Iosif Solomonovich Shapiro (on his seventieth birthday)

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On 13 November 1988, the eminent Soviet theoretical physicist and corresponding member of the USSR Academy of Sciences, Iosif Solomonovich Shapiro, was 70 years old.

I. S. Shapiro was born in Kiev in the family of a civil servant. In 1926, he moved to Moscow together with his family. Having graduated with distinction from middle school, he began his studies in 1936 at the Moscow State University (MGU) Faculty of Physics. His graduation in 1941 from the university (in the Physical Optics Department) coincided with the beginning of World War II. After completing his military training, I. S. Shapiro fought in the field artillery in the Central and the First Belorussian fronts. After demobilization and the completion of additional schooling in nuclear physics at MGU, I. S. Shapiro began his career in science, working from 1945 at MGU, from 1958 at the Institute of Theoretical and Experimental Physics, and from 1981 at the P. N. Lebedev Physics Institute of the Academy of Sciences.

The most strongly expressed characteristic of I. S. Shapiro's creative individuality, which determined his whole scientific creativity, is the intrinsic internal independence of his scientific viewpoints from the prevailing hypotheses, which are fashionable at a given moment. I. S. Shapiro is a bright representative of the physics style of thinking, when understanding of a problem is at first attained in the "language of phenomena", drawing widely on analogies from various areas of physics, and not in the language of formulae. Along with this, his physics intuition is combined with a mastery of a powerful mathematical apparatus, and his breadth of scientific vision is combined with concreteness of results, which are directly related to the observed phenomena, thereby stimulating the development of experimental work. A deep understanding of physics theory structure, originality in his choice of study topic, and boldness in solving the posed problems are characteristic of I. S. Shapiro.

I. S. Shapiro began his career in science under the direction of I. M. Frank, as an experimenter. He constructed the first triggered Wilson cloud chamber in this country, for research in the areas of cosmic rays and nuclear physics (1946). I. S. Shapiro's first published paper, completed together with I. M. Frank in 1948, was devoted to the experimental study of the composition of the horizontal component of cosmic radiation at sea level.

Preparing for his candidate examinations, I. S. Shapiro devised and solved a problem—the calculation of the internal conversion coefficients with pair production for nuclear transitions of arbitrary multipolarity (JETP, 1949).

A number of theoretical results obtained by I. S. Shapiro are connected with the symmetry properties of space-time.

In 1955, he obtained an expansion of the relativistic wave function in terms of states, with a definite four-dimensional angular momentum, which form a unitary infinite representation of the Lorentz group. It was later generalized by mathematicians for multidimensional spaces. Shapiro's transformation is used for the separation of variables in relativistic equations, in scattering theory, and in the relativistic problem of bound states (currently quite urgent).

IOSIF SOLOMONOVICH SHAPIRO

In 1956–1965, I. S. Shapiro carried out studies regarding the nonconservation of spatial parity. He was among the first to realize the possibility (at that time appearing to many quite doubtful) of nonconservation of parity, as well as the significance of this fact for nuclear physics. I. S. Shapiro was the first to calculate the probability for various effects of the nonconservation of parity in the interaction of muons with nucleons and nuclei. I. S. Shapiro's papers set in motion a series of experimental investigations both in this country and abroad (CERN, UK, USA, Canada—TRIUMF, and Switzerland—SIN).

I. S. Shapiro's work on enhancement of nonconservation of parity in nuclei occupies a special place. He predicted that, owing to a number of specific properties of medium and heavy nuclei, the weak effects of the nonconservation of parity in nuclear forces, amounting to only 10^{-7} of the strong interaction, may increase to a level accessible to experimental observation. This work initiated the carrying out in the Institute of Theoretical and Experimental Physics of experiments which were the first to demonstrate the weak interac-

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tion of nucleons and its strengthening in the nucleus. This direction of study, the impetus to the development of which was given by I. S. Shapiro, subsequently proved to be extremely fruitful. The point is that several factors for the increase of nonconservation of parity in an atomic nucleus can act jointly with each other and increase the effect by even a million times. An increased nonconservation of parity, amounting to a value of the order of 10%, was observed in recent years in the Neutron Physics Laboratory of the Joint Institute for Nuclear Research at Dubna. The effect which appeared at one time to be vanishingly small, has now become visible to the unaided eye.

A significant place in the work of I. S. Shapiro is occupied by the solution of problems which link the physics of processes within the nucleus with the physics of elementary particles. In 1961 he proposed and then developed a new approach to the theory of direct nuclear reactions, based on a nonrelativistic analog of field diagram technique. This led to pointing out effective methods for the identification of the mechanism of reactions and the recovery of information about an elementary event from nuclear data. It is difficult to imagine contemporary physics of nuclear reactions, especially at high energies, without a diagrammatic apparatus. This work gained international recognition, and has found its way into textbooks.

A completely new field of the physics of elementary particles was opened by I. S. Shapiro's work on the theory of interaction for slow antinucleons with nucleons. In 1969 he formulated the idea of the existence of pseudonuclear systems, consisting of a baryon and an antibaryon. I. S. Shapiro and his collaborators subsequently studied numerous observed phenomena resulting from the strong nuclear baryon-antibaryon attraction at low energies. This work stimulated the construction at CERN of a unique low-energy antiproton storage ring (LEAR), and the development of experiments at this installation. Studies in this area are closely tied to the work of I. S. Shapiro and his pupils. The pioneering role of this work is widely recognized. The attention of the largest centers of high-energy physics was drawn to a new direction in the study of antimatter properties. Recently obtained experimental results at CERN (in 1986–1987) convincingly confirmed the predictions of the theory of the characteristics of baryon-antibaryon nuclear interaction, which lead to exotic phenomena (for example, to a sharp angular anisotropy of scattering at very low energies).

I. S. Shapiro's interest in the usage in theoretical physics of a mathematical apparatus that was new to it, in particular topology, led him to work in a new subject area. In 1986–1987, he developed for nuclear material (neutron stars, heavy nuclei) a theory of triplet Cooper pairing with a strong spin-orbital coupling, having examined the physical properties of various superfluid phases and their possible observable manifestations. These results were used, in particular, for explaining the nature of the recently discovered high-spin states of heavy nuclei.

I. S. Shapiro's own interest in the origins of revolutionary scientific ideas which had a "difficult fate", that is, at first not being accepted, and then "upsetting the world", prompted him to an in-depth study and interpretation of the history of physics. Many people read with interest his article "The history of the discovery of the Maxwell equations" in Uspekhi Fizicheskikh Nauk (1972), which was translated into a number of foreign languages. I. S. Shapiro delivered a series of lectures at the Institute of Theoretical and Experimental Physics and the P. N. Lebedev Physics Institute of the USSR Academy of Sciences on the history of science (non-Euclidian geometry, the law of conservation of energy, "The mathematical origins of Isaac Newton's natural philosophy").

Much of I. S. Shapiro's time and energy is given over to organizational scientific activity. At his initiative and under his direction, several thematic international seminars on nuclear physics were conducted (in 1967, 1970, and 1973), with the participation of eminent Soviet and foreign scientists. At I. S. Shapiro's initiative, the Moscow Engineering-Physics Institute School of Theoretical Nuclear Physics was organized in 1970. As a vice-chairman of the Scientific Council of the USSR Academy of Sciences for physics of the atomic nucleus and as a member of the Bureau of the Nuclear Physics Section of the USSR Academy of Sciences, I. S. Shapiro at the present time takes an active part in the organization of periodically convened all-Union conferences on nuclear physics, and in the coordination of scientific research in this field. The weekly seminar on nuclear theory, chaired by I. S. Shapiro for about twenty years, is well known among nuclear physicists.

I. S. Shapiro is a member of the editorial board of the well-known international journal "Nuclear Physics. Ser. A (Intermediate Energies)". For many years he was a member of the editorial board of the journal "Letters to the Editor of Zhurnal Eksperimental'noi i Theoreticheskoi Fiziki (JETP Lett.)".

I. S. Shapiro devotes a great deal of attention to the development of scientific manpower. Since 1946 he has been lecturing at the leading physics institutions of higher education. For more than twenty years, he has been a professor at the Moscow Engineering-Physics Institute. Lectures on various sections of theoretical physics, delivered by him with great pedagogical mastery, are the basis of several textbooks.

Among I. S. Shapiro's students there are now famous specialists, doctors, and candidates of science.

Iosif Solomonovich's students and those closely acquainted with him know well the integrity and firmness of his character, the quickness of his responses in scientific discussions, and his lasting enthusiasm for theater.

I. S. Shapiro greets his birthday full of creative energy and new scientific projects. Heartily congratulating Iosif Solomonovich on his seventieth birthday, we wish him good health, prosperity, and new creative achievements in his many-sided scientific career.

Translated by R. S. Prokop