hand, Russian work in the field of controlled thermonuclear fusion is equal to that of the US.

Col. Raymond S. Sleeper, an Air Force technical expert, has analyzed US-Russian competence in six vital areas of space and science.

He has found the US ahead in the areas of aerodynamics technology and electronic command and control. The Soviets lead in general education and power of rocket boosters.

Two areas--basic research and the scientific aspects of nuclear weapons--showed no predominance in either the US or Russia. Soviet spacecraft payload capacity is superior and affords a lead for militant exploitation. However, the US leads in aerodynamics, exemplified by B52 and B58 bombers, and command control systems.

Rep. Jim Wright of Texas stated recently that "if Nikita Khrushchev really does intend to bury us, he probably will have to borrow an American shovel." The Soviets probably aren't in this bad a shape, but Rep. Wright has come up with some amazing figures through research. According to him, sixty per cent of the TV sets made in Russia last year were not operational after six months. He also found that Soviet ballbearings wear out twice as fast as Swedish models, and that roller bearings last only about a third as long.

Said Rep. Wright: "The Russians have succeeded in sending a space probe to the Moon, but they have not been able to build tractors that their farmers can depend on.

"While they have assembled a 100-megaton bomb, they haven't manufactured reliable dental drills to fix people's teeth." (Source: The San Francisco Chronicle, May 28, 1963; Electronic News, June 10, 1963; New Port News, Va. Daily Press, June 9, 1963; Washington Daily News, June 11, 1963)

WEST GERMANY ENTERS SPACE AGE. Hans Lenz, West Germany's minister for Scientific Research, announced Germany's space flight projects to a symposium at Stuttgart, which was attended by some 400 scientists from Europe and the United States.

West Germany is directing its efforts in 4 projects, which are still only paper calculations:

1. A communication satellite to be put into a polar orbit.
2. A high-energy rocket propulsion stage to be filled by liquid hydrogen.
3. A space transport employing various combinations of propellants.
4. A space probe rocket with paraglider landing wings to allow the craft to be used repeatedly.

US scientists who attended the previous symposiums noted that the Germans have moved beyond the talking stage.

The Boelkow Development Company of Munich, which is designing the German satellite, states that the satellite would circle the Earth in an elliptical orbit with a perigee of approximately 385 km (239 mi) and an apogee of 1448 km (900 mi). The orbit would have an inclination of 15 deg to the Earth axis. The axis of the satellite would be stabilized. The symmetric axis would be directed at the Sun; the position of the vertical coordination axis would be stabilized with the help of two stars in the vicinity of the ecliptical poles.

The weight of the satellite would be 1360 kg (3000 lb), two-thirds of which would be utilized by the space capsule and the rest in equal amounts by probing instruments and reentry capsule. The life expectancy of the satellite equipped to use solar energy would be four to five years.

To get a satellite of such magnitude aloft, a rocket as powerful as the American Atlas would be required. Judging from the experience with the American Tyros meteorological satellite, one might question whether or not the thrust would be sufficient to place the satellite into polar orbit or to force it to follow in a near-equatorial orbit.

On May 2, West German scientists fired a three-stage rocket 104.6 km (65 mi). The rocket was designed by Berthold Seliger, who helped in the development of Germany's V-1 and V-2 rockets in World War II. The new rocket is developed from V-2. It will be used in space research and possibly in developing an anti-missile rocket.

Seliger said that he had only "limited support" from the West German government; however, officials promised "very good support" on future projects. Seliger and his team are cooperating with other Western European space organizations.

The amount that the Bonn government has indicated it is willing to spend (fiscal year 25 million) on space development proves that it still is undecided. (Source: The New York Times, May 5, 1963, and The Washington Post, May 3, 1963)

FROM THE SEMITECHNICAL LITERATURE

NEW ISOTOPES. Isotopes of the 102nd element have reportedly been synthesized by three Soviet scientists, E. D. Donets, V. A. Shchegolev, and V. A. Yermakov. The work was accomplished at USSR Nuclear Reaction Laboratory, Dubna, under G. N. Flerov, Associate Member of Soviet Academy of Sciences.

It was announced that the discovery was made possible through 10 million volt cyclotron, and that no deficiences are present that could cast doubt on the experiment. However, US scientists have indicated their belief that the isotope is unsuitable as a nuclear energy source because of sheer formation complexity. Only eleven new isotopes have been synthesized by scientists since 1941. (Source: Soviet Science in the News, June 10, 1963, publication of Electro-Optical Systems, Inc.)

LUNAR IMPACT VIDEO SYSTEMS. Russia has developed impact resistant television transmitters that have reportedly withstood free-falls from altitudes of 1981 m (6500 ft) without damage.

I. Aleksandrov, Designer, Space Television Systems, has announced that several television sets were dropped without parachutes from aircraft flying at an altitude of 2 km (1.25 mi). The transmitters hit Earth and were not damaged by the impact; they began to operate effectively.

Aleksandrov said that a similar transmitter was carried aboard Luna-4, launched on April 2, and passed lunar surface, missing impact, last April 6. (Source: Soviet Science in the News, June 10, 1963, publication of Electro-Optical Systems, Inc.)

FROM THE TECHNICAL LITERATURE

CHEMISTRY

CRYSTALLIZATION BY CHEMICAL METHOD FROM A GAS PHASE. A study of crystallization by the chemical method from a gas phase has been conducted at the Institute of Crystallography, Academy of Sciences, USSR, and presented by Academician N. V. Belov. The study was prompted by the differences observed in carrier mobility and resistivity, between Ge semiconductor layers built up on a Ge single-crystal bulk substrate by crystallization from the gas phase and the layers built up in vacuum. The layers built up by crystallization are identical to those of the substrate in carrier mobilization and resistivity, while layers built up in vacuum differ considerably from those of the substrate. These contrasting reactions have been ascribed to the different mechanisms of Ge single-crystal formation.

The experiments were carried out in a quartz reactor in which single-crystal Ge substrates were placed on a graphite support heated to 700° or 800°C (1260° or 1440°F). The $H_2 + GeCl_4$ mixture was fed to the reactor at room temperature. The results are given crystal growth rate plots compared with the initial $GeCl_4$ concentrations and flow velocity in the reactor. Photomicrographs were made of the Ge layers built up at various initial $GeCl_4$ concentrations.

Analysis of these results and of the possible reactions, $GeCl_4 + Ge = 2\ GeCl_2$ and $GeCl_4 + H_2 = 2\ GeCl_2 + 2\ HCl$, have led to the following conclusion: crystallization from the gas phase makes control of growth possible by the nature of its peculiar type of crystallization, in which both the initial chemical compound and the intermediate reaction products directly participate in the crystal growth process. During the process of crystal growth, evaporation [sic] and dissolution of the crystals take place. These processes contribute to the formation of perfect crystals by abrogating irregularities in the particle-buildup sequence and correcting errors in the crystal growth. Growth of the crystals becomes self-regulated, due to the chemical reaction, and comparatively unsensitive to changes in process parameters. In contrast, the structure of vacuum films is highly imperfect and thus has low electrical parameters. (Source: Doklady Akademiya Nauk SSSR (Proceedings of the Academy of Sciences, USSR), No. 2, March 11, 1963, and Library of Congress, AID Press)

ELECTRONICS

PHOTORESISTOR-CIRCUIT SENSITIVITY ANALYZED. A method for calculating optimum parameters of circuits with CdS photoresistors has been presented by S. P. Papazov and I. A. Moslarov. The scientists have designed the method to overcome difficulties caused by the nonlinearity of photoresistor characteristics and by technological defects.

The maximum circuit sensitivity ν is taken as the criterion of optimum performance, and an expression is derived for sensitivity as a ratio of the difference between the maximum and minimum values of the output voltage to the average value.

The derivation utilized a hyperbolic approximation of the dependence of photoresistance on illumination. Thus it was found that as the resistance R of the circuit increases, ν declines nonlinearly. A maximum of nonlinearity is attained when per cent modulation of light m = 0.5. With very large values of R, $\nu \rightarrow 0$; with small values of R, ν approaches a constant value. The optimum value of initial illuminance E_0 was found to be within the limits of 0.1 to 0.3 $E_{0\ sat}$, and that of m is 1. With these values, the coefficient of nonlinear distortion does not exceed 5%. Results obtained for CdS may be extended to other types of photoresistors. (Source: Automatika i Telemekhanika (Automation and Telemechanics), No. 3, March 1963, and Library of Congress, AID Press)

LASERS

RUBY LASERS STUDIED AT LIQUID NITROGEN TEMPERATURE. Soviet scientists V. K. Konyukhov, L. A. Kulevskiy, and A. M. Prokhorov investigated spectral components of ruby laser emission that are equivalent to laser transitions to the ±1/2 and ±3/2 components of the ground state at 77.4°K.

Using a light-pink ruby specimen 6 mm (0.236 in.) in dia and 60 mm (2.36 in.) long, with one end silver-coated, a laser beam was transmitted through a Fabry-Perot interferometer having a 0.20 cm (0.079 in.) air gap into a long-focus camera. There it was photographed on a red-sensitive film or separated by a mask into two components that were detected individually by a photomultiplier and registered on a dual-beam oscillograph. Only the ±3/2 component was visible near the laser threshold, the other appearing at higher pumping energies. Their frequency difference that was obtained from the interference pattern (0.36 ± 0.03) cm^{-1} (0.14 ± 0.01 $in.^{-1}$) agrees (within the experimental error) with the result determined by the splitting of the Cr^{3+} ground state in the Al_2O_3 lattice (the ground state was determined through EPR methods).

The conclusion was reached that the components carry different loads of output energy; that is, near the threshold most of the energy is carried by the ±3/2 component, while the ±1/2 component increases significantly above the threshold to 21 ± 1% of the former component. The time variation between the two is quite dissimilar. The shortwave component (±3/2) was generated in 0.5 to 0.8 μ sec, and its duration was increased by increasing the pumping energy while the long wave component (±1/2) was generated in 0.1 to 0.15 μ sec; conversely, its duration decreased from increased pumping energy. (Source: Doklady Academiya Nauk SSSR (Proceedings of the Academy of Sciences, USSR), No. 3, March 1963, and Library of Congress, AID Press)

LASER EXCITATION OF RECOMBINED EMISSION. Soviet scientists N. G. Basov, L. M. Lisitsyn, and B. D. Osipov made an experimental study of recombined emissions in germanium, silicon, and gallium arsenide at various temperatures, using a ruby laser (6934Å) to obtain high excitation levels, and a spectrometer with a lead sulfide indicator (100 μ sec time constant) for analysis. Samples of n-type germanium, having a 40 ohm·cm resistivity and a 1.5 mm (0.059 in.) diffusion length shaped like a "Weierstrass sphere" 8 mm (0.314 in.) in dia, were excited by light pulses with a duration of 200 μ sec and a density of 10^6 w/cm^2.

A broad band amplifier was used to amplify the signal which was registered by a dual-beam oscillograph, while a photomultiplier monitored the laser output. Results indicated that an intensity of recombined emission at the temperature of liquid nitrogen is "two orders" greater than at room temperature; and at the temperature of liquid helium it was 2 to 3 times greater than at the temperature of liquid nitrogen. Silicon and gallium arsenide gave analogous results. (Source: Doklady Akademiya Nauk SSSR (Proceedings of the Academy of Sciences, USSR), No. 3, March 1963, and Library of Congress, AID Press)

MATERIALS ENGINEERING

EFFECT OF ULTRASOUND ON STRUCTURE OF ALUMINUM ALLOYS. Experimental Al-Mn, Al-Zr, and Al-Zr-Fe alloys have been tested to determine the effects of ultrasonic vibrations on the crystallization of aluminum-base alloys.

Although ultrasound was ineffective once primary crystallization had ended, it caused a considerable refining of the grain size of the intermetallic compounds during the primary period.

The grain size of the Al-Mn alloys decreased as the amplitude of ultrasound increased, reaching a minimum at an amplitude of 25 μ for an alloy with 1-2% Mn and at an amplitude of 50 μ for an alloy with 5% Mn. However, this was found to be true only for those Al-Mn alloys in which primary solidifying intermetallic compounds do not cause modifications.

The ultrasound always produced a fine structure in the Al-Zr alloys, for even at low contents of Zr (0.1-0.2%), a structure-refining effect of ultrasound was observed. The intermetallic compounds of an Al-Zr-Fe alloy were obtained in a finely dispersed state under the effect of ultrasound.

The study was conducted by three Soviet scientists, G. I. Eskin, I. N. Fridlyander, and M. K. Rubleva. (Source: Izvestiya Akademiya Nauk SSSR (News of the Academy of Sciences, USSR), No. 1, 1963, and Library of Congress, AID Press)

PHYSICS

NONRADIATIVE TRANSITION PROBABILITY OF SM^{2+} IN FLUORITE. B. Z. Malkin, a Soviet scientist, determined the probability of the nonradiative two-phonon transition $^7F_1 \rightarrow {}^7F_0$ of Sm^{2+} in the center of cubic cells of F^- ions in a fluorite lattice. This probability determination of the transition, which occurs during the functioning of a four-level laser using a $CaF_2:Sm^{2+}$ crystal, permits the calculation of the rate of transition of ions to the ground state following a stimulated emission of a photon with an energy of 14, 118 cm^{-1} (4630 ft^{-1}). The value of $W(^7F_1 \rightarrow {}^7F_0)$ is determined to be $2.2 \cdot 10^{10}$ sec at 0°K and rises with increased temperature. This result supports the position of W. Kaiser and others who state that there is no accumulation of Sm^{2+} ions at the $^7F_1$ level during the operation of a $CaF_2:Sm^{2+}$ laser. (Source: Fizika Tverdogo Tela (Solid State Physics), No. 4, April 1963, and Library of Congress, AID Press)

PROPULSION

LIQUID SUSPENSION FLOW IN PIPES. Liquid suspensions have been studied as possible fuels or heat-transfer agents by V. I. Kofanov. The scientist obtained correlations for calculating the heat transfer and hydraulic resistance of water suspensions of aluminum, iron, and other solids flowing through pipes at pressures ranging from 5 to 91 mm (0.19 to 3.58 in.) Hg and at temperatures of 27.85 to 46.7°C (82.13° to 116.06°F). A pipe 3020 mm (118.8 in.) long with an internal diameter of 12.65 mm (0.5 in.)

was used in experiments. On the basis of experimental data the following expression, which can be used in design calculations, was established.

$$Nu = 0.026\ Re^{0.3}\ Pr^{0.4} \left(\frac{r}{-r}\right)^{0.015} \times \left(\frac{\rho_1}{\rho_2}\right)^{0.12} \times \left(\frac{c_1}{c_2}\right)^{0.15} \times \left(\frac{d_1}{d_2}\right)^{0.02},$$

where ρ_1 and ρ_2 are densities of the liquid and of the solid body; c_1 and c_2 are heat capacities of the liquid and of the solid body; r is pipe radius; and d_1 and d_2 are diameters of the pipe and of the solid particle.

The variations of the Nu number from 100 to 700 correspond to the variations of Re from 4000 to 20,000 Pr from 1.5 to 40, r from 0 to 0.2, ρ_1/ρ_2 from 0.1 to 0.7, c_1/c_2 from 2 to 10, and d_1/d_2 from 14 to 22,000. Experimental data on hydraulic resistance in isothermic conditions of flow satisfy the expression $\xi = 0.316/Re^{0.25}$. (Source: Teploenergetika (Thermal Energy), No. 3, March 1963, and Library of Congress, AID Press)

RELIABILITY

AGING ELEMENTS STUDIED BY SCIENTIST. V. B. Gogolevskiy has studied the reliability of elements subject to aging, with attention given to their gradual failures. The scientist derived a formula determining the probability of nonfailure operation of an element for a period of time t, based on the assumption that the distribution of nonfailure operating times for a given element obeys the normal law:

$$P(t) = \frac{1}{2\pi\sigma} \int_t^{\infty} \exp\left\{ - \frac{(T_m - x^2)^2}{2\sigma^2} \right\} dx,$$

where T_m is the mean life of an element and σ^2 is its variance.

The determination of P(t) is reduced to establishing the distribution parameters $T_m(t)$ and $\sigma(t)$, which are functions of the variables $x_1(t)$, $x_2(t), \ldots, x_m(t)$, characterizing various operating conditions of an element. The method of determining $T_m(t)$ and $\sigma(t)$ is presented, and formulas are derived for calculating probability P(t) not only for constant operating conditions but also for any operating conditions of elements with variable parameters $x_1(t), \ldots, x_m(t)$.

$T_m(t)$ and $\sigma(t)$ can be determined by this method even when the distribution of nonfailure operating times is not normal. The derived formulas are used to calculate the mean life of the winding in electromagnetic devices. (Source: Avtomatika i Telemekhanika (Automation and Telemechanics), No 3, March 1963, and Library of Congress, AID Press)

SCIENCE AND TECHNOLOGY SECTION TRANSLATIONS

The following article was selected and translated from current Soviet literature by the Science and Technology Section.

"Cosmic Physics" by G. A. Skuridin

Observation of the movement of artificial satellites and cosmic rockets is basically accomplished through the medium of radio technology. For this purpose every cosmic craft is equipped with devices designed to make orbital and telemetric measurements under the control of Earth stations in the Command-Computation Complex.

The simplest radio medium for the receipt of data from the trajectory of the cosmic craft is the on-board radio station, Mayak. A group of co-workers, under the leadership of Academician V. A. Kotelnikov, developed a method and a measuring device for the determination of the orbital parameters of artificial satellites of the Earth based upon the Doppler effect; that is, time variations in the receipt of the satellite's radio signals corresponded to the movement of the transmitter Mayak on-board the satellite.

The flights of the first artificial satellites of the Earth and cosmic rockets presented the astronomers with the problem of following their movements with optical means. This was speedily solved through the establishment of a network of optical stations, situated at many points in the USSR. New optical devices were required to observe the flight trajectories of artificial satellites of the Earth, and especially, cosmic rockets at distances of hundreds of thousands of kilometers from Earth. Under the leadership of I. S. Shklovski, a photographic camera using electron-optical modifications was developed, which increased the accuracy of the measurement of the satellite coordinates by several seconds.

Another important method of observing the movement of cosmic rockets was the "artificial soda comet" that was created in space as proposed by I. S. Shklovski. This method utilized the presence of an intensive dispersion of several gases with different spectral lines and belts characteristic of the given gas-resonant-florescence. As proven by calculations, soda was the best selection for the creation of an artificial comet. The invaluable quality of the soda cloud consists of its dispersion of light in a strictly determined wavelength of $\lambda = 0.589\ \mu$ (yellow-orange portion of the spectrum). Utilizing appropriate filters, one may observe the soda cloud even though it is projected against the bright heavenly background. This method was experimentally tried in the launching of a geophysical rocket on 19 September 1958 to an altitude of 430 km (267 mi) and during the launch of the first and second Soviet cosmic rockets towards the Moon. The "artificial comet" was created at a distance on the order of 100,000 km (62,000 mi) from Earth and was observed by many observatories on Earth.

The density, pressure, and composition of the upper atmosphere may be computed by the variation in the parameters of the orbits of the artificial satellites, occurring as a result of the atmospheric "braking" that is proportional to its density. This atmospheric density influence is at its strongest in the area of the orbital perigee, where it produces intensive "braking." M. L. Lidov, P. E. Yelyasberg, V. D. Yastrebov, and G. A. Kolegov developed methods for the determination of the atmospheric density based upon the "braking" of the artificial satellites of the Earth.

The average value of the atmospheric density at the perigee altitude of the Soviet satellite [225-228 km (139-146 mi)], which was determined from the "braking" action, is equal to 3.10^{-13} g/SM^3. This exceeded the density values by 5-10 times, which had been previously indicated for those altitudes in numerous atmospheric tables, based upon measurements made by geophysical rockets prior to the launches of satellites, which indicates much higher temperatures in the atmosphere. During the existence of the satellite, the change in the latitudes and longitudes of the perigee occurs slowly. This factor permitted the determination of the atmospheric density over various points of the Earth's surface, on bright and shaded sides of the Earth. On the basis of the "braking" of the first two Soviet satellites of the Earth in the perigee region, M. L. Lidov was the first to establish that the density values on the illuminated side of the Earth was 20-30% greater than on the shady side.

Analysis of the movement of later satellites disclosed even greater daily variations in the atmospheric measurements. It was also established that the atmospheric density decreased in the passage from the northern latitudes towards the south and that solar activity influenced variations in the densities.

Previously we discussed the artificial "soda comet." This completely optical method of observing the movements of cosmic rockets permitted us to determine the density of the atmospheres in which the artificial comet was fashioned. V. G. Kurt's calculations, based on the theory of diffusion with the provision that the atmosphere in altitudes up to 500 km (310 mi) is basically nitrogen-oxygen, gave the density values as $6.7 \cdot 10^{-15}$ g/SM^3 (accuracy up to 30%) at an altitude of 430 km (267 mi).

The third Soviet artificial satellite of the Earth accomplished density and pressure measurements at various altitudes, using an ionization and magnetic electrical discharging manometer, under V. V. Mikhnevich and B. S. Danilin. During the determination of pressure by the manometer on board the satellite, it was necessary to consider its orientation in space, its movement, and the composition and temperature of the gases. For a final interpretation of the manometer readings, it was also necessary to establish a connection between the pressure within the manometer, which is measured and transmitted to Earth, and the pressure of the exterior mediums. This task was solved by E. G. Shvidkovski and A. I. Repnev, using the laws of molecular aerodynamics. The analysis of the movement of the third satellite was based upon the work of V. V. Beletzski, who used the magnetometric data from the satellite to write formulas to determine the orientation of the gauges in the manometer.

These measurements led to the first reconstruction of an atmospheric cross section at altitudes of 225-500 km (139-278 mi). This data, which agrees with density values received from the "braking" of the satellites and from the diffusion of the soda vapors, led to the determination of the altitude of a homogeneous atmosphere at various distances from Earth. The results of measurements taken by increasing that altitude are reflected on the decrease of the molecular weight caused by the dissociation of molecular oxygen and on the constant increase in the atmospheric temperatures. Molecular weight in altitude ranges of 100-2000 km (62-1242 mi) changes from 29 to 2. For altitudes on the order of 200 km (124 mi), the molecular weight is $\sim$27.

The study of the chemical composition of the upper atmosphere with mass-spectrometers is accomplished in the Soviet Union by geophysical rockets, which are launched to altitudes on the order of 400 km (248 mi) and by the third satellite. These observations have produced changes in our ideas of the physics and chemistry of the ionosphere and the ionization sources in the atmosphere, under V. G. Istomin, A. A. Pokhunkov, and A. D. Danilov.

An analysis of the experimental data demonstrated that the recombination processes are more intense in the ionosphere than originally believed. Mass spectrometric study by geophysical rockets is accomplished by the exclusive method of detachable containers, which guarantees the complete freedom from rocket contamination and the receipt of data for considerable portions of the trajectory from an undisturbed atmosphere. Results of fundamental importance were received from the first launch on 9 September 1957.

At altitudes of 100-210 km (62-130 mi) dominated by ions, ions of nitrogen oxide were registered. Subsequent launchers registered molecular and atomic oxygen as well as molecular and atomic nitrogen. Thanks to the measurements of V. G. Istomin and the concurrent study of the electron concentration in the atmosphere by K. I. Gringaus, it was possible to calculate the absolute concentration of ions in atomic nitrogen. For nitrogen oxide ions, molecular and atomic oxygen, effects were discovered that could be connected with the daily changes in the ionosphere. The relative concentration of atomic oxygen in altitudes of 140 to 200 km (86-124 mi) grows with the increase in the altitude of the Sun, which essentially is regulated by the changing lighting conditions of the atmosphere. The relative ion concentration in molecular oxygen, however, decreases during the day due to the protracted illumination of the Sun.

During the flight of a geophysical rocket launched 15 June 1960 and likewise during other flights, ions of the metals--magnesium, iron, calcium, and possibly silicon--were registered, besides ions of the nitrogen-oxygen composition. Apparently the metallic ions are of meteoric origins, since they were registered in the region of 100-120 km (62-74 mi) where small meteors are consumed. The more substantial result of the mass spectrometric measurement of neutral composition in the atmosphere was the disclosure of the gravitational division of argon and molecular nitrogen at altitudes approaching 105-110 km (65-68 mi). The establishment of that limit for all launches demonstrates that above the atmospheric level exists gravitational separation. An analogous separation between nitrogen and atomic oxygen was not detected. This indicates that the distribution of various forms of oxygen, according to the altitude, must be associated not only with Dalton's law and gravitational forces but also with complex chemical and photochemical processes.

It is important to note that in none of the measurements that had been performed were any ions of hydrogen or helium detected. Mass spectrometric investigations on rockets and on the third satellite indicated that the Earth's ionosphere, up to an altitude on the order of 1000 km (620 mi), remains a nitrogen-oxygen one and that the atomic oxygen ions are dominant. Besides this, it was indicated that at altitudes of 500 km (310 mi) a noticeable quantity of molecular ions was observed, while higher--only atomic ions were seen. Apparently above 1000 km (620 mi), the transition from a nitrogen-oxygen atmosphere to hydrogen-helium begins.

Beginning in 1954 in the Soviet Union, increased rocket investigations under the direction of K. I. Gringaus were conducted in altitudes containing electron concentrations. These were based on fixed measurements for the dispersion of radio waves radiating from the rockets taken by a dispersion interferometer proposed by Academician L. I. Mandelshtam and N. D. Papeleksi--a variant of the method of a phase-sound. Besides this, measurement of the rotation of the plane of polarization in radio waves (Farraday Effect) was used. All of these measurements were conducted simultaneously with terrestrial equipment. As a result of this effort a significant feature in the reconstruction of the ionosphere was established: an important maximum electron concentration exists in the ionosphere at altitudes on the order of 300 km (186 mi). These investigations established that an error existed in USA rocket measurements that were conducted earlier at altitudes up to 380 km (245 mi), and indicated that the electron concentration at that level approached zero. The ion trapping method, first developed in the USSR (used by the third satellite), allowed direct measurement of concentrations of positive ions in altitudes on the order of 1000 km (620 mi). It was indicated that in altitudes more than 400 km (248 mi), a significant decrease in the concentration of positive ions occurred, while at the altitude of 980 km (600 mi) the ion concentration was approximately equal to 50,000 per cm^3 if they were atomic oxygen ions.

It was also established that negative ions exist in insignificant quantities and that the ionospheric plasma basically consists of electrons and positive ions. These tests, started by K. I. Gringaus with the third satellite, were continued by him with the launching of cosmic rockets in the direction of Venus and the Moon.

As a result of the measurements conducted by three Soviet cosmic rockets with the use of traps, a great amount of experimental material was received, from which is is possible to conclude that the Earth is encircled by a very expanded and rarefied atmosphere, which consists of ionized gas. This atmosphere, in all justice, may be called an "Earth corona" or a "geo-corona." The ion concentration in a "geo-corona" is on the order of several hundred positively charged particles in a cm^3. The very character of the ion concentration, varying in accordance with distance, indicates that the "geo-corona" consists of hydrogen. It may be traced up to 20,000 km (12,400 mi). However, there is a basis to postulate that the expansion of the "geo-corona" is a varying dimension. This may depend upon many factors, chiefly upon the solar activity.

An analysis of the measurement of intensity in the electro-magnetic field of radio signals is developed in the works of L. N. Kazantsev, T. S. Romanov, and A. Ya. Klimentenko, which was of considerable assistance in answering a series of questions dealing with the factual absorption of radio waves in the ionosphere and in reaching conclusions on the dispersion of short waves at great distance. In this connection great interest is aroused by instances when it was possible to continue tracing the passage of radio signals further than through direct radio visibility.

For such evidences of super-distant propagation of radio waves, it is possible to apply the so-called antipode effect, which is the sudden rise in the amplitude of a signal at a point directly opposite to the site of its radiation. The super-distant propagation of radio waves at distances of 8-10 thousand km (4960-6200 mi) apparently indicates the presence of singular wave guide channels in the ionosphere. The study of the general ionospheric qualities is also possible through the observation of the amplitudes of radio signals only during the moment of their appearance ("radio rise") and disappearance ("radio setting"). This method, developed in the works of Ya. L. Alpert and others, permitted the evaluation of the passage of electron concentration above the main limit of the ionosphere. This method was also used in an attempt to make an approximate calculation of the motion of the concentration of neutral particles in accordance with the altitude.

On the second and third Soviet artificial satellites of the Earth, cosmic ship-satellites, and cosmic rockets, equipment was installed for the study of radiation near Earth and in cosmic space. The equipment was developed by S. N. Vernov, A. E. Chudakov, Y. I. Logachev, and P. V. Vakulov.

On the second satellite, measurements were conducted by counters of charged particles. During the satellite's flight over the territory of the Soviet Union, these measurements were performed during the straight and reverse loops. The altitudes of the satellite during the straight loops were from 225-240 km (139-155 mi), while on the reverse ones it increased from 350-700 km (215-340 mi) during the decreases in the latitudes from 65° to 40° north. Measurements at these altitudes permitted the disclosure of the dependence of the intensity in the primary cosmic radiation on the altitude and likewise on the geographical longitude and latitude.

In middle latitudes during the change of altitudes from 250-700 km (155-340 mi), the intensity of the cosmic radiation grows primarily 40%. This singularity may be variously interpreted. It is fully possible that the increase in the intensity may be produced by the decrease in the screening action of the Earth and the influence of its magnetic field, which impedes the penetration of cosmic radiation towards Earth. Likewise, it is not excluded that the increase in the intensity of the cosmic radiation is associated with the beginning of its penetration into a radiational zone.

Measurements from the second satellite included the registration of short-periodic variations (oscillations) in the intensity of cosmic radiation, which was apparently connected with the status of the interplanetary medium close to Earth. In one instance an abrupt increase of 50% was noticed in the increase of cosmic radiation particles at a time when Earth stations did not detect any noticeable change in its intensity. Possibly this occurred because of an increase in the intensity of particles of the outer radiation belt at low altitudes or because the Sun's generation of low energy cosmic rays was greatly absorbed by the Earth's atmosphere.

On the third Soviet satellite a more sensitive apparatus--scintillating register--was installed. The transmission of data from the scintillating counter was accomplished through the use of the radio transmitter Mayak, on a frequency of 20 megacycles, for a period of two years during the flight of the satellite.

The analysis of the data from the device established that for all instances, except when the satellite entered the area of the geo-magnetic latitudes of 55°-65° in the northern and southern hemispheres, there was observed a sharp increase in the intensity of X-ray radiation, which was created by electrons that bombarded the airframe of the satellite. The energy of these electrons was about 100 million electron-volts or less, and their current was rated 10^3-10^4 part./cm^2·sec·sterad. These tests also established that the radiation intensity increases with altitude. This reflects on the fact that in the zone of polar radiation, charged particles accumulate, which achieve oscillation along the force lines of the magnetic fields.

Thus tests on the third satellite definitely indicate the existence of a zone of intensive radiation, which was called the outer radiation belt around the Earth. From these circumstances, it follows that the Earth's magnetic field serves as a unique trap for charged particles of small energies, in which the particles may move along practically closed trajectories for a very long time.

At geomagnetic latitudes of more than 65°, the accumulation of particles of greater energies does not occur, and therefore the areas belonging to the magnetic belts show a freedom from that type of radiation.

Beyond the outer radiation zone around the Earth, an inner radiation zone exists, which was detected by an American scientist and which is situated in the equatorial region at an altitude of 2000 km (1240 mi). With the help of the third Soviet satellite, more detailed information has been received about that zone. Measurements indicate that during the movement of the satellite toward the equator, the radiation intensity sharply increases, notwithstanding the decrease in altitude of the satellite from 1600 to 1100 km (992-682 mi).

Latitude is the determining factor in this instance. It was shown that the charged particles of the outer zone become charged at altitudes around 1000 km (620 mi) from 35° southern geomagnetic latitude to 35° in the northern geomagnetic latitudes. The altitude of the lower limits of the outer zone appears to be varied in the eastern and western hemispheres: 1500 km (930 mi) in the eastern and 500 km (310 mi) in the western. This situation is dependent upon the displacement of the magnetic dipole relative to the center of the Earth. Analysis of the data has shown that in the outer zone the more characteristic photons have energy on the order of 100 million electron-volts.

Further study of the radiation from the outer radiation zone was continued with the flights of Soviet cosmic rockets. Measurements were made at distances of 8-150 thousand km (4.9-93 thousand mi) from the center of the Earth. As a result, the space disposition of the outer zone was determined, and the composition of the radiation in the outer zone was studied in greater detail.

Comparison of the readings from all devices installed on the first cosmic rocket leads to the conclusion that the maximum of the intensity is attained at a distance of 26,000 km (16,155 mi) from the Earth's center. At a distance of 55,000 km (34,000 mi), the radiation intensity is practically equivalent to zero (in relation to the background of constant radiation). Besides its dependence upon distance, the intensity of radiation is essentially determined by the magnetic force line upon which the measurement is being conducted. It was established that the flow of particles was not directed in one course because they achieved oscillation along magnetic force lines from one hemisphere to the other, experiencing full charging upon their approach to Earth.

Similarly, according to data from the first cosmic rocket, the outer zone is situated in the area between the magnetic force lines with L = 3 and L = 9, when L is the distance from the top of the force lines in the equatorial plane to the Earth's center, expressed as radii of the Earth, R_0 = 6371 km (3900 mi). The maximum intensity is seen on the force line with L = 4.5.

The second cosmic rocket carried assorted apparatus which enabled greater research to be conducted along the outer zone, as well as observations along the detected radiation belts around the Moon.

As is known, the maximum radiation of the outer zone on 2 January 1959 was observed at a distance of 26,000 km (16,155 mi) on the force line of L = 4.5. On the 12th of September, the maximum was observed at a distance of 17,000 km (10,540 mi) from the Earth's center on the force line of L = 3.5. The reasons for this condition may be varied. First, there is the difference in the distribution of the trajectories of 2 January and 12 September in relation to the direction toward the Sun; this could create a noticeable deformation of the magnetic field of the Earth. Second, the deformation of the field could have been caused by the varying character of corpuscular currents. And finally, the changing character of the injection of the particles into a radiation zone could have caused the deformation.

Results from the measurement of the composition of particles in the outer belt, by the second cosmic rocket, re-affirm the data from the first cosmic rocket, in that the particles in excess of one cm of aluminum are soon absent from the outer radiation belt. Essentially new data were received from readings of gaseous-charged counters placed inside a container and screened supplementary filters of copper and lead. Both counters registered photons with energies more than 400 million electron-volts. Analysis of the readings of the gaseous-charged counters produces the conclusion that electrons with energy on the order of a million electron-volts, when the current is $\sim 10^6$ cm^{-2}, exist in the outer belt.

One of the most important tasks of the cosmic rocket launched 12 September 1959 was the attempt to discover the radiation belts around the Moon. The received data was negative: in the flight to the Moon, up to a distance of 100 km (62 mi) from its surface, there was no increase seen in the radiation intensity in the limits of 10% from the cosmic background. By this method it was possible to deduce that no lunar radiation belt exists for all practical purposes.

Under the supervision of V. I. Krasovski, measurements for intensity of soft corpuscular radiation in the upper atmosphere were conducted with the third satellite. These observations were accomplished by means of luminescent counters covered with thin foils, admitting the radiation from a narrow, solid angle. At altitudes of 1500-1800 km (930-1100 mi) in the southern hemisphere, the first discoveries of strong currents of electrons with energies around 10 million electron-volts were made. An analysis of the distribution of directional speeds of these electrons in the magnetic field led to the conclusion that the suppressed portion of the registered radiation was captured by the Earth's magnetic field. It was also shown that at this time the chief current of electrons from those altitudes invades the suppressive atmospheric layer, at altitudes of 100-300 km (62-186 mi).

Essentially new results in the study of cosmic rays, obtained during the flights of the second and third ship-satellites, were processed by groups of scientific workers under the leadership of I. A. Savenko and L. V. Kurnosov.

Observations from the ship-satellites produced detailed measurements of the intensity of cosmic radiation for all longitudes and latitudes, at altitudes of 200-300 km (124-186 mi), and gave the possibility of making the first maps of the planetary distribution of cosmic radiation--to investigate in detail the limits of radiation belts and detect the anomaly in the distribution of cosmic radiation; and to construct the geomagnetic equator in accordance with the minimum in intensity of cosmic rays.

Having made a detailed map of the distribution zone of increased radiation in the northern and southern hemispheres of the Earth, from the obtained experimental data, I. A. Savenko graphically proved that the geographic limits of these zones coincide with lines of specular points for particles captured by the Earth's magnetic poles. In this manner it was established that the radiation intensity in the northern hemisphere is synonymously connected with the radiation intensity in the southern hemisphere by strong lines of the geomagnetic field.

Comparison of the scintillating counter and the Geiger counter indicated that the registered increased radiation intensity at the larger latitudes was explained by the electrons, with energies on the order of 100 million electron-volts. Having received detailed information on the distribution of the intensity of particles in the outer radiation belt for all lengths, it was possible to evaluate the speed of the "straying" electrons from the outer belt, and likewise, to essentially clarify the mechanics of its creation.

The establishment of strict borders for the outer radiation belt and its association with the characteristics of the geomagnetic field led to the substantiation of a very important allegation--that the discovered anomalous increase in the radiation intensity, in the region of the Southern-Atlantic anomaly described by I. A. Savenko, L. V. Kurnosova, and S. L. Mandelshtam, is associated with the particles of the outer radiation belt. It descends to an altitude of 250-300 km (155-186 mi) in that area, according to measurements taken by the second and third cosmic ship-satellites.

Through a detailed analysis of the recordings of the various gauges, it was established that the nature of radiation in various sectors of the zone with a high anomalous radiation level is distinctive, in that protons are dominant closer to the equator while electrons are dominant at a greater distance.

A very interesting result was the detection of a weak penetrating radiation in the equatorial regions, which is treated as intensive currents of electrons with energies on the order of 10^4 electron-volts. As pointed out earlier by V. I. Krasovski, similar particles were detected at altitudes of 1500-1800 km (930-1100 mi) by the third satellite. Electrons registered by this means cannot be spontaneous solar corpuscles. It is more reasonable to suppose that they are directed toward the atmospheric electrons and are accelerated in the outer atmosphere because of the transformed geomagnetic fields.

Using the apparatus developed under the leadership of L. V. Kurnsov, it was possible to ascertain the spatial distribution of radiation intensity in the region of the Southern-Atlantic anomaly, as well as the instability of the limits of outer radiation belts of the Earth descending in the polar regions to an altitude of 200-300 km (124-186 mi). Through investigations by the second and third cosmic ship-satellites, it was shown that the radiation intensity at altitudes of 190-340 km (115-210 mi) is several times greater than the intensity of cosmic radiation over the entire surface of the Earth within the limits of latitudes from -65° to +65°.

K. I. Gringaus and his co-workers achieved considerable results in the investigation of interplanetary plasma with cosmic rockets. Using three electron traps for charged particles, an immediate registration of the currents of charged particles with comparatively low energies was initially accomplished. The registration of solar corpuscular currents was principally a new result. They were primarily registered by traps, at distances exceeding 200,000 km (124,000 mi) from Earth on 13 September 1959, during the flight of the third cosmic rocket; and in February 1961 at a distance around 2 million km (1,240,000 mi), during the flight of the automatic interplanetary station launched towards Venus. The greatest observed solar corpuscular current, on the order of 10^9 part./$cm^2 \cdot$sec, was registered 17 February 1961, at a distance of around two million km (1,240,000 mi). On Earth a magnetic storm was observed at this time.

The investigation of interplanetary plasma, through the use of traps, permitted an evaluation of its density. It became clear that the "stationary" ionized gas in interplanetary space was very rare, and that its density did not exceed several particles per cm^3. Besides this, it was shown that the constant "solar wind" with noticeable currents of particles does not exist in interplanetary space.

A more substantial result, obtained by K. I. Gringaus, was the discovery of electron currents with energies exceeding 200 electron-volts, and a density flow on the order of 10^8 part./cm^2.sec at a distance of 45-80 thousand km (24,800-49,600 mi) from the Earth's surface. These currents indicate the existence of an independent outer belt of charged particles surrounding the Earth, which consists of particles of comparatively low energies.

During the flights of the first and second cosmic rockets, the first careful measurements were made of the intensity of primary cosmic radiation beyond the outer limits of the Earth's radiation belt, where the Earth's magnetic field does not indicate a substantial influence. As a result of these measurements, it was established that the current of the primary cosmic radiation constitutes 2.3 ± 0.1 part./$cm^2 \cdot$sec, while the photon current of high energy is very small.

The distribution of primary cosmic radiation on Earth is dependent upon the influence of the geomagnetic field on the primary particles of cosmic rays. This influence is determined by the character of the field at distances on the order of an Earth radius from the surface of the Earth.

The investigation of the geomagnetic equator, according to the minimum of the intensity of cosmic rays, was blessed by much effort, inasmuch as this method would produce valuable evidence of the nature of the Earth's magnetic field at great distances from Earth. The experimental difficulty in the investigation of this problem rested on the necessity of creating similar conditions at numerous points on Earth, for the measurement of the intensity distribution of cosmic rays along meridians. It was likewise necessary to conduct all measurements simultaneously, or at least within a very brief interval of time.

Beginning in 1951, the efforts of many researchers produced the value for the minimum in intensity of cosmic rays at 21 terrestrial points. These measurements were conducted by numerous methods, under various conditions, and during various times during a ten-year period. Therefore in a series of instances, notwithstanding the statistical accuracy in measurements conducted by individual authors, their measurements did not agree with each other and failed to make the location of the geomagnetic equator more precise.

The measurements of I. A. Savenko, based upon the second and third cosmic ships, led to the receipt of data on the minimum in intensity of cosmic rays practically at the same time (in a period of a day) for twenty two geographic points on Earth, and with great statistical accuracy carefully established the geographic position of the geomagnetic equator in 1960.

Studies conducted by L. V. Kurnosov with Soviet artificial satellites, cosmic rockets, and ship-satellites produced interesting information concerning the atomic components of cosmic rays.

First, measurements of the nuclear spectrum, according to charges in the absence of matter, were made above the apparatus.

Analysis of the data indicated that the propagation of the nuclei of lithium, beryllium, and boron is comparatively large and constitutes 50%, for example, in comparison with the more heavier nuclei in cosmic rays. The combination of data received at the present time gives a basis to confirm that sources of cosmic rays are distributed sufficiently distant, while the nuclei of the middle groups are dependent upon the processes of disorganization of the more heavy nuclei which have a completely secondary origin. Observation of the lesser current of super-heavy nuclei ($Z \geq 30$) likewise upholds that viewpoint. It would be extremely interesting to give a more accurate evaluation of the significance of the current of super-heavy nuclei to determine the straying period of cosmic rays in cosmic space, inasmuch as this could be the key to the understanding of the mechanism of the origin of cosmic rays.

At the present time the question still exists concerning the variations in the cosmic ray components.

In tests conducted by L. V. Kurnosov on 12 September 1959, discovery was made of a short-life growth of nuclei S $Z \geq 15$ and ≥ 2 correlated with chromospheric flares and splashes of radiation on the Sun. These facts indicate an existence on the Sun of a mechanism for the acceleration of heavy nuclei up to energies of 10^{10} electron-volts.

The direction, in the future, of that type of evidence will produce the complete story of the acceleration of nuclei to relativistic velocities and will solve the riddle of a series of mechanisms in the generation of solar cosmic radiation. Obviously, it is possible to predict the existence of several assorted mechanisms on the Sun for the acceleration of particles. The Sun serves also as a source of nuclei at the same time that they are leaving it in compact groups. Apparently the mediums of these mechanisms are such that mainly only heavy nuclei ($Z \geq 15$) accelerate.

Energetic spectrums of nuclei, measured by the latitudinal effect, appear identical for various groups of nuclei. This agrees with the over-all view of the origin of cosmic rays during flares of super-new stars.

During the ascent of the geophysical rockets in various periods of solar activity, observations were made of the variation in cosmic rays with instruments developed in the Yakutsk affiliate of the Siberian Branch of the Academy of Sciences USSR, under the direction of Y. G. Shafer. These studies indicated that the intensity of cosmic radiation increased 10% during a decrease of solar activity during the period 1958-1960.

The beginning of magnetic studies in cosmic space was initiated with the measurement of the magnetic field close to Earth by the third Soviet artificial satellite, under the leadership of N. V. Pushkov and S. Sh. Dolginov. These measurements led to the determination of the degree of conformity among various magnetic charts, for the actual distribution of the field over an enlarged portion of the territory of USSR.

A comparison of the values received for the geomagnetic field intensities with the values of the intensities calculated on the basis of the co-efficients of disintegration of the geomagnetic potential in a series of spherical harmonics led to the establishment of their conformity within the limits of 0.1 - 1% over the greater portion of the USSR territory, including the Siberian quiet magnetic anomaly. The differences between measured and calculated values of the field carry a systematic character and a constant indication.

Similarly, it was established that within higher stated limits (0.1-1%), the field at flight altitudes of the third artificial satellite [230-800 km (144-490 mi)] is determined by the distribution of the field on the surface of the Earth.

The difference between the measured and calculated values for the field, in the near-vicinity of the Earth, could be compared with the measurement results from the geomagnetic field, at great distances from Earth, from 2 to 10 Earth deg. Such studies were made during the flights of the first and second Soviet cosmic rockets.

Studies from the first cosmic rocket were made on 2 January 1959, during the time of a weak although quiet magnetic storm with a characteristic sudden onslaught. The comparison between the measured and calculated values of the field, during the portion of the flight [15,000-30,000 km (9300-18,600 mi)] from the center of the Earth, uncovered a considerable separation between experimental and theoretical curves.

Besides this, at distances of 19-22 thousand km (12-14 thousand mi) from the center of the Earth, an area was detected where variation in the field essentially differed from space changes which were theoretically obtained.

Comparatively rapid changes in the field at these distances afforded the assumption that the source of the disturbance was near. This source was naturally associated with the disturbed state of the outer zone of radiation, which does not have a large spatial heterogeneity for such distances.

During the flight of the second cosmic rocket on 12 September 1959, magnetic measurements were made during a magnetically quiet day. The rocket passed the outer radiation zone, on the night-side of the Earth, at distances of 18-95 thousand km (11-59 thousand mi) from its center.

The comparison indicated that the measured and calculated values of the field at distances of 28-50 thousand km (18-30 thousand mi) practically do not separate; while at closer distances the measured values appeared less than the calculated ones. At distances of 18 thousand km (11,000 mi), the difference was 8% of the value of the field at that location. This significantly exceeds the difference between measured and calculated values of the field at low altitudes in the immediate vicinity of the Earth, as established through the measurements taken by the third artificial satellite of the Earth. At distances of 55-95 thousand km (34-59 thousand mi), measured values of the field appeared to be greater than the calculated ones.

Experimental data received from the first and second cosmic rockets on magnetically quiet and stormy days permitted the expression of the assumption that the observed effects are results of the influence of exterior sources of the magnetic field; and within the region of magnetosphere of the Earth, from 2 to 3.5 Earth deg are especially magnetically active.

The flight of the second Soviet cosmic rocket led to magnetic investigations in the immediate vicinity of the Moon. A noticeable magnetic field of the Moon was not detected. The aggregate of experimental data, received at distances constituting the length of the radius from the Moon's surface, indicated that the effective magnetic moment of the Moon may be less than 1/1000 from the magnetic moment of the Earth. During the flight of the automatic interplanetary station to Venus, an opportunity was presented to complete the magnetic measurements in the distant reaches of the geomagnetic field 165-175 thousand km (105,000-110,000 mi), and in interplanetary space 1.9 million km (1.2 million mi) from Earth. These measurements presented some evidence of the nature of the field beyond the geomagnetic field and the singularities of the mechanism for the formation of the magnetic disturbances.

As in known, the short wave radiation of the Sun is completely absorbed in the mass of the Earth's atmosphere and does not attain the Earth's surface. Study of this radiation seemed possible only in the past years with instruments placed in geophysical rockets and satellites. The study was conducted under the leadership of S. L. Mandelshtam, A. I. Efremov, and V. K. Prokofev. Using the apparatus developed under the leadership of S. L. Mandelshtam in a series of tests on geophysical rockets and ship-satellites, the "border" of the solar spectrum was investigated. It was established that the solar radiation spreads into the short wave direction up to long waves on the order of 3-4 Å (1Å = 1.10^{-8} cm), that is, into the region of soft x-rays. The energy emanating from the Sun is comparatively slight in this spectral region. According to measurement data, the energy penetrating the spectral region shorter than 10 Å is composed of 1.10^{-4} - 1.10^{-3} erg/sec per cm^3 at the border of the atmosphere. However, this radiation penetrates into the Earth's atmosphere quite deeply--to altitudes on the order of 80 km (50 mi), and apparently exerts an important influence on the ionization of the Earth's atmosphere at these altitudes.

X-ray radiation descends with the solar corona--with tenuous gases which surround the Sun and are found when the temperature attains 1-2 million degrees. Measurements which were completed by geophysical rockets, during a period when the Sun was in a complete eclipse on 15 February 1960, indicated that during the time when the solar disk was covered by the Moon, the Sun's x-ray radiation did not disappear but only weakened proportionally to the remaining open area of the inner corona.

Using apparatus developed under the leadership of A. I. Efremov and installed on the second ship-satellite, it became possible to register a solar flare at a time when the "border" of the spectrum traveled into a more intensive short wave direction--up to 1-2 Å, while the radiation intensity in an area shorter than 10 Å increased 11 times. This effect may be interpreted as a temperature increase in the coronal region, where the flare occurred as being up to 7-8 million degrees. During this activity the radiation current in a more long wave region of the spectrum (44-110 Å) almost did not change.

Investigations under the leadership of V. K. Prokofev were crowned by the measurements of the intensity of the spectral lines of ions of helium with long waves of 304 Å. This radiation penetrates into the Sun's chromosphere, and the measurement of the of the radiation intensity of helium can lead to the procurement of evidence of physical processes occurring in the Sun's chromosphere as well as its structure.

Beginning in 1956 in the Soviet Union, investigations of meteoric matter were started with direct methods, using apparatus installed first on geophysical rockets and then on artificial satellites. These studies were accomplished by the collective efforts of co-workers under the leadership of T. N. Nazarov.

Theoretical studies, according to the interpretation of experimental data, were conducted by K. P. Staniukovich and Academician M. A. Lavrentev.

Based upon measurements from geophysical rockets, the third artificial satellite of the Earth, and cosmic rockets, a possible theory can be assumed that the Earth is surrounded by a dust cloud situated at altitudes 100-300 km (62-186 mi) over its surface.

On the basis of direct experiments, it is also possible to conclude that the density of meteoric matter surrounding the Earth is not stable. Experiments conducted various times at altitudes of 100-300 km (62-186 mi) demonstrated that the frequency of hits apparently does not surpass 10-15 times. At that time, great variations were observed at altitudes of 400-2000 km (248-1240 mi).

On 15 May 1958, the apparatus on board the third artificial satellite of the Earth registered from 4 to 11 hits per 1 m^2/sec, while on May 16 and 17 the current decreased, for example, 10,000 times.

The explanation for the existence of the dust cloud around the Earth is presently the subject of many hypotheses, both in the USSR and abroad. In accordance with the hypothesis of V. I. Moros, a singular class of interplanetary particles exists which has a comparatively unstable structure. These particles, according to his proposal, are divided at altitudes of several hundred km above the Earth and produce a visible increase in the concentration of dust near it.

E. L. Ruskol proposes that as a result of the collision of meteoric bodies in the vicinity of Earth, particles might be fashioned and then entrapped within closed orbits of the Earth. As a result of an extended period of such a process, it is possible that a visible increase in the concentration of dust particles could occur in the vicinity of the Earth.

So far none of the hypotheses explaining the presence of an increased density of meteoric particles near Earth, as offered by both Soviet and foreign scientists, are acceptable as final. For a well-defined answer to this question, it will be necessary to obtain new experimental data concerning the density of meteoric matter in cosmic space--its physical and chemical properties.

However, at the present time, it is already possible to conclude that the meteoric density during cosmic flights is not as great as earlier proposed.

The circle of observations conducted on artificial satellites of the Earth and cosmic rockets indicates that cosmic physics will become a self-supporting science. This indicates that in the USSR a large group of scientists is developing, who are devoting their creative skills to develop this science. Such studies have become possible because of the tremendous labors of the countless groups of Soviet constructors, engineers, and laborers who have furnished our scientists with all of the requirements in conducting a study of cosmic space. (Source: Priroda (Nature), No. 1, 1963)

REPORT ON COSPAR

The 4th annual meeting of the Committee on Space Research (COSPAR), a unit of the International Council of Scientific Unions, was held in Warsaw, Poland, June 3-12. The countries represented were Argentina, Australia, Austria, Belgium, Brazil, Canada, Czechoslovakia, Denmark, Finland, France, German Democratic Republic, German Federal Republic, Greece, Hungary, India, Iran, Israel, Italy, Japan, Mexico, Netherlands, Norway, Pakistan, Poland, South Africa, Sweden, Switzerland, United Kingdom, USA, and USSR. The committee began its session with a report from each member nation on its national space research activities during 1962.

Prof. Anatoly Blagonravov, head of the Department of Technical Sciences at the USSR Academy, announced Soviet intentions to launch an unspecified number of spacemen this year. This is the first specific indication of Russian manned space flight since the double flight of Nikolayev and Popovich last August. Blagonravov told the session that two unmanned shots toward Venus and Mars and more launchings of small space satellites will be undertaken during 1963.

Blagonravov also released the first measurement data from the Cosmos satellite series and gave some details of the twin flights last August. This was noted as the most specific disclosure by the Soviets to date.

The chief American delegate, Professor Richard W. Porter, appealed to the session for international cooperation in the 3 fields of space research: communications, meteorology, and magnetic measurements. Porter said that 21 space flights were planned by the US this year, compared with the 19 satellites and space probes in 1964.

Blagonravov announced that 71 rockets and 12 sputniks had been launched by the USSR in 1962. He also acknowledged that radio contact with the Soviet Mars 1 space probe had been lost because of a defect in the satellite's orientation system.

S. V. Vernov, a Soviet expert on cosmic rays, reported that the intensity of the cosmic ray--extremely high-energy particles that are shot from the Sun and similar stars in other galaxies--bombardment of the Earth from other solar systems has doubled in the last five years. At the same time, those from the Sun have been decreasing.

Knowledge of how and why these particles are produced is of importance not only for an understanding of the universe but also for the safety of interplanetary travel. The particles have an effect on the human body similar to atomic radiation.

Blagonravov reported that the lack of a solution to the problem of shielding space travelers still barred manned flights to the Moon and other planets. But both Soviet and US scientists concluded that radiation in space presented no insurmountable barrier to an early manned flight to the Moon.

Contraverting US findings that the Moon is covered with a blanket of dust from 101.6 mm (4 in.) to 0.91 m (3 ft) thick, a Soviet scientist announced to the session that the Moon is covered with a slag-like material. V. V. Sharnov said that the presence of slag is confirmed by the analysis of radio astronomical observations.

Speculating on the surface of other planets, Sharnov said that Mercury's surface is similar to that of the Moon and that Mars is mostly covered with dust.

The following articles were scheduled for delivery at the COSPAR symposium. Copies can be obtained through the NASA library, 876-8386.

UPPER ATMOSPHERE (MOSTLY BELOW 100 KM)

ARKING, A.: Percentage cloud cover from Tiros photographs. (USA)

RAHMATULLAH, M.: Some aspects of stratospheric circulation derived from meteorological rocket firings over the USA during winter 1961. (Pakistan)

GROVES, G. V.: Meteorological and atmospheric structure studies with grenade. (UK)

BLAMONT, J. E.: Mesure de la température de l'atmosphère de 100 à 200 km au moyen de nuages de potassium. (France)

BLAMONT, J. E.: Mesure de la température de l'atmosphère par fluorescence de A10 (100-200 km). (France)

ROSENBERG, N. W., EDWARDS, H. D., WRIGHT, J. W.: Ionospheric winds: motions into night and E_s correlations. (USA)

BLAMONT, J. E.: Mesures simultanées de vents (100-150 km) en différents points du Globe. (France)

BLAMONT, J. E.: Turbulence entre 90 et 100 km. (France)

du CASTEL, F., REVAH, I., SPIZZICHINO, A.: Sur les cisaillements de vents dans la basse ionosphère. (France)

LINK, F.: Sur la couche absorbante élevée de la Terre. (Czechoslovakia)

DUNKELMAN, L.: Visual observations of the atmosphere from US manned spacecraft in 1962. (USA)

UPPER ATMOSPHERE (MOSTLY ABOVE 100 KM)

WITT, G., HEMINWAY, C., SOBERMAN, R.: Collection and analysis of particles from the mesopause. (Sweden/USA)

SCHAEFER, E., NICHOLS, M.: Recent results obtained from a rocket-borne mass spectrometer. (USA)

MAROV, M. Ya.: Density of upper atmosphere in the drag of the "Cosmos-3" and "Cosmos-5" satellites. (USSR)

ROEMER, M.: Exospheric densities deduced from satellite drag data. (Germany)

JACCHIA, L. G., SLOWEY, J.: Correlations between geomagnetic and atmospheric disturbances from the drag of the Explorer IX satellite. (USA)

PAETZOLD, H. K.: New results about the annual and semi-annual variation of the upper terrestrial atmosphere. (Germany)

KALLMANN-BIJL, H. E., SIBLEY, W. L.: Diurnal variation of temperature and particle density between 100 km and 500 km. (USA)

NICOLET, M.: Variation of solar radio emissions and of thermopause temperature. (Belgium)

GODART, M., NICOLET, M.: Diurnal variation of atomic hydrogen in the upper atmosphere. (Belgium)

KOCKARTS, G., NICOLET, M.: Atomic hydrogen and low temperatures at the thermopause level. (Belgium)

DONAHUE, T. M.: Scattering of Lyman α and 01 (1300) in the upper atmosphere. (USA)

IONOSPHERE (MOSTLY D- AND E-REGIONS)

NICOLET, M., SWIDER, W.: Ionospheric reactions and behavior of positive ions. (Belgium)

AIKIN, A. C., KANE, J. A.: The determination of the origin of the D-Region by rocket experiments. (USA)

HALL, J. E.: Electron densities in the D-Region deduced from rocket measurements. (UK)

JOHNSON, D., KAVADAS, A.: The presence and measurement of electric fields and electron densities within an auroral display. (Canada)

SAGALYN, R., SMIDDY, M.: Rocket investigation of the electrical structure of the lower ionosphere. (USA)

KAISER, T. R.: Some theoretical considerations concerning radio-frequency impedance probes. (UK)

BARNES, R. A., GOLOMB, D., ROSENBERG, N. W., WRIGHT, J. W.: Formation of an electron depleted region in the ionosphere by chemical releases. (USA)

LISZKA, L.: A study of ionospheric irregularities using satellite transmissions at 54 Mc/S. (Sweden)

NAKATA, Y., NEMUGAKI, R.: Some results of radio observation of Courier 1B. (Japan)

KOKOURYN, You. L.: Results of radioastronomical research of the inhomogenities of the ionosphere structure. (USSR)

IONOSPHERE (MOSTLY F-REGION AND ABOVE)

MOLOZZI, A. R.: Instrumentation of the ionospheric sounder contained in the satellite 1962 Beta Alpha (Alouette). (Canada)

NELMS, G. L.: Some ionospheric results from the topside sounder satellite, 1962 Beta Alpha One (Alouette). (Canada)

KING, J. W., LUSCOMBE, G. W., SMITH, P. A., LYTH, J., HELM, H.: The structure of the Top-Side ionosphere as deduced from ionograms obtained with the Alouette satellite. (UK)

ALPERT, Ya. L.: Results of the radio-research of the ionosphere using "Cosmos" artificial satellites. (USSR)

SHARP, G. W., HANSON, W. B., McKIBBIN, D. D.: Some ionospheric measurements with satellite-borne ion traps. (USA)

BOWEN, P. J., BOYD, R. L. F., HENDERSON, C. L., RAITT, W. J., WILLMORE, A. P.: Ionospheric results using Langmuir probes in the "Ariel 1" satellite. (UK)

GRINGAUS, K. I., GOROZHANKIN, B. N., SHUTTE, N. M., GDALEVITCH, G. L.: Measurements of the variation of the charged vertical distribution and the ion structure in the external ionosphere since the maximum solar activities after the data received from the "Cosmos" ion traps. (USSR)

ROTHWELL, P. (Miss), SAYERS, J.: Magnetic field aligned structure of ionosation density in the topside ionosphere: Direct measurements from satellite Ariel 1. (UK)

RAWER, K.: Scientific uses of "Trailer-Satellites". (Germany)

VASSY, E.: Sur la détermination du contenu total d'électrons de l'ionosphère à l'aide de satellites artificiels. (France)

SOMAYAJULU, Y. V., TYAGI, T. R., BHATNAGAR, V. P.: Ionospheric electron content and its variations from Faraday fading of satellite radio signals. (India)

SCHMELOVSKY, K. H.: Plasma temperatures and recombination processes in the outer ionosphere. (Germany)

MAGNETOSPHERE (EXPERIMENTAL RESULTS)

GALPERIN, You. I., KRASOVSKI, V. I.: Methods of corpuscular studies using the "Cosmos-3" and "Cosmos-5" satellites. (USSR)

GALPERIN, You. I., TEMNY, V. V.: Stable corpuscles in exosphere after the data received from the "Cosmos-3" and "Cosmos-5" satellites. (USSR)

BOLJUNOVA, A. D., GEORGIO, N. V., MOULARCHIK, T. M.: Sporadic corpuscles in ionosphere and exosphere after the data received from the "Cosmos-3" and "Cosmos-5" satellites. (USSR)

SEWARD, F. D., KORNBLUM, H. N., GILBERT, F. C.: Near-Earth charged particle fluxes measured with polar orbiting satellites. (USA)

FRANK, L. A., FREEMAN, J. W., Jr., VAN ALLEN, J. A.: Recent observations of the electron fluxes in the vicinity of the Earth's outer magnetosphere. (USA)

McDIARMID, I. B., BURROWS, J. R., BUDZINSKI, E. E., ROSE, D. C.: High latitude particle flux measurements from the satellite 1962 Beta Alpha (Alouette). (Canada)

GRINGAUS, K. I., BESROUKIH, V. V., RYBTCHINSKI, P. E., SHERONOVA, S. M. (BALANDINA): Measurements made in the Earth's magnetosphere using the traps of charged particles at the "Mars-I" station. (USSR)

REID, G. C.: The effect of magnetic storms on the radial distribution of magnetically trapped particles. (USA)

WALT, M., CRANE, G. E.: Analysis of atmospheric scattering loss rates for geomagnetically trapped electrons. (USA)

CAHILL, L. J., Jr.: Studies of the boundary of the magnetosphere. (USA)

McILWAIN, C. E., PIZELLA, G.: On the energy spectrum of protons trapped in the Earth's inner Van Allen zone. (USA/Italy)

MAGNETOSPHERE (EXPERIMENTAL RESULTS CONTINUED AND THEORY)

FILZ, R., YAGODA, H.: Observations on trapped protons in emulsions recovered from satellite orbits. (USA)

KATZ, L., SMART, D.: Satellite observations of trapped radiation injected by nuclear detonations. (USA)

MANCZARSKI, S.: Some new results of sounding of the exosphere. (Poland)

KNUTH, R., LAUTER, E. A.: Effects of trapped particles in lower ionosphere at medium latitudes. (Germany)

ALFVEN, H.: On the hydromagnetics of the magnetosphere. (Sweden)

SINGER, S. F.: Recent results on trapped radiation in light of the neutron Albedo theory. (USA)

ADAM, N. V., BENKOVA, N. V., ORLOV, V. P., OSIPOV, N. K., TIURMINA, Z. O.: Calculated magnetic field of the Earth. (USSR)

SCHATZMAN, E.: Sur les changements de période de rotation de la Terre. (France)

SOLAR RADIATION

TOUSEY, R., PURCELL, J. D., AUSTIN, W. E., GARRETT, D. L., WIDING, K. G.: New photographic spectra of the Sun in the extreme ultraviolet. (USA)

NEUPERT, W. M.: Emission of extreme ultraviolet radiation from solar centers of activity. (USA)

LINDSAY, J. C., NEUPERT, W. M., BEHRING, W. E.: The solar spectrum from 50 A to 400 A. (USA)

POUNDS, K. A.: Solar X-radiation in the wavelength band 3-18A. (UK)

CHUBB, T. A., FRIEDMAN, H., KREPLIN, R. W.: Spectrum of solar X-ray emission from 2-20 Kev during subflare activity. (USA)

ELWERT, G.: Relations between the solar X-ray and particle emission. (Germany)

SVESTKA, Z.: Spectral anomalies associated with the extraordinary X-ray emission recorded by the SR-1 satellite on August 7, 1960. (Czechoslovakia)

WHITE, W. A.: Solar X-ray microflares and quiet Sun radiation. (USA)

INTERPLANETARY MEDIUM

GAJEWSKI, R.: Alfvén waves in dipole magnetic field. (Poland)

IOSHPA, B. A., MOGILEVSKY, E. L., OBRIDKO, B. N.: Observations of the free of force magnetic field on the Sun and the questions of generation of corpuscular geoeffective streams. (USSR)

SCHERB, F.: Velocity distributions of the interplanetary plasma detected by Explorer 10. (USA)

PATTERSON, T. N. L., JOHNSON, F. S., HANSON, W. B.: The distribution of interplanetary hydrogen. (USA)

KAISER, T. R.: The distribution of interplanetary particles. (UK)

BRANDT, J. C.: On the interplanetary gas exterior to the orbit of Earth. (USA)

MOGILEVSKY, E. I.: Interdependence of solar corpuscular streams and the magnetosphere and the ionosphere of the Earth. (USSR)

OBAYASHI, T.: Interaction of solar plasma streams with the outer geomagnetic field. (Japan)

GORGOLEWSKI, S.: Some results of the Polish radioastronomical investigations from the point of view of space radiocommunication. (Poland)

D'AIUTOLO, C. T.: Review of meteoroid environment based on results from Explorer 13 and Explorer 16 satellites. (USA)

SHELTON, R. D.: Factors influencing the rate of meteoroid impact on a satellite. (USA)

PLANETS AND GALACTIC RADIATION

LILLEY, A.E., BARRETT, A. H.: Preliminary results of the Mariner II microwave radiometer experiment. (USA)

KOUZMYN, A. D.: Radioastronomical research of Venus. (USSR)

RZHYGÁ, O. N.: Research of the planets Venus and Mars by a radar method. (USSR)

WALKER, J. C. G., JASTROW, R.: The temperature of the exospheres of the planets. (USA)

IATSENKO: Ionosphere of Venus. (USSR)

HADDOCK, F. T., SCHULTE, H. F., WALSH, D.: Cosmic radio intensities at 1.2 and 2.0 Mc/s measured at an altitude of 1700 kilometers. (USA)

HAYAKAWA, S., MATSUOKA, M.: Possible mechanisms of galactic X-ray emission. (Japan)

HYKOLSKI, G. M.: Star coronas and their study in the field of X-rays and extreme ultraviolet. (USSR)

ARNOLD, K.: A method for the determination of the gravity-field of the Earth by satellites. (Germany)

HIGH ENERGY PARTICLES

DURNEY, A. C., ELLIOT, H., HYNDS, R. J., QUENBY, J. J.: Energetic particle results from Ariel. (UK)

POMERANTZ, M. A., DUGGAL, S. P., WHITTEN, L.: Spectrum of heavy nuclei in the primary cosmic radiation. (USA)

MANZANO, J. R., CARDOSO, J. M., GHIELMETTI, H. S., ROEDERER, J. G.: The anisotropy of galactic radiation in space during geomagnetic disturbances. (Argentina)

ROEDERER, J. G., CARDOSO, J. M., GHIELMETTI, H. S.: On the fine structure of high energy solar particle injections. (Argentina)

GHIELMETTI, H. S., GODEL, A., ROEDERER, J. G.: High altitude measurements of cosmic ray intensity over Argentina. (Argentina)

ANDERSON, KINSEY A.: Solar cosmic ray events during late August 1957. (USA)

BOCLET, D., DUCROS, G. et LABEYRIE, J.: Sur la spectroscopie du rayonnement Gamma dens la haute atmosphère (Expérience en fusée). (France)

TERRESTRIAL LIFE IN SPACE

GREENE, V. W.: Research to determine the existence and identity of viable microorganisms in the stratosphere. (USA)

GORDON, A.: Gravity and plant development: speculations and bases for experiment. (USA)

VORONOV, G. T.: Low temperatures and life. (USSR)

WELCH, E.: Physiologic requirements in relation to manned space missions. (USA)

ADEY, W.: Effects of gravity on the functions of the central nervous system. (USA)

GRAVELINE, D.: Cardiovascular deconditioning: role of blood volume and sympathetic neurohormones. (USA)

NEUMAN, F.: Calcium metabolism under conditions of weightlessness. (USA)

FEDOROV, N. M.: Radiation in outer space and life. (USSR)

LANGHAM, H.: Some radiobiological aspects of early manned space flight. (USA)

SAKSONOV, P. P., ANTIPOV, V. V.: Effect of space radiation on the Earth's forms of life. (USSR)

MYERS, J.: Use of algae for support of the human in space. (USA)

HAUTY, T.: Human reliability and confinement. (USA)

SCHER, S., PACKER, E., AND SAGAN, C.: Biological contamination of Mars: survival and growth of terrestrial microorganisms in simulated Martian environments. (USA)

BRUCH, C. W.: Some biological and physical factors in dry heat sterilization: a general review. (USA)

SILVERMAN, G.: Exposure of microorganisms to simulated extraterrestrial space ecology. (USA)

OPFELL, J.: A general review of chemical sterilization in space research. (USA)

JAFFEE, L. D.: Problems in sterilization of unmanned space vehicles. (USA)

TREXLER, P. C.: Gnotobiotic techniques and their application to spacecraft fabrication. (USA)

EXTRATERRESTRIAL BIOLOGY AND ORGANIC CHEMISTRY METHODS FOR THE DETECTION OF EXTRATERRESTRIAL LIFE

KUIPER, G. P. AND JASTROW, R.: (Title of papers not yet available) Current state of knowledge of Mars and Venus. (USA)

IMSHENETSKI, A. A.: Outer space and life. (USSR)

SAGAN, C.: Extraterrestrial life: a critical review. (USA)

BRIGGS, M.: Organic constituents of carbonaceous chondrites. (USA)

MIYAMOTO, S.: Observational study on the general circulation of Martian atmosphere. Cloud observation during the 1963 opposition. (Japan)

SHOEMAKER, E. M.: Analysis of the lunar terrain. (USA)

KOZIEL, K.: Crater Mösting A as a first order point of triangulation on the Moon. (Poland)

REA, G., BELSKY, T., AND CALVIN, MELVIN: Reflection spectra of bio-organic materials in the 2.5 - 4 μ region and the interpretation of the I.R. spectrum of Mars. (USA)

WEAVER, H., DANIELSON, R., WOOLF, N. J.: Infrared spectra of Mars obtained with stratoscope II. (USA)

YAGODA, H.: Interaction of cosmic and solar flare radiations with the Martian atmosphere and their biological implications. (USA)

MILLER, S. L.: Synthesis of organic compounds under primitive Earth conditions. (USA)

YOUNG, R. S.: Bacteria under simulated Martian conditions. (USA)

LEVINTHAL, E.: Multivator - A biochemical laboratory for Martian experiments. (USA)

ZHOUKIOVA, A. I.: Functional evolution of organisms. (USSR)

VISHNIAC, W.: Terrestrial models for extraterrestrial microorganisms. (USA)

HOROWITZ, N., LEVIN, G. V.: The "Gulliver" - An instrument for extraterrestrial life detection. (USA)

HOROWITZ, N.: The design of Martian biological experiments. (USA)

VISHNIAC, W.: The Wolr trap. (USA)