Scientific session of the Division of General Physics and Astronomy of the Academy of Sciences of the USSR (6 December 1982)

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An anniversary scientific session of the Division of General Physics and Astronomy, in celebration of the 60th anniversary of the formation of the USSR, was held on December 6, 1982 at the P. N. Lebedev Physics Institute of the Academy of Sciences of the USSR. The following reports were presented:

1. *A. M. Prokhorov*, Physics in the USSR: stages in a long journey.

2. *E. K. Kharadze*, 60 years of growth of science in Georgia.

3. *G. B. Abdullaev*, Achievements in physics in Azerbaĭdzhan.

4. *Kh. I. Amirkhanov*, Development of physics in Dagestan.

The texts of three of these reports are published below.

Physics in the USSR: stages in a long journey

A. M. Prokhorov

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Sixty years ago, a new type of union arose for the first time in world history: a fraternal union of peoples. Up to that time, the most typical interrelations between different nations were interrelations between oppressors and the oppressed, colonial powers and colonies. The union of fraternal republics—the USSR—is a union of equal peoples. However, in order to realize equality in deed, it was necessary to provide for rapid and all-round social, economic, and cultural development of formerly backward peoples. Science by no means played the last role in solving this problem. To demonstrate this role using the example of the development of physics and astronomy, we shall first recall the principal milestones in the history of the USSR Academy of Sciences. For without the leading, strong core of outstanding scientists, educated in the best traditions of M. V. Lomonosov, and D. I. Mendeleev, N. I. Lobachevskii and P. N. Lebedev, I. P. Pavlov and I. M. Sechenov, it would have been impossible to create new scientific centers at the periphery.

I

The great October socialist revolution opened up unlimited possibilities for the development of science and placed science at the service of the people. From the first months of the existence of the Soviet Republic, in spite of the extremely difficult conditions of the civil war and the general collapse, the development of science became an object of constant concern of the party and of the government. In April 1918, V. I. Lenin indicated the very important role of science in building up a socialist society and he set forth the immediate tasks confronting the scientists of our country in his "Draft of a plan for scientific-technical work". The most important tasks were the following: exploration of the natural resources of the country, formation of a plan to reorganize industry and the economic development of Russia, and formulation of recommendations for efficient distribution of industrial enterprises taking into account the proximity of sources of raw materials, power generation for industry, and transportation facilities.

The successful solution of these problems was facilitated by the practical measures taken by the Soviet government to form a network of new scientific institutions and to improve the working and living conditions of scientists. For the first time in world history, the management of science was viewed as the most important problem facing the government. During the period from 1918 to 1925, more than 50 scientific-research institutes were created in the country, including a number of physics institutes that were large for their time.

The Physicotechnical Institute in Petrograd (now called the A. F. Ioffe Physicotechnical Institute of the USSR Academy of Sciences), under the direction of Academician A. F. Ioffe, became the true cradle of Soviet physics. Remarkable scientists, of which Soviet science is justly proud, grew up within the walls of this institute: A. P. Aleksandrov, L. A. Artsimovich, P. L. Kapitsa, I. K. Kikoin, Yu. B. Kobzarev, G. V. Kurdyumov, I. V. Kurchatov, P. I. Lukirskiĭ, N. N. Semenov, and Ya. I. Frenkel'. The institute already made important contributions to many branches of physics during the first years of its existence.

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At the initiative of Academician D. S. Rozhdestvenskiĭ, a State optics institute was created in 1918. This institute played a decisive role in the development of the Soviet optical industry. In 1921, a physics and mathematics institute, incorporating the physics laboratory which was part of the Academy of Sciences since 1725 and was renamed the Physical Laboratory in 1912, was created in Petrograd.

In Moscow, Academician P. P. Lazarev founded the Physics and Biophysics Institute. The Nezhegorod Radio Laboratory, where research in radio engineering and electronics began under the direction of M. A. Bonch-Bruevich, was created in 1918.

Many, now well known, Soviet scientists began their scientific careers by participating in research on the Kursk magnetic anomaly, undertaken in 1919 under the instructions of V. I. Lenin.

More than 200 scientists and engineers under the direction of G. M. Krzhizhanovskiĭ participated in the development and realization of Lenin's plan for electrification of Russia (GOELRO). The GOELRO plan, which V. I. Lenin called the second program of the Party, provided for not only the creation of 30 large electrical power plants, but also for fundamental reconstruction of all sectors of the economy: development of heavy industry and transportation, introduction of progressive farming systems, and increase in the productivity of labor. The plan, confirmed by the Soviet of the People's Commissars on December 21, 1921 and intended for 10 to 15 years, was already fulfilled, according to its basic indicators, by 1931.

The role of science in the life of our country increased even more in the legendary years of the first five-year plans. Soviet physicists participated in the creation of new metals, alloys, instruments, and technological processes, and they devoted much effort to teaching. During this period, at the initiative of A. F. Ioffe, physics institutes patterned after the Physicotechnical Institute were created in Khar'kov, Sverdlovsk, Tomsk, and Dnepropetrovsk.

After the USSR Academy of Sciences moved to Moscow in 1934, most physics institutes, which belonged to different government departments, were transferred to the Academy. Under the direction of Academician S. I. Vavilov, the Physics Institute of the USSR Academy of Sciences, which was created in 1934 based on the Physics Division of the Physics and Mathematics Institute which moved to Moscow, became the largest scientific center. In 1934, Academician P. L. Kapitsa created the Institute of Physics Problems. In 1938, the Laboratory of Crystallography, later changed to the Institute of Crystallography, was organized. Academician A. V. Shubnikov was its founder and first director.

Widespread introduction of broadcasting over the enormous territory of the Soviet Union required the design and creation of new radio stations. This work was directed by Academician A. L. Mints.

The scientists of the Academy of Sciences already contributed a great deal toward strengthening the defenses of the country and developing the armaments industry in the years before the war. The principles of pulsed radar were developed under the direction of Academician Yu. B. Kobzarev at the Physicotechnical Institute. In 1936, Academician A. P. Aleksandrov directed research on the protection of ships from magnetic mines here as well. In the state Optics Institute, objective lenses for aerial photography, range-finders, and sighting as well as other optical instruments were developed under the direction of S. I. Vavilov.

After the treacherous attack by the fascists on our country, the staffs of physics institutes concentrated their efforts on supporting the front. Brigades were created for demagnetizing warships, which saved hundreds of ships from destruction. In besieged Leningrad, physicists helped to provide uninterrupted operation of the Road of Life on the ice of Lake Ladoga. Under the direction of Academician L. F. Vereshchagin, industrial installations were created for strengthening gun and mortar barrels. Specialists in electronic optics worked on devices for night vision.

By the time World War II started, it was clear that atomic energy could have military applications. At the end of 1942, the party and the government charged Academician I. V. Kurchatov to direct the work on the development of an atomic bomb. Four years later, the first nuclear reactor in Europe was started up in Moscow. An atomic bomb was built in 1949 and the first hydrogen bomb in the world was built in 1953.

Research conducted under the direction of I. V. Kurchatov at the Institute of Atomic Energy also opened up the way to peaceful uses of atomic energy. The first nuclear power plant in the world started to generate electricity in 1954 and the atomic icebreaker "Lenin" went on its first voyage in 1960.

In the years following the war, the network of physical institutes was greatly expanded and strengthened. The Instututes of Radio Engineering and Electronics (1953), Physics of High Pressures (1958), Solid State Physics (1963), Theoretical Physics (1965), Space Research (1965), and others appeared within the structure of the Academy of Sciences. A number of physical institutes was created in the Siberian Division of the USSR Academy of Sciences and in the Academies of Sciences of the Republics in the Union.

Without the participation of physicists, the successes achieved by our country in the assimilation of space would have been unthinkable. We should especially note the contribution of radio physicists, who not only succeeded in solving the complicated problem of transmitting information between space stations and ground-based control centers, but also developed a number of radiophysical methods for investigating planetary atmospheres and cosmic plasma.

Soviet physics, by right, occupies one of the leading places in world science. Seven Soviet scientists have been awarded Nobel prizes in physics, and many physicists have been selected as honorary members of academies of sciences of different countries.

Soviet physicists not only added many brilliant pages to the history of theoretical physics, solid state physics, optics, quantum electronics, plasma physics, radio physics and electronics, nuclear physics, and the physics of elementary particles, but also played a decisive role in the creation and development of many branches of modern technology.

II

Soon after the formation of the USSR, the Academy of Sciences began to take part in the systematic development of science in the national republics and provinces. The point is that together with republics where science and scientific education were adequately developed for their times (for example, in 1915, the Ukraine already had approximately 40 scientific institutions and 27 institutions of higher learning and, in 1919, an Academy of Sciences for the republic was created), the USSR acquired as members republics that had no scientific institutions and institutions of higher learning at all (Kazakhstan, Moldavia, Kirgiziya, and Tadzhikistan).

In the first stage, when adequate resources and personnel for creating permanent scientific institutions were still not available in the country, a network of expeditions of the Academy of Sciences was organized. Their work was coordinated by a special committee, which was created in 1926 for investigating republics in the union and autonomous republics and was headed by Academician A. E. Fersman. Tens of expeditions to all corners of our country, from the western boundaries of the USSR to the Urals and Siberia, from the Kol'skiĭ Peninsula to Central Asia and Trans-Caucasia, were organized to study deposits of fossil fuels, metals, construction materials, and raw materials for the chemical industry. Starting in 1927, in connection with the construction of Turksib (Turkestan-Siberia railroad), the Academy of Sciences organized investigations concerned with choosing the route for this future major railroad. Geological investigations on the Kol'skiĭ Peninsula uncovered extremely rich apatite-nephelite deposits. Exploration of Kara-Bogaz Bay and of the potash deposits in the vicinity of Solikamsk was undertaken.

The expeditions contributed a great deal to overcoming the technical-economic backwardness of the peripheral regions of the country. A network of new scientific institutions and institutions of higher learning in all the republics belonging to union as well as in the autonomous republics was created next. An important event was the opening of the Academy of Sciences of the Belorussian SSR in 1929. Close contacts were immediately established between the Academies of Science of the USSR, the Ukrainian SSR, and the Belorussion SSR.

In 1931, the Presidium of the USSR Academy of Sciences made the decision to organize a network of centers and stations of the Academy, which later served as centers of crystallization for the growth of national scientific institutions. These institutions were required to have a complex character and were created taking into account the economic and cultural requirements of the republics, regions and provinces.

The Trans-Caucasian Affiliate of the USSR Academy of Sciences was created in 1931 and later, in 1935, it was transformed into three affiliates: Georgian, Azerbaĭdzhan, and Armenian.

Kazakhstan and Central Asia, which did not as yet have their own scientific personnel, were less prepared for the creation of regional scientific institutions. In 1932, the Kazakh and Tadzhik Centers of the USSR Academy of Sciences were created there. It should be emphasized that the organizers and the first directors of these and other centers were leading Soviet scientists: Academicians V. L. Komarov, A. F. Ioffe, A. E. Fersman, A. A. Baĭkov, I. M. Gubkin, I. P. Bardin, V. P. Volgin, and others.

By 1938, the Academy of Sciences already had six affiliates (Far-Eastern, Georgian, Azerbaĭdzhan, Armenian, Ural, and Kazakh) and three centers (Kol'skiĭ, Northern, and Tadzhik). From 1938 to 1941, the Uzbek, Turkmen, and Tadzhik affiliates were organized. Some of the affiliates grew to such an extent that it was possible to create independent academies of sciences based on them. In 1941, the Academies of Sciences of the Georgian and Lithuanian SSR were formed; in 1943, the Academy of Sciences of the Armenian SSR was formed; and, the Academy of Sciences of the Azerbaĭdzhan SSR was formed in 1945. In the years after the war, Academies of Sciences were also created in other republics based on the corresponding affiliates: Latvia, Estonia, and Kazakhstan (1946), Tadzhikistan and Turkmenia (1951), Kirgiziya (1954) and Moldavia (1951). By the end of the 1950s and beginning of the 1960s, the Academies of Sciences of the republics in the Union became large scientific centers. Together with the formation of academic scientific institutions, the party and the government devoted constant attention to the creation of institutions of higher learning in all republics in the Union and in the autonomous republics and to the development of their economy and culture. As an illustration, I shall present several numbers. Belorussia, Uzbekistan, Kazakhstan, Azerbaĭdzhan, and Lithuania had no institutions of higher learning at all before the revolution and now there are 29 in Belorussia, 40 in Uzbekistan, 46 in Kazakhstan, 15 in Azerbaĭdzhan, and 12 in Lithuania. Republics which prior to the revolution had no scientific-research institutions at all, now have many: there are about 100 in Kazakhstan (we have in mind not only academic institutions), more than 30 in Moldavia about 30 in Kirgiziya, also about 30 in Tadzhikistan, and more than 70 scientific-research institutions in Armenia.

III

Our Division of General Physics and Astronomy of the USSR Academy of Sciences devotes constant attention to developing contacts with the Academies of Sciences of the republics of the Union, scientific centers, and affiliates of the USSR Academy of Sciences and giving them scientific-methodological aid. This is, in particular, illustrated by the geography of out-of-town scientific sessions of our Division over the last 15 years. I recall the locations and dates of these sessions:

1) April 23–25, 1968, Tbilisi;

2) December 16, 1968, Leningrad;

3) May 19–20, 1969, Baku;

4) April 14–16, 1971, Tashkent;

5) April 20–22, 1971, Ashkhabad;

6) June 6–10, 1972, Minsk;

7) October 3–6, 1973, Kishinev;

8) April 3–6. 1974, Leningrad;

9) April 20–23, 1976, Tallin;

10) May 23–25, 1979, Kiev;

11) April 20–22, 1982, Sverdlovsk.

Meetings were also held in scientific centers near Moscow: Fryazino, Krasnaya Pakhra, and Chernogolovka.

In the republics of the Union, such sessions are usually held together with the corresponding division of the republican Academy, and the agenda includes reports from the leading scientists of the USSR Academy of Sciences and of the republican Academies. Such meetings are becoming a kind of inspection of the achievements of the scientists in the republics and permit us to plan, together with the directors of the republican Academies, the most promising paths for further research, to help formulate new scientific directions, to create new institutions, and to expand work performed jointly.

I remind you that in 1945, a committee was created for coordinating the scientific work of the Academies of Sciences of the republics in the Union. Scientists from our Division actively participate in out-of-town meetings and commissions of the Presidium of the USSR Academy of Sciences whose purpose is to become acquanited with the work performed at the Academies of Sciences in the republics and to give them scientific-methodological help. Such trips usually end with a discussion of the work performed in the republican Academies and their scientific institutions at the meetings of the Presidium of the USSR Academy of Sciences, where recommendations are made on creating new scientific institutions and new directions for scientific research at existing institutes are formulated. Over the last five to seven years, the Presidium of the USSR Academy of Sciences has in this manner become acquainted with the work of all the Academies of Sciences of the republics in the Union.

We cannot neglect mentioning the extensive work on preparing scientific personnel for the republics in the Union, which our institutes perform through goal-oriented postgraduate study. Many leading scientists in the Academies of Sciences of the republics in the Union, including institute directors and academy presidents, are proud of being graduates of the Physicotechnical Institute of FIAN. Our leading scientists regularly travel out of town to scientific and educational institutions in the republics of the Union to give lectures and to consult. We should especially emphasize the great benefit and the great results achieved in joint research performed by many of our institutes and institutes of the republican academies.

IV

It is impossible to give even a brief review of the most important scientific achievements of multinational Soviet physics in a single report, so that I shall limit myself to separate examples only. First, I want to note that an indication of the successful development of physics and astronomy in a number of republican academies is the election of their presidents as members of our Division. I recall that the members of our Division are:

G. V. Abdullaev, President of the Academy of Sciences of the Azerbaĭdzhan SSR;

V. A. Ambartsumyan, President of the Academy of Sciences of the Armenian SSR;

N. A. Borisevich, President of the Academy of Sciences of the Belorussian SSR;

E. K. Kharadze, President of the Academy of Sciences of the Georgian SSR;

K. K. Rebane, President of the Academy of Sciences of the Estonian SSR;

Kh. I. Amirkhanov, Chairman of the Presidium of the Dagestan Affiliate of the USSR Academy of Sciences; and,

S. V. Vonsovskiĭ, chairman of the Ural Scientific Center of the USSR Academy of Sciences.

The Academy of Sciences of the Ukrainian SSR recently celebrated its 60th anniversary (in 1979), and two of its leading physical institutes celebrated their 50th anniversary: the Physics Institute and the Khar'kov Physicotechnical Institute.

The Physicotechnical Institute in Khar'kov (UFTI) was organized in 1929 by students of A. F. Ioffe and graduates of the Leningrad Physicotechnical Institute: I. V. Obreimov, L. V. Shubnikov, K. D. Sinel'nikov, and A. K. Val' ter. The first director of the institute was Academician I. V. Obreimov. From 1932 to 1937, the theoretical division of the institute was headed by L. D. Landau. Here he created the theory of second-order phase transitions and the theory of the intermediate state of superconductors, and most important he created an extraordinary school of theoreticians, whose graduates include such outstanding physicists as I. Ya. Pomeranchuk, E. M. Lifshitz, A. I. Akhiezer, I. M. Lifshitz, and others. UFTI was the first institute in our country in which liquid hydrogen was made in L. V. Shubnikov's laboratory, even before the organization of the Institute of Physics Problems in Moscow, and then (in 1933) liquid helium as well.

UFTI was organized from the outside, so to speak, but the Institute of Physics of the Academy of Sciences of the Ukrainian SSR grew out from within Kiev University. Its organizer and first director was Academician of the Academy of Sciences of the Ukrainian SSR, A. G. Gol'dman. The out-of-town session of DGPA in

May 1979 in Kiev was timed to coincide with the 50th anniversary of the Physics Institute. We acquainted ourselves with the laboratories of the Institute and heard review reports of the most important scientific results obtained there. Just as in the Leningrad Physicotechnical Institute, the Physics Institute of the Academy of Sciences of the Ukrainian SSR, served as a center for the creation of a number of physical institutes in the Ukraine: Institute of Metal Physics (1954), Institute of Semiconductors (1960), Institute of Theoretical Physics (1966), and Institute of Nuclear Physics (1970). Research on excitons in crystals, which was awarded the Lenin Prize in 1966, as well as work on the creation of tunable lasers and optical frequency standards, on nonlinear optics and holography, and many other directions, performed at the Physics Institute of the Ukrainian SSR, has been widely recognized.

We should also mention the E. O. Paton Institute of Electrical Welding, with which we collaborate closely. The scientific foundations of the technology and the high-efficiency equipment for pulsed laser welding and heat treatment were developed there and introduced into the electronics industry. This work was awarded the State Prize of the USSR in 1979.

The Main Astronomical Observatory of the Academy of Sciences of the Ukrainian SSR has been operating successfully under the direction of Ya. S. Yatskiv, Corresponding Member of the Academy of Sciences of the Ukrainian SSR. In September of 1982, the Executive of our Division heard his report on the program of ground-based observations of Halley's comet (without which the planned investigations of the comet in space would be impossible) and confirmed him as the director of this program.

I shall now say a few words about the achievements of Belorussian physicists. A new phenomenon has been discovered at the Physics Institute of the Academy of Sciences of the Belorussian SSR; stabilization-labilization of complicated electronically excited molecules, based on which new models of the energetics of complex molecules were developed. This led to the creation of a new branch of physics: the spectroscopy of free complex molecules. This series of experiments was awarded the Lenin Prize in 1980.

Wave front inversion in four-wave interaction was discovered at the same institute (the authors called this phenomenon dynamic holography). This work was awarded the State Prize of the USSR in 1982.

The Institute of Electronics of the Academy of Sciences of the Belorussian SSR, which is growing successfully, was created in 1973 with the help of DGPA. A plant for building scientific instruments is being built in Minsk with the close collaboration of the Academies of Sciences of the USSR, Belorussian SSR, and Estonian SSR. This plant will produce mainly optical spectroscopy instruments, using primarily tunable lasers, which the institutes of our Division urgently need. The production of many instruments, developed in our institutes (FIAN, Institute of Spectroscopy, FTI), as well as at institutes of academies in the republics, is planned.

It is not a random occurrence that the Academy of Sciences of the Estonian SSR is participating in the creation of the plant in Minsk. Excimer and nitrogen pulsed lasers and tunable dye lasers together with the control and measurement systems have been developed and are being built at the Institute of Physics and the Special Design Office of the Academy of Sciences of the Estonian SSR. They are distinguished by their excellent design and good performance. However, the present production capacity of the Academy of Sciences of the Estonian SSR cannot provide the required number of these lasers. The unique double vacuum monochromators for the 100–300 nm spectral range, whose development was awarded a State Prize of Estonia, are also being made.

At the Institute of Physics of the Academy of Sciences of the Estonian SSR, investigations of molecular crystals using optical and radio spectroscopical methods occupy a central position. K. K. Rebane, Corresponding Member of the Academy of Sciences of the USSR, was awarded the P. N. Lebedev gold medal of the Academy of Sciences of the USSR for this work. Detailed investigation of the low-temperature vibronic spectra of crystals led to the discovery of a new phenomenon: hot photoluminescence of crystals. This work was recognized as an important discovery.

The out-of-town session of the Joint Scientific Committee of the Academy of Sciences of the USSR on the problem of "Optics" with the participation of its member committees on coherent and nonlinear optics, spectroscopy and luminescence, was held in Tallin in October. The participants of the session became acquainted with the Special Design Office and the Institution of Physics in Tallin and Tartu and gave their work high marks.

The staff members of the Institute of Astrophysics and Physics of the Atmosphere, together with cosmonauts Gretchko, Gubarev, Klimuk, and Sevast'yanov, carried out a series of investigations of silvery clouds, the atmosphere, and the earth's surface with the help of a remote-controlled radiometer on board the Salyut-4 orbiter. This work was awarded the State Prize of Estonia in 1979.

The Institute of Physics of the Academy of Sciences of the Azerbaĭdzhan SSR is the leader in this country in research on selenium and instruments based on it. An entire industrial sector on the production of high-purity selenium and highly efficient selenium transducers, which are exported to many countries in the world, has been created in Azerbaĭdzhan. A large number of previously unknown groups of ternary and quatenary anisotropic semiconducting compounds, which are promising for microelectronics and laser technology, were first predicted to exist and obtained at the Institute of Physics,

Several years ago, the Institute of Exploration of Natural Resources from Space and the Scientific-Production Organization for Space Research, which organizes and conducts polygonal exploration of the earth from

space and coordinates this work within the framework of the Interkosmos program with the participation of socialist countries, were created at the Academy of Sciences of the Azerbaĭdzhan SSR. Methods for decoding and interpreting aerocosmic information about the environment for the interests of geology, geography, oceanography, and aqua- and agricultures were developed here.

The work performed by Byurakan Astrophysical Observatory of the Academy of Sciences of the Armenian SSR and its director Academician V. A. Ambartsumyan are well known.

An important achievement of the observatory in recent years is the discovery and investigation of a new class of galactic systems: compact groups of compact galaxies.

A number of new types of lasers have been created, and new crystals for quantum electronics have been grown at the Institute of Physics Research of the Academy of Sciences of the Armenian SSR. The technology for obtaining a number of crystals has been introduced into industry.

High-sensitivity radiometers in the decimeter and centimeter ranges, which are widely used in measurements of the electrodynamic characteristics of antennas for long-range space communication and for radio astronomy, have been created at the Institute of Radio Physics and Electronics.

At the Academy of Sciences of the Georgian SSR, physics research is concentrated in the Institute of Physics. The achievements of Georgian physicists in solid state physics and low-temperature physics are well known. I recall the classical experiments of E. L. Andronikashvili, Academician of the Academy of Sciences of the Georgian SSR, with liquid helium, initiated by him in the 1940s at the Institute of Physics Problems in Moscow and continued under his direction in Tbilisi. In recent years, the Institute of Physics has also achieved successes in the development of physical methods for investigating biological objects.

The Abastumani Astrophysical Observatory is celebrating its 50th anniversary this year. It was created in 1932. Here, the study of the interstellar medium, variable and nonsteady-state stars, and the structure of the galaxy is progressing successfully.

The Executive of our Division became acquainted with the achievements of Kazakh physicists very recently, on November 3, when we examined the work of the Ionosphere Sector of the Academy of Sciences of the Kazakh SSR. The study of the ionosphere above Kazakhstan is of special significance, since space vehicles are often launched here. In recent years, the staff members of the sector performed a large series of investigations of wave processes in the neutral atmosphere and ionosphere and clarified the influence of these processes on the conditions for propagation of radio signals. Considering the urgency of this subject, its applied value, and the presence of a group of qualified scientific workers, the office of DGPA supported the petition of the Presidum of the Academy of Sciences of the Kazakh SSR for changing the Ionosphere Sector into an Institute of the Ionosphere of the Academy of Sciences of the Kazakh SSR.

The mechanisms and laws governing the natural separation of the uranium 234 and 238 isotopes were established at the Institute of Physics and Mathematics of the Academy of Sciences of the Kirghiz SSR. This work has been recognized as an important discovery. The observed distribution of isotopic shifts between uranium 234 and 238 in subsurface waters as a function of depth formed the foundation for the development of a model of the formation and circulation of subsurface waters in the Chuĭskaya Valley.

In Latvia, the staff members of the Institute of Electronics and Computer Technology of the Academy of Sciences of the Latvian SSR were awarded the State Prize of the USSR in 1981 for developing the principles of automated scanning systems for optical microscopy and the creation and introduction of a complex of instruments for analyzing microscopic objects in scientific research and in industry.

An interesting series of studies on the orientation and control of parts made of conducting nonmagnetic and ferromagnetic materials by means of an electromagnetic field was conducted at the Institute of Physics of the Academy of Sciences of the Latvian SSR. Use in industry confirmed the high efficiency and resolution of the method. Automatic machines created on the base of this method are being introduced into the enterprises of Minradioprom for assembling different industrial holders and clamps. A number of factories in Riga, including the well-known VEF radio factory, are participating in this work.

Investigations of the collective response of a solid-state plasma to excitation of electromagnetic waves were conducted at the Institute of the Physics of Semiconductors of the Academy of Sciences of the Lithuanian SSR. The properties of hot electrons in the case of inhomogeneous heating were studied theoretically and experimentally. It was shown that, in this case, a homogeneous semiconductor acquires asymmetrical electrical properties. This work has been recognized as an important discovery and is already finding practical applications. Investigations of current instabilities in a solid-state plasma led to the creation of new types of semiconducting devices: avalanche diodes, which have played an important role in the assimilation of the submillimeter wavelength range. This work was awarded the Lenin Prize in 1978.

A universal method for calculating the spectra of highly ionized atoms in the relativistic approximation, which is of particular interest for astrophysics, was created at the Institute of Physics of the Academy of Sciences of the Lithuanian SSR.

At the Academy of Sciences of the Moldavian SSR, important results were achieved in the technology of manufacturing and in investigations of the properties of and application of thin filaments (microwires). This work took into account the industrial base of the republic and the results of research performed in a num-

ber of laboratories of the Institute of Applied Physics of the Academy of Sciences of the Moldavian SSR. Together with these institutes, the Special Construction-Technology Office of Solid-State Electronics of the Academy of Sciences of the Moldavian SSR, and the Scientific-Production Organization "Mikroprovod" participated in this work. A theory of excitons and bio-excitons with high density in semiconductors was developed at the Institute of Applied Physics. This work was awarded the State Prize of Moldavia in 1981.

At the Academy of Sciences of the Tadzhik SSR, the most significant research is research on seismology and earthquake-proof construction, as well as on the search for earthquake precursors. The creation of an automated system for operational forecasting of earthquakes using computers is being completed at the Institute of Earthquake-Proof Construction and Seismology. I should also mention the work in acoustics, performed at the physicotechnical institute under the direction of Academician of the Academy of Sciences of the Tadzhik SSR, A. A. Adkhamov.

Interesting research on the propagation of radio waves and radio astronomy is being conducted at the Academy of Sciences of the Turkmen SSR. The Institute of Solar Energy, which is the principal organization in the USSR on the problem of utilizing solar energy in agriculture, was created here in 1979. In 1980, the Scientific-Production Organization "Solntse" was created in the Academy of Sciences of Turkmen SSR in order to accelerate the rate of assimilation of the newest solar equipment in the national economy.

Work performed at the Institute of Nuclear Physics of the Academy of Sciences of the Uzbek SSR made it possible to manufacture for the first time in this country the radioactive isotope phosphorus-32 with high specific activity and chemical purity as well as orthophosphoric acid and its compounds containing this isotope, whose physicochemical properties are better than those of similar materials manufactured abroad. This permitted reducing the importation of radioisotopes and to save more than one million rubles in foreign currency. Radioactive preparations manufactured for diagnostics of cardiovascular, endocrine, and other diseases are supplied to more than 200 organizations in the USSR, Bulgaria, and the German Democratic Republic. The Institute of Nuclear Physics of the Academy of Sciences of the Uzbek SSR is the only supplier of 18 compounds tagged with phosphorus-32.

I also remind you that the prize of the Academy of Sciences of the USSR, named after the well-known Russian astronomer F. A. Bredikhin, was awarded in 1980 to V. P. Shcheglov, Academician of the Academy of Sciences of the Uzbek SSR, for his work on the history of the astronomy of the Ulugbek era.

I have briefly recounted the achievements of the Academies of Sciences of all the republics of the Union. In conclusion, I add a few words about the Dagestan Affiliate of the Academy of Sciences of the USSR, which is headed by a member of our Division, Kh. I. Amirkhanov The leading role in this affiliate is played by the Institute of Physics, where serious progress has been achieved in the physics of semiconductors, optics, thermophysics, and geophysics. A commission of DGPA, visited there recently in October and approved the Institute's work.

The Soviet people have a right to be proud of the successes achieved in science in our country. The efforts of Soviet physicists and astronomers in the future will also be directed toward accelerating scientific-technological progress as much as possible and gaining positions of leadership in all basic areas of physics and astronomy.