SOVIET PHYSICS USPEKHI VOLUME 15, NUMBER 6 MAY-JUNE, 1973

53(47)

FIFTY YEARS OF THE USSR AND SOVIET PHYSICS

Usp. Fiz. Nauk 108, 617–624 (December, 1972)

ON October 30, 1972, the Soviet nation marked a portentious date—50 years have passed from the day when the first All-Union convention of Soviets opened in Moscow and accepted the declaration and agreement concerning the formation of the Union of Soviet Socialist Republics on the basis of equality of rights and their voluntary entry into the Union. This step was undertaken after the first Socialist republic—the Russian and Transcarpathian Federations and the Ukrainian and Belorussian Soviet Socialist Republics—resolved during the conventions of the Soviets of the Republics to form one indivisible Soviet government.

The fiftieth anniversary of the establishment of the USSR is a bright landmark on the road of the development of our fatherland. Once reached, one can look back with legitimate pride at the road traveled, at times hard but always victorious, and view with confidence the new boundless horizons opening up before the multinational Soviet people.

In the period preceding the October Socialist revolution and the formation of the Soviet State, Physics in the fatherland was represented by a number of prominent scientists: namely, M. V. Lomonosov, V. V. Petrov, and when speaking of the end of the preceding century and the beginning of the present one, A. G. Stoletov, N. A. Umov, A. S. Popov, P. N. Lebedev; the fundamental research of these scientists brought them recognition in their lifetimes. It is well known, in addition, that because of the backwardness of the czarist regime, the development of physical sciences in the country was not encouraged and the initiative of talented people who were trying to develop them on the proper scale in pre-revolutionary Russia, responding to the state's needs and relying on talented youth who had studied in institutions of higher learning, met with an impenetrable wall of indifference, lack of understanding, and unwillingness to understand.

This initiative was particularly activated in the final years of the last century and the first decades of the 20th century, when truly revolutionary progress was made in physics, as manifest in the discovery of x-rays, radio and radioactivity and in the appearance of the quantum theory and the relativity theory. Even then, the leading Russian scientists—physicists and mathematicians—clearly demonstrated the exceptional advantages which a close contact between industry and science offer to the development of industry. However, only the great October socialist revolution permitted the realization of these opportunities, since the Soviet government and the man heading it, Vladimir Il'ich Lenin, not only treated those ideas with full understanding but also encouraged and stimulated their realization in every way possible.

In the program adopted by the Seventh Congress of the Communist Party in March 1919 it was stated that, "The Soviet authorities had already accepted a whole series of measures directed toward the development of science and its collaboration with production: the creation of a whole network of new institutes of applied science, laboratories and experimental stations, pilot plants for the verification of new technical methods, improvements and discoveries, evaluation and organization of all scientific resources and means, etc. The Communist Party, while supporting all these measures, also strives toward their further development and the creation of the most favorable conditions for scientific work in its connection with the increasing of the production resources of the country."[1] This full support of the scientists reflected the deep understanding of the leaders of the Soviet government of the role that science would play in a country on the road toward the construction of a communist society.

This statement should be particularly emphasized, since often, when reporting the first steps made by the Soviet authorities toward the support of organizational efforts of individual foremost Russian scientists to organize on a firm basis the scientific and primarily physical and technological research, a somewhat philanthropic character is unwittingly attributed to this support, remarking that in the environment of intervention, civil war, hunger, and cold, the steps of that type by the Soviet government, namely, every type of encouragement of basic research, were to some degree a tribute to "utopian dreams" and not directly tied to the urgent needs of the country.

Materials published in honor of Lenin's 100th birthday give a clear idea of the value which he and his advisers ascribed to the mobilization of the scientific resources of the country, and of the attention which the Soviet government, literally from the first days of its existence, paid to scientists and their research. "It is necessary to take all science and technology, all knowledge and art. Without this we cannot build the life of a communist society. And that science, technology, art is in the hands of specialists and in their heads" wrote V. I. Lenin.[2] These thoughts of Lenin appear also in the program approved by the eighth congress of the communist party, where it was indicated that "... the task of developing the productive forces demands an immediate, wide-ranging and comprehensive use of the specialists of science and technology inherited by us from the capitalists, disregarding the fact that for the most part they are inevitably saturated with a bourgeois world outlook and customs."[3]

An obvious exception to the majority mentioned in this program were those physicists who immediately offered their services to the Soviet government and directed all their efforts toward the fastest possible building-up of science in Soviet Russia and the organization of corresponding scientific-research institutes and laboratories. Petr Petrovich Lazarev, Abram

[1] The Communist Party of the Soviet Union in Resolutions and Decisions of Congresses of Conferences and Plenary Sessions of the Central Committee in Russian, Vol. 2, Moscow, Politizdat, 1970, p. 53.

[2] V. I. Lenin, Collected Works (in Russian), Vol. 38, p. 55.

[3] Op. cit., p. 52.

Fedorovich Ioffe, Dmitrii Sergeevich Rozhdestvenskiĭ, Aleksandr Aleksandrovich Fridman, Aleksandr Alekseevich Chernyshev, and many, many others immediately and unreservedly sided with the Soviet authorities. Much documented evidence has been preserved of their contacts, which were fruitful for the development of science and the Soviet government, with the government and with Lenin personally. The foregoing pertains to no less a degree to the leaders of the Russian Academy of Sciences—to its president, Academician Aleksander Petrovich Karpinskiĭ, its science secretary Sergeĭ Fedorovich Oldenburg, academicians V. A. Steklov, A. E. Fersman and others. Their memoirs have preserved for future generations that deep impression which had been made on them by business meetings with V. I. Lenin, A. V. Lunacharskiĭ, V. D. Bonch-Bruyevich, N. P. Gorbunov and other party figures and statesmen of the Soviet government.

The problem of redistributing industry throughout the country concerned the Soviet government to an exceptionally great degree. This problem was raised immediately, primarily because many regions of our country had been seized at that time by White armies or occupied by German armies.

In Lenin's famous "Outline of a Plan for Scientific and Technological Projects" (April, 1918), addressed to the Academy of Sciences, it was indicated in particular that "this plan should include a rational distribution of industry in Russia from the point of view of the proximity of raw materials and the least labor from the extraction of the raw material through all the successive stages of manufacture until the delivery of the finished produce... . Special attention must be paid to the electrification of industry and transport and to the application of electricity to farming. The use of low-grade fuel (peat, cheaper coals) to get electric energy with the least expenditure for extraction and transportation of fuel."[4] This "outline" was the answer to a suggestion coming from the Academy of Sciences, that it participate in the research on the natural wealth of Russia. In April, 1918, the Council of Peoples' Commisars decreed "to support this suggestion, to acknowledge in principle the need of financing the corresponding projects of the Academy and to indicate to it as its most important and pressing task the resolution of the problems of the proper distribution of industry throughout the land and the most rational use of its economic resources."[5]

In this way, the question of a rational distribution of industrial enterprises and the scientific-research establishments closely linked with them was in the center of attention of the Soviet government, which was striving to organize this project on a scientific basis. Lenin and the Soviet government directed their efforts to promote the development of science in other centers of the Soviet state, without weakening, where possible, the scientific and industrial potential of Petrograd and Moscow. Of great importance here also was the desire to promote in every way possible the awakening of national awareness and provide access to science and culture for the representatives of various nationalities, who had been part of the former Russian Empire and under czarist conditions did not have the opportunity of getting the necessary education. These aims were served, as is known, by the formation, besides the Russian Soviet Federated Socialist Republic (composed of numerous autonomous Soviet Socialist Republics), also of the Ukrainian and Belorussian Soviet Socialist Republics and the Transcaucasian Soviet Federated Socialist Republic, uniting in its composition the various peoples of the Transcaucasus region.

Petrograd and Moscow, Kiev and Khar'kov, Odessa and Kazan'—old university and student cities of Russia and the Ukraine, and new educational institutes created in the first post-revolutionary years—were called upon specially to train specialists for our country's science and industry and to offer higher education to the representatives of all nations who had been denied access to higher institutions of learning during czarist Russia.

On the basis of France's experience, it was noted long ago that the maximum concentration of scientific resources, which began immediately after the 1789 revolution and which gathered a large assembly of scientists of world renown within the walls of Paris—at the expense of a certain empoverishment of the other cities of the country—has subsequently led to results unfavorable to the development of science in France as a whole. Centralization and easier scientific contacts and exchanges ensuing from it can bear and did bear rich fruits in the first years of that process which, afterwards, caused a certain slowing down of the development of science as a whole. From this point of view, the progress of physics in Germany, beginning with the second half of the 19th century, was due in many respects to the presence in the country of many centers "equally important" from the point of view of level of learning and teaching.

The enumerated and similar considerations, taken as a whole, determined the initial but far-reaching steps taken by the Soviet government in drawing science and industry together in the rehabilitation of old centers and, chiefly, opening of new ones, in enrolling specialists already present in the country, and in wide and extraordinary training of new specialists. It is well known that those policies bore fruit literally in the first years of the existence of the new order (electrification of the country, the discovery and scientific extraction of new sources of raw materials, specifically the Kursk magnetic anomaly, the fast growth of the scientific potential of Socialist Republics). It is appropriate to mention that later, in the years of the second world war the presence of these industrial and scientific centers—in the Urals, in Siberia, in Central Asia—helped the country to an extreme degree, at the front and in the rear, in its heroic struggle with the fascist aggressors. We note that the relocation of a part of the mentioned enterprises and institutions in new regions played subsequently a major role in the development of industry and science in those regions.

The organization of new centers of physics research in the country was a complex matter and the work consisted at times of separate and at first glance not so important measures. Characteristic examples of this sort are the congresses and conferences conducted by

[4] V. I. Lenin, Collected Works (in Russian), Vol. 36, pp. 228-231.

[5] See "Lenin and the Academy of Sciences. A Collection of Documents" (in Russian), Nauka, 1969, p. 40.

the Academy of Sciences and leading institutes. And so, the 1928 congress of Russian physicists, which began in Moscow, moved afterward to Nizhniĭ Novgorod (Gorkiĭ), and then sailed down the Volga, with stops at the most important cities along the Volga, Saratov and Kazan'. The First All-Union Physics Congress (1930) was held in Odessa. During the lectures given by important scientists and during the discussions and conversations, new and talented scientific workers and students appeared; these youths, as a rule, were invited to work on probabion at the universities which had already been founded. The same goals were served also by special conferences on more restricted topics, convened in cities of the Ukraine, Transcaucasus, Central Asia, etc. Often, the location for a conference was chosen because of publications or personal contacts between the leading physicists of the country and the youth have revealed that the particular city had a group of scientific workers ready to take the initiative. In this way, together with the early understandable drift of youth to the most important scientific centers of the country, Moscow and Lenin'grad, there was already in the 1920's a systematic counterflow of scientists, primarily young ones, to new industrial towns, which appeared everywhere in the years of the first five-year plans. Perhaps, the most characteristic feature of this plan was the "splitting" of new institutes away from the Leningrad Physico-technical Institute, one of the first scientific establishments created during the years of Soviet rule. Daughter physico-technical institutes were organized in Khar'kov, Tomsk, Sverdlovsk, Dnepropetrovsk, and the Leningrad Physico-technical Institute sent its graduates to all these these cities.

The fast mastery of "new territories" by physics was promoted also by the reorganization of the institutions of higher education, which were faced with the task of training research engineers equipped with enough basic knowledge to enable them to master quickly a given specific subject, and prepared to solve the specific problems confronting an enterprise or chosen to investigate in a scientific institution. All of this led to a quick distribution throughout the country and its republics of new plant laboratories which very often grew subsequently into scientific-research institutes. It is interesting to note here that the idea of organizing plant laboratories goes back directly to L. I. Lenin: A resolution by the Council of People's Commisars, establishing a Scientifical-Technological Division at the All-Russian Council for the National Economy (August, 1918), mentions specifically that one of the tasks of the Division is "the organization, with the participation of the corresponding organs of the Soviet authority ... of laboratories and experimental stations in the most important plants, factories, trade units, agricultural communes, etc., to render scientific services, improve production, and verify the usefulness of new discoveries."[6]

This national-economic policy was further developed in successive years. We are now witnessing not only its fruits, but also a new step in this direction, when institutions of higher learning are organized and function successfully in giant enterprises.

A strong foundation which permitted us to achieve our well-known successes in this direction was the successful solution of the problem of local scientific personnel. The table[7] allows us to judge how wide the "geography" of the scientific researches in the USSR is and what a weighty contribution is made to this research by the Soviet Socialist Republics. The dynamics of the growth of scientific personnel in the academies of the Republics, traced through the past three decades, is also sufficiently eloquent.

The academies of science of the Soviet republics solve today the problems of modern science on part with the most advanced foreign and domestic achievements. Mention any branch of contemporary physical science pursued in the Soviet Union, and it will without fail come to light that one or several of the academies of the Republics make a considerable contribution to it. And so, an extraordinarily broad spectrum of problems in semiconductor physics and the solid state physics is worked on in the Ukraine and in Belorussia, in Azerbaidzhan and Moldavia, in Georgia and Lithuania, in Uzbekistan, Kirghizia and Estonia. Problems in theoretical physics are solved in the institutes of the Georgian, Kazakh, Uzbek, and Ukrainian Academies of Sciences. All the academies of Sciences of the union republics, without exception, make their own weighty contribution to the solution of complex physico-technical problems. Let us name, for example, research on magnetohydrodynamics carried out in the institutes of the Latvian Academy of Sciences on heat and mass exchange in Belorussia, electronics in Georgia, Armenia, Uzbekistan, and finally, work on the methods of electric-spark metal working in Moldavia. The research of Belorussian and Estonian physicists on the questions of quantum optics and spectroscopy is well known.

Problems of astrophysics and radioastronomy are being worked on on a wide scale in Armenia, Azerbaidzhan and Georgia, in Uzbekistan and Tadzhikistan, in Latvia and Estonia, and in the Ukraine. Theoretical and applied problems in geophysics, including problems in the physics of the earth's crust and atmosphere and seismology, are solved by the institutes of the Turkmenian, Tadzhik, and Armenian Academies of Sciences. It is not by accident that we did not mention the RSFSR, since even a listing of the physics problems worked on by the scientists from this republic in Moscow and Leningrad, in Gorkiĭ and Kazan', in Sverdlovsk and Tomsk, in Yakutsk and Apatity, in Saratov and Novosibirsk, or even a mere mention of the cities, would require too much space. In the last years alone there were organized in the RSFSR powerful centers of learning such as the large scientific centers of learning in Siberia, the Urals, and the Far East, and the Bashkir, Dagestan, Karelian, Kola and Komi branches of the USSR Academy of Sciences.

Soviet physics has received recognition and its "civic rights" a long time ago and with good reason, since the friendly force of scientists, which consists of representatives of various nationalities of our multinational socialist government, devotes its work to its development and success.

In this connection, it is appropriate to mention an

[6] Op. cit. in preceeding footnote, p. 58.

[7] See "National Economy of the USSR in 1970, A Statistical Annual" (in Russian), Moscow, Statistika, 1971, pp. 659, 660.

	Year of foundation of academy of sciences	Number of scientific institutions in the academy (1970)	Number of scientific workers					
			1940	1950	1960	1970		
						Total	Among them doctors of sciences	Among them candidates of sciences
USSR	1725	234	98 315	162 508	354 158	927 709	23 616	224 490
RSRSR			61 872	111 699	242 872	631 111	16 135	145 071
Ukr. SSR	1919	75	19 304	22 363	46 657	129 781	3 123	33 317
Belor. SSR	1928	32	2 227	2 629	6 840	21 863	425	5 564
Uzb. SSR	1943	31	3 024	4 541	10 329	25 244	494	6 907
Kaz. SSR	1945	36	1 727	3 305	9 623	26 802	421	6 272
Georg. SSR	1941	41	3 513	4 843	9 137	20 160	989	5 860
Azerb. SSR	1945	30	1 933	3 364	7 226	17 082	652	5 346
Lit. SSR	1941	12	633	1 402	3 320	8 978	182	2 710
Mold. SSR	1961	19	180	745	1 199	5 695	113	1 834
Latv. SSR	1946	16	1 128	2 184	3 348	8 895	175	2 517
Krig. SSR	1954	18	323	841	2 315	5 867	128	1 572
Tadzh. SSR	1951	18	353	715	2 154	5 067	102	1 364
Arm. SSR	1943	33	1 067	2 000	4 275	12 808	482	3 346
Turkm. SSR.	1951	16	487	656	1 836	3 649	62	1 200
Est. SSR	1946	15	544	1 121	2 227	4 707	133	1 610

episode which took place several years ago when a famous British physicist was a guest of our academy. During the banquet given in his honor, a toast (among many) was made to the blossoming of British physics. The honored guest, while expressing his gratitude, remarked however that British physics as such does not exist, because physics is an international discipline which clearly reflects the collective character of scientific creativity and progress towards discovery of the secrets of nature. The observation is completely correct (it is necessary, by the way, to mention that under the term "British physics" is meant physics in England, which is worked on by scientists who live in the British isles!). The more reason for us to be proud of the flourishing achievements of Soviet physics, which has rich and distinctive traditions, both dating back to our fatherland's pre-revolutionary past and to the period of existence of the multinational Soviet government. Typical of Soviet physics are also the new directions in research, which have first appeared here in the USSR and have become part of the stock of the world's physics and set a trend in it.

Soviet Physics is justly proud of its successes and looking back on the whole journey traveled by it from the historic day of the pronouncement of the Soviet government, we see the constant creation of new physics centers everywhere in the territory of our country, their distribution on the map of our fatherland is a certain special "physical geography" of the USSR.

With every year, the scope of projects undertaken by Soviet science is growing. In a summary report of the Central Committee of the Communist Party of the Soviet Union, the 24-th Congress of the Communist Party of the Soviet Union, General Secretary L. I. Brezhnev specifically elaborated on the modern problems of the science and technology revolution and the further unification of science with production, on the acceleration of scientific-technological progress, and on the means of realizing it. "In an era when science assumes an increasingly greater role as a direct productive force, it is no longer its individual achievements that are important, no matter how brilliant they be, but the high level of all production", the speech says, "this imposes even more responsible tasks on our science. It demands improvement of its effectiveness, further development of basic research, concentration of forces and the attention of scientists on the most important and long-term directions for scientific-technological progress. Scientific research and design organizations and pilot plants are called upon to develop more thoroughly methods for a new technology and for new technological processes to be introduced in the national economy. The tasks before the Government Committee on Science and Technology, the Academy of Sciences, and the ministers are increasing."[8]

Soviet physicists make their own weighty contribution to the construction of communist society in our country. They face the 50th anniversary of the Soviet government with an awareness of the immensity of the tasks standing before science in our country.

[8] L. I. Brezhnev, "Summary Report of the Central Committee at the 24th Congress of the Communist Party of the Soviet Union" (in Russian), Moscow, Politizdat, 1971, pp. 68-69.

Translated by J. G. Adashko