Petr Efimovich Spivak (on his eightieth birthday)

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Petr Efimovich Spivak was born on 29 March 1911. He occupies a special place which belongs exclusively to him in our country's experimental nuclear physics. Having graduated from the famous Leningrad Physicotechnical Institute and having absorbed the traditions and methodology of scientific creativity of such outstanding scientists as A. I. Alikhanov, L. A. Artsimovich and I. V. Kurchatov, P. E. Spivak already at the earliest period of his scientific activity which coincides with the prewar years and is associated with the investigation of cosmic rays proved himself to be a highly gifted and original physicist. Together with M. S. Kozodaev he then essentially laid the foundation of our country's nuclear electronics: the unique developments of low-noise linear amplifiers of pulsed signals, of the first scaling circuits, and also (and few know about this) the creation independently of Russia of the first tube-based coincidence circuit, which all remained unpublished and, undefended by any kind of author's cerificates.

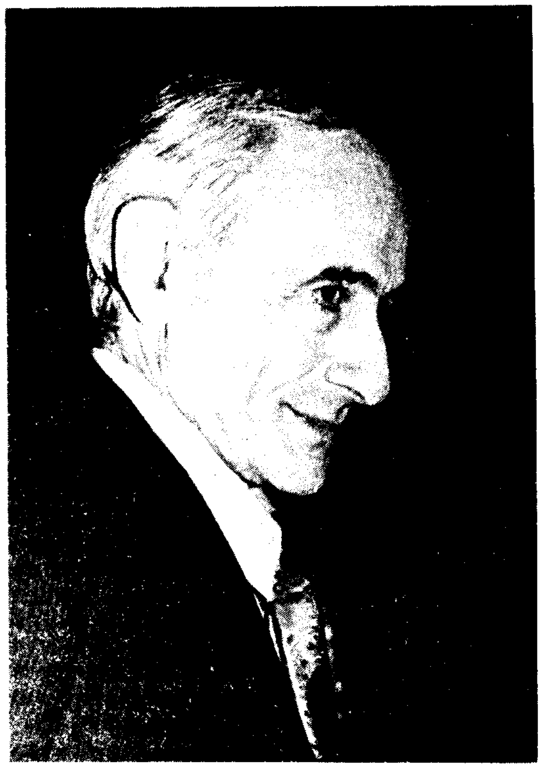
At the same time appeared the first results of the developments of P. E. Spivak in the field of technology of nuclear-physics experimentation: he invented and cooked special vacuum sealants—the "Spivak sealants", constructed elements of high vacuum technology, created original proportional counters, multiwire "carpets" of Geiger counters etc.

Heading in 1943 on the invitation of I. V. Kurchatov the science sector in the famous Laboratory No. 2, P. E. Spivak soon began preparations for conducting an experiment on discovering the decay of the free neutron, and also of experimental investigations designed to search for a finite neutrino mass. These two directions remained the principal ones in the scientific work of P. E. Spivak in the course now of more than forty-five years.

The results of his work over many years on the beta-decay of the free neutron are most widely known and have been generally acknowledged throughout the world. Essentially P. E. Spivak and his collaborators (A. I. Sosnovskiĭ, Yu. A. Prokof'ev, *et al.*) succeeded already in 1949 to observe for the first time the phenomenon of neutron decay, and only the conditions of secrecy in which at that time all the work on nuclear physics was being carried on, led to the fact that these results were published only at the International Conference on the Peaceful Utilization of Atomic Energy in Geneva in 1955, and therefore a portion of the discovery of this fundamental process is usually ascribed to Snell and Robson.

During three decades of persistent work in the laboratory P. E. Spivak carried out several measurements of the half-life of neutron decay with ever increasing accuracy, and the latest results of these unique investigations gave a value of $T_{1/2}$ with an error of 1%, and it is specifically about this value that the data obtained in recent years in the number of investigations of other authors are grouped.

In 1962 for the experimental investigations of the beta-decay of the free neutron P. E. Spivak and Yu. A. Prokof'ev were awarded for the first time since its inauguration the I. V. Kurchatov Prize and Gold Medal.



PETR EFIMOVICH
SPIVAK

Neutrino physics always attracted Spivak's burning interest, and in the course of all his life he again and again returned to thoughts of mounting different experiments directed to the search of methods of recording and studying the properties of this amazing particle. Spivak's colleagues remember that long before the first publication by Reines and Cowan that appeared in 1953 he began planning an experiment close to their idea with the aim of discovering neutrinos using a reactor. The project developed on his initiative and with his participation in the seventies of a unique pulsed source of reactor neutrinos "RING" became widely known but unfortunately never realized. At the same time and under his direction an extensive program of research on neutrino physics was developed, which became the foundation of this entire direction of investigations that have been successfully carried out at the I. V. Kurchatov Institute of Atomic Energy in the course of the last 15 years. P. E. Spivak devoted many years of his life to the problem of neutrino mass. Already in 1947 he undertook the first attempts to obtain tritium in a reactor and to prepare a tritium source for

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carrying out a search of anomalies near the end of the beta spectrum.

Along the long and difficult, and occasionally dramatic path to this goal P. E. Spivak succeeded in finding solutions to a large number of most complicated experimental problems such as the creation of an electrostatic beta-spectrometer with energy resolution of approximately 1 eV, a cardinal suppression of background overloading of the beta-detector brought about by the presence of high voltage within the vacuum volume of the installation, and many others. At the present time the accumulated experimental experience and the results attained in these investigations are utilized in a new large installation created at the Institute of Nuclear Research at the Academy of Sciences of the USSR with the participation of P. E. Spivak the aim of which is the search for neutrino mass in the region of masses down to several electron volts.

A special place in the scientific output of P. E. Spivak is occupied by a set of investigations on measuring neutron constants in the fission of isotopes of uranium and plutonium and other elements that are important for practical problems of nuclear energetics.

These investigations were started in 1948 on the suggestion of I. V. Kurchatov. The experimental data obtained in those years by P. E. Spivak and his collaborators on the multiplication of thermal, epithermal and fast neutrons on being captured by the ^{235}U, ^{233}Pu and ^{239}Pu nuclei were an important contribution to the search being conducted under the guidance of I. V. Kurchatov of the ways of producing new systems of atomic reactors and breeders. It is of interest to note that the values of the constants for multiplication by thermal neutrons measured with an accuracy unequaled in those times have survived tests by time, remaining for many years among the most reliable data in the physics of nuclear fission.

In the process of carrying out this set of investigations a new method was created based on the use of a graphite prism and new methodology was developed for measuring small relative variations of current in ionizations chambers with an accuracy at the level of 10^{-5} which was record-setting for that time. In conjunction with this a solution was found for the first time to a problem important for neutron metrology of precision absolute standardization of neutron sources. This set of investigations was in 1953 awarded the State Prize of the USSR.

A considerable response in the scientific community was evoked by the papers of P. E. Spivak and his collaborators in the sixties after the discovery of the nonconservation of parity in the weak interactions, in which measurements were carried out of the longitudinal polarization of electrons in the beta-decay of a number of nuclei. A first-class experiment based on double Mott scattering of electrons was carried out with the greatest mastery and record-setting accuracy and showed that in some cases the longitudinal polarization of electrons differs appreciably from v/c, which until now has no unambiguous theoretical interpretation.

Finally it is necessary to mention also those numerous incomplete investigations in which the multifaceted talent and the bright creative signature of P. E. Spivak is evident. All this and the preparation for measuring the e/m ratio for electrons and positrons, and the attempt to discover the appearance of a magnetic field from rotating masses in the course of which P. E. Spivak created unique electronic amplifying systems with a bandwidth of a fraction of a Hertz; this and the study of the possibility of accelerating a bunch of plasma running along "tracks" in a magnetic field, and the beginning of development in the seventies of a new direction associated with ultracold neutrons, in the process of which P. E. Spivak found new technical solutions of the problem of creating intense sources of ultracold neutrons and the spectrometry of ultracold neutrons, and also proposed an original method of "gravitational containment" of ultracold neutrons stored in a vessel without using any valves (this method has been utilized in a recent paper on the measurement of neutron lifetime carried out at the Leningrad Institute of Nuclear Physics of the Academy of Sciences of the USSR on an installation named "Kovsh" ("Ladle")).

The unusual capacity for working and the demands made on himself and on those surrounding him, the lack of compromise in discussing scientific and technical problems have long ago attached to Spivak the fame of an "iron spring"; the amazing intuition, distinctiveness and originality of his creative thought, and also the complete mastery of different techniques created for him the fame of a wizard of physics experiment, a wizard who is capable both of producing with his own hands an ultrathin organic film, and also to create an installation with the highest attainable high vacuum, and to solve, for example, the problem of the most subtle mechanisms of the origin of background in a detector, and either to suppress it, or to find a reliable method of determining it with high accuracy.

And when one wonders with whom Petr Efimovich could be compared one thinks of such Titans of experiment as R. W. Wood and P. N. Lebedev.

Today P. E. Spivak is full of vigor, energy and plans: he is preparing a new experimental installation for measuring the neutron lifetime aiming at an accuracy of $+3$ s and at the same time participates in carrying out a unique experiment in searching for neutrino mass.

We wish to dear Petr Efimovich many more years of health, active scientific creativity and great successes.

Translated by G. M. Volkoff