

FIFTY YEARS OF "USPEKHI FIZICHESKIKH NAUK"

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THE first issue of the journal "Uspekhi Fizicheskikh Nauk" was published just 50 years ago, in April 1918.* Publication of this journal was one of the measures aimed at the development of physics in Russia after the revolution, which uncovered the widest prospects for the construction of science in the country. A very small group of physicists of all ages, operating at that time with tremendous enthusiasm, in spite of the technical difficulties and hard living conditions, using the long-range state inducement by the Communist Party and the Soviet Government, without literally losing a minute, "rolled up their sleeves" and proceeded to the most important matter of the development of modern physics in Russia. Among the most active organizers of physics of the older generation was P. P. Lazarev, the Director of the first Research Physics Institute in the country without teaching functions,† who, while not so old in years, occupied a leading position in the Russian science even before the Revolution. Besides the organization of the Institute, Lazarev's initiative was instrumental in the creation of scientific literature, and one of the results of this initiative was the organization of the revue "Uspekhi Fizicheskikh Nauk" (Advances in Physical Sciences), and it was precisely the words "physical sciences" in the plural which emphasized that the journal will be devoted to reviews of current problems not only in physics but in related sciences. In the revolutionary foreword to the first number we read: "... an unfavorable condition hindering rapid development of scientific activity in Russia is the paucity of literature on current problems of physics, so that the young people who embark on a scientific career are unable to follow the progress of either Russian or international science ... Being a review journal and including articles written by specialists, "Uspekhi Fizicheskikh Nauk" will contain, in addition, abstracts of journal articles, bibliography, and a personalia division."

The present generation can hardly imagine the difficulties entailed in the publication of the journal during those hard times. In the article devoted to the publication of the last number of the 75th volume of this journal (containing the index of articles of all 75 volumes), D. I. Danin described this with brilliant words, exactly representing the conditions under which our journal began its half-century existence: "Publication was of such a journal, so remote in its academic character from the severe needs of the revolutionary daily existence, in 1918, a most difficult period for the revolution, may seem like a miracle. Shots in streets, frozen laboratories, life of hunger, and the optimistic idea of reporting on the progress of scientific studies of nature!"

*The first issue of the journal is marked: "Printing completed 29 April 1918"

†See my article "Fifty Years of Soviet Physics" Usp. Fiz. Nauk 93, 197 (1967) [Sov. Phys.-Usp. 10, 678 (1968)].

Detachment from life? Haughty arrogance? No, this was faith in the revolution. Faith in the future. Devotion to science. And unselfish and inexhaustible enthusiasm of the group of Moscow physicists headed by the Academician Professor P. P. Lazarev ...

The journal devoted to continuous reporting of all the news concerning the physical exploration of the world was launched during the most promising time of history, and was born for a long life."*

The appearance of this journal made a strong impression. The isolation of Russia from the world's science, resulting from first World War and subsequent intervention and blockade, was still strongly felt. Moreover, the lack of influx of new literature and other difficulties caused a year to elapse between the publications of the first and second volumes of the journal. But then, the second volume, containing two issues, was overfilled with material enthralling any one interested in physics. A large article by P. Z. Épshtein "The Use of Quantum Science in the Theory of Spectral Series" constituted a valuable monograph, presenting the complete picture of the development of the "old" quantum mechanics: quantization of systems with several degrees of freedom after Sommerfeld, relativistic theory of the fine structure of hydrogen lines, theory of the Stark effect (developed by P. Z. Épshtein himself), general considerations on the structure of phase space—all this was contained in the first article in a concise but exceedingly clear exposition. The next article, by P. P. Lazarev, was devoted to the investigation of the then puzzling phenomenon—the Kursk magnetic anomaly, the study of which occupied the author. Further, in a large article, V. K. Frederiks reported, for the first time in Russian, the principles of the general theory of relativity. This was followed by an abstract prepared by G. S. Landsberg on the first observation of the deflection of a light beam in the sun's gravitational field in accordance with results of an expedition during the solar eclipse of 1919—an event which is included among the greatest sensations in the history of science. Both last articles were devoted to a field which aroused unprecedented passion among those dealing with the purely scientific problems of relativity theory, and brought to the forefront the deepest philosophical questions concerning space and time. This was followed by a translation of Rutherford's Baker lecture "Nuclear Structure of the Atom," where he described in detail, besides the main concepts of the nuclear structure of the atom, also his experiments in which the nuclear reaction of nitrogen with an alpha particle (then called transmutation of elements) was realized for the first time. Although interest and the excitement caused by these papers were only slightly less intense than the excitement produced by

*D. Danin, 75 Volumes of Optimism (On a Journal Born the Year after the Great October Revolution), Nauka i zhizh' (Science and Life) No. 11, 73, (1962).

relativity theory, no one thought that these papers represent the start of a new era in the history of humanity—the start of the nuclear century with its frightful danger of nuclear war, on the one hand, and with the occurrence of an infinite number of peaceful applications of nuclear energy on the other, including new, nuclear power, and the attractive prospects of obtaining energy almost gratis as a result of thermonuclear fusion.

An article by the present author described experiments by Aston, who proved the existence of isotopes of ordinary (i.e., non-radioactive) elements, and discussed the significance of the "integer rule" established by Aston for the study of the structure of the atomic nucleus.

Besides the foregoing articles, which described new sensational triumphs of physics, of which we, isolated by the war and by the subsequent blockade from the rest of the world received only incomplete data, the second volume contained also other valuable articles, for example an article by Academician A. N. Krylov "Outline of the History of Establishment of the Basic Principles of Mechanics," an article by P. P. Lazarev "The Main Psychophysical Law and Its Modern Formulation," a very large number of abstracts of individual articles, reports of new books, and much other interesting and valuable material.

It is difficult to imagine the impression produced, especially on the periphery, by these two books of the second volume, which greatly exceeded in size the first volume. Since that time, the journal appeared systematically, changing sometimes its format and frequency, until its modern "scale" was finally established—twelve large issues, forming annually three solid volumes of approximately up to 800 pages each, i.e., 2400 pages annually.

It can be stated with assurance that the journal occupied a fitting position in the world's scientific literature in physics; the number of references to it in original papers printed in other journals is large. However, to us in the Soviet Union, it played an important role, which can not fail to be noticed here at the occasion of such an important date as its 50th anniversary. Remaining within this sphere of dry facts, it should be recognized that the launching of this journal was a matter whose full importance to the country can be assessed only now, fifty years later. Indeed, to develop advanced science in the country, i.e., to solve the problem faced by the Communist Party and the Soviet Government, it was insufficient just to greatly broaden higher education and to organize large research institutes, particularly in the field of physics. It was necessary to make accessible on time and exhaustively all the new accomplishments of science to the young people who were being trained in the universities and worked in the research institutes. In the case of physics this was a particularly important and difficult problem, because this very science has been advancing at a tremendously rapid rate, discarding all customary so-called "common sense" concepts and replacing them by new concepts, which could not be mastered easily. The Soviet reader kept in touch with this entire historically tremendous revolution, with all the dizzying discoveries occurring in physics and sciences related to it, by the issues of "Uspekhi Fizicheskikh Nauk," which were

published practically without interruption during all fifty years.

We are reminded perforce of the time of establishment of the new (as it was then called) or simply quantum mechanics (as it is called now). With beating heart, and sometimes with great excitement, the physicists of my generation, and even of some following generations, read in "Uspekhi" the translations of articles of the founders of the quantum mechanics—Heisenberg, Schrödinger, Bohr, Dirac, as well as articles by Soviet theoreticians, who explained or discussed these new theories. In the 20's and 30's, that which students now learn from text books, could be found only in the original papers (which were accessible to few), or in the "Uspekhi" articles; "Uspekhi" was in a manner of speaking a giant all-union seminar, in which many thousands and tens of thousands future physicists and engineers earned about physics and related specialties.

Of course, I quoted quantum mechanics only as an example. There was no problem or trend in Soviet or world's physics which was not explained in the pages of our journal. Nuclear physics and nonlinear oscillations, elementary particles and solid state with its mechanical, electric, and magnetic properties—it is meaningless to list them all, since we are referring to all of contemporary physics. There was no active Soviet physicist who did not publish in "Uspekhi," starting with the founders of Soviet science Ioffe, Lazarev, Rozhdestvenskiy, the first rank of the then young physicists Vavilov, Kurchatov, Kapitza, Semenov, Tamm, Frenkel, and Fock, and ending with their students and students' students.

The revolution that started in physics 65 years ago—with the time of "creation" of Planck's energy quantum—continues to this very day. Striking experimental discoveries, such as the Mossbauer effect or the development of lasers, have handed the researcher unusually powerful and just as extraordinarily subtle means of penetrating into the nature of physical phenomena. Artificial earth satellites, automatic space stations, and flights of astronauts have extended our concepts of the universe to an unprecedented degree. Astronomy, which could only recently study the surrounding world only through the narrow slit of the optical spectrum, now has at its disposal a wide range of radio waves, x-rays, gamma rays, cosmic rays, and even neutrinos—surprising particles which have neither mass nor charge and have an amazing penetrating power. No less exciting results were obtained in the most important and most expensive (in the literal sense of the word) region—in the field of elementary particles. Only recently, physicists were quite disturbed by the rapid growth of the number of newly discovered "elementary" particles and the apparent chaos of their properties. But now we are beginning to discern outlines of a regular and orderly classification, which made it possible to predict the existence of one more particle (called omega-minus), which completes a regularly constructed group—the decuplet of elementary particles. This particle has by now been discovered—an event analogous to a considerable degree to the prediction of new elements on the basis of the Mendeleev periodic system and the subsequent discovery of these elements.

An entire new world of phenomena was discovered as

a result of the creation of quantum electronics. Physical optics, almost filed away and forgotten, received a new lease on life as a result of the possibility of studying nonlinear phenomena, studies whose importance of which was emphasized long ago by S. I. Vavilov, but the access to which was discovered only now as a result of the legendary light intensities obtainable from lasers. All these and many other phenomena, facts, and theories, which can not and need not be listed here, since they cover all of modern physics, are reported in the pages of "Uspekhi." Any one who proceeds to study a new field or needs a reference, will always find a number of required articles in the pages of this journal. "Uspekhi Fizicheskikh Nauk" is a unique encyclopedia of modern physics, which reflects at the same time not only a modern state of the problem, but also its development during the last 50 years.

In this connection, it is well to recall that review articles have in recent years assumed a much greater role than at the launching of "Uspekhi." At the same time, the relative value of these articles to the system of scientific literature has changed.

The rapid growth of this literature is well-known. By way of illustration we present the following figure: the number of bibliographic units reported in Referatsionnyi Zhurnal, Fizika (Abstract Journal, Physics) in 1966 exceeded 50,000, and of course continues to increase. In fact, the number of these "units" pertaining to physics is much larger, since in accordance with the character of the organization of the Soviet Abstract Journals, many papers published in the physics journals are abstracted not in the "Fizika" Series but in many other series of the abstract journal (mechanics, chem-

istry, astronomy, etc). Under these circumstances there is no doubt that machine search for scientific information will be intensively developed in the nearest future. Although the computer can in principle provide within a very short time a bibliography of scientific papers on any question, given a reasonable classification and indexing of the published papers, this still does not solve the problem completely, since a study of all these papers frequently requires too much time and labor, and furthermore labor which is far from always productive. Therefore well-prepared reviews, which present all the facts and theories in a concrete field in its place, and give a complete picture of the status of any problem at a given instant, are absolutely essential at the present stage of the development of science. It is important, of course, that these reviews have a critical character, and not be a mechanical set of abstracts of papers pertaining to the subject of the article. It is precisely such reviews which "Uspekhi Fizicheskikh Nauk" publishes.

The history of scientific literature shows that journals and scientific annals are created, reach full development, but ultimately go over into a lower branch of the life curve and die out. As to "Uspekhi," we can note with satisfaction that in spite of its half century of existence, our journal is still on the rising part of its vital activity. This is particularly helped by the influx of new young forces, which have joined the editorial staff in recent years. This gives us a right to count on at least one more half century of full blooded existence of the journal, created during the first year of the greatest revolution in the history of humanity.

Translated by J. G. Adashko