Samuil Markovich Osovets (Obituary)

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Samuil Markovich Osovets, a prominent specialist in the field of plasma physics, doctor of physico-mathematical sciences, recipient of a Lenin prize died on June 3, 1983.

S. M. Osovets was born in Khar'kov on May 20, 1911. At the age of 15 he entered the factory school of the Khar'kov electro-mechanical factory (KhEMF), and in September 1930 he was admitted, in the category of workers, to the Khar'kov electro-technical Institute from which he graduated in 1935. Upon graduation from the Institute Osovets worked at the same KhEMF where he at first was involved in problems of regulating powerful traction motors for the first electric locomotives made in our country, and later he was involved in the construction of electrical systems of stabilizing shipboard guns. In 1936 he joined the Communist Party.

When World War II began Osovets in July 1941 left for the front. He took part in the battle of Stalingrad, commanding a unit of antiaircraft guns, and in the battle at the Kursk sector in the summer of 1943. For his active service Osovets was awarded the Order of the Red Star and the medal "For the Defense of Stalingrad." In April 1944 after being severely wounded he was demobilized and after recovery he began working in the All-Union Electro-Technical Institute where he participated in defense research. In 1946 Osovets defended his candidate thesis and was appointed as a lecturer in the Artillery Academy.

The year 1948 turned out to be a watershed in the scientific biography of Osovets: he made the transition from the engineering, essentially electro-technical research, to the study of problems in atomic physics.

One of the main tasks of the "atomic problem" was the production in macroscopic quantities of the highly enriched isotope uranium-235 which is a nuclear fuel. Among the different methods of isotope separation which were being developed at the time the electromagnetic method gave small quantities of the enriched product, but immediately produced a high concentration of the light isotope. In 1948 Osovets became involved in work on the atomic problem and immediately devoted his attention to the very important problem: the investigation of the stability of ion beams of uranium in an electromagnetic separator. These investigations were necessary in order to obtain highly focussed beams of the separated uranium isotopes. A successful completion of the whole complex of problems of electromagnetic separation was achieved in 1951.

In 1950 began the search for the solution of one of the most global and inspiring problems of the century—that of controlled fusion of light nuclei, a problem which in the event that a successful solution is obtained promises to make available an unlimited source of energy.

This work was started by a small group of physicists—both experimental and theoretical. Osovets became one of

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the active members of this small group. During the first stage of the investigations the principal attention was directed to an exhaustive study of the phenomenon of z-pinch—the compression of a filament of deuterium plasma which occurs in the case of a powerful pulse discharge under the action of the magnetic field produced by the current itself. The fantastically unexpected results that were obtained, first of all the discovery of neutron radiation from the plasma, which, as further experiments had shown, was not of thermonuclear origin, inspired the participants in these investigations. It is noteworthy that the first correct interpretation of the dynamics of the self-constricting plasma filament was given in the famous Leontovich-Osovets equation. In 1958 a Lenin prize was awarded to the group of participants in the work on the z-pinch and Osovets was among them.

As the work on controlled fusion was expanded and as the front of scientific investigations was broadened Osovets's interests turned to a number of new ideas. We are referring to the dynamic action on the plasma filament of high frequency fields; in particular he proposed the theory of dynamic stabilization of plasma. In the course of further ex-

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periments, of which S. M. Osovets was an active organizer and participant, the discovery was made followed by a detailed investgation, of the so-called "drag current" arising in a plasma under the action of a travelling electromagnetic wave. This phenomeon continues to occupy the attention of physicists both in our country and abroad, since it, in principle, offers the possibility of constructing a steady-state reactor—a tokamak in which the current can be maintained by a noninductive method. This series of investigations was summarized by S. M. Osovets in an excellent review published in Usp. Fiz. Nauk in 1974.

During the last fifteen years some problems of physiology have become firmly established among the scientific interests of S. M. Osovets. He became interested in the applications of the theory of nonlinear oscillations to the explanation of processes in living nature. In making his choice Osovets selected the most complicated one—oscillatory processes in the human organism. After spending several years in studying and thinking over the problem he started working on a specific problem—the occurrence of pathological oscillatory regimes in the system controlling posture and movement. In the paper "On the resonance nature of hyperkinesis in the case of Parkinson's disease" at the 4th International Biophysics Congress (1972) this serious illness was explained as a case of parametric excitation in the structurally simple reflex circuit approximately described by the Mathieu equation. It should be noted that Japanese scientists independently obtained some of the results of this paper only seven years later.

After that Osovets began to study processes occurring in the central nervous system in cases of epilepsy. It turned out that they can also be investigated as a nonlinear resonance with such characteristic phenomena as frequency division in an electroencephalogram, amplitude growth by abrupt jumps, etc. . A further development of these investigations was a series of papers and articles on the nature and functional role of an electroencephalogram itself (Usp. Fiz. Nauk, 1983). The discovery of the fact that a dynamic system can become a generator of random processes which was made in 1971 by Ruelle and Takkens made possible the development of a structural dynamic model and the explanation with the use of the very simple technique of the Wilson-Cowan equations of a number of phenomena which prior to that were not clear. In particular these phenomena are associated with such fundamental functions of the brain as the processing and storing of information.

It should be noted that in such fields as the functioning of memory and control over it at present there is not a single working hypothesis deserving confidence. Therefore each new contribution in this domain is significant. The thoughts expressed in the latest papers of S. M. Osovets open up the possibility of further investigations.

No matter what problem Osovets posed for himself his thoughts on the subject were always distinguished by plastic clarity.

In the memory of all those who knew him Samuil Markovich Osovets will remain a man of great original talent, kindness and ready sympathy. His whole life and scientific activity are firm testimony to this.

Translated by G. M. Volkoff