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OBITUARY

In Memory of Semen Samoĭlovich Moiseev (November 23, 1929–June 5, 2002)

Professor Semen Samoĭlovich Moiseev, a well-known theoretical physicist; a prominent Russian scientist in the fields of plasma physics, theory of turbulence, and processes of self-organization in nonequilibrium media; and a principal researcher at the Institute of Space Research of the Russian Academy of Sciences died in his 73rd year on June 5, 2002, after an extended illness.

S.S. Moiseev was born on November 23, 1929. After graduating in 1952 with honors from Kharkov State University (KSU), he worked as a teacher in Slavyansk and Poltava. However, his inquisitive intellect craved new knowledge. Therefore, in 1960, he moved to Novosibirsk, where he began to work in the field of controlled fusion research at the Institute of Nuclear Physics of the Siberian Division of the USSR Academy of Sciences. There, he obtained pioneering results, which were reported at the largest international conferences and were the basis for his candidate's and doctoral theses. Among those results, it is worth noting the solution of the problem of anomalous Bohm diffusion in fusion devices, the studies on low-frequency instabilities in inhomogeneous plasmas and transformation of electromagnetic waves in nonsteady and inhomogeneous plasmas, and the development of principles of novel plasma diagnostics based on the generation of higher harmonics in plasma resonance layers.

It should be noted that the versatile scientific activity of Moiseev resulted in the development of a number of important directions in plasma physics, hydrodynamics, and nuclear energetics. His works, which were always in the vanguard of scientific research, gained worldwide recognition in the scientific community.

In 1968, Moiseev moved to the Kharkov Institute for Physics and Technology (KIPT). There, he further developed his earlier studies on plasma stability and plasma heating as applied to beam–plasma systems and proposed new, original ideas in other fields of plasma physics, among them, a model of the nonlocal transfer of electromagnetic signals in inhomogeneous plasmas (the effect of kinetic transparency of wave barriers), new mechanisms for the generation of electromagnetic radiation associated with the wave conversion in the presence of plasma density gradients, the focusing and channeling of radiation in a plasma, and the resonant-cone effect in the excitation of electromagnetic waves by small-size sources. He also developed new approaches to the theory of strong hydrodynamic turbulence and to the formation of nonequilibrium power-law distributions of charged particles in collisional media. The results of these studies were published in Reviews of Plasma Physics and Usp. Fiz. Nauk (Sov. Phys. Uspekhi). For these results, which were very important for practical applications, Moiseev received a series of inventor's certificates. For works on the kinetic transparency of wave barriers in a plasma, Moiseev and his colleagues were awarded the 1979 Ukrainian SSR State Prize in Science and Technology.

In 1980, Moiseev began to work in Moscow at the Institute of Space Research of the USSR Academy of Sciences. There, he developed new approaches toward increasing the efficiency of absorption of high-power laser radiation in an inhomogeneous plasma via the channeling and self-focusing of laser beams. The results of his long-term studies on the mechanisms for the generation of electromagnetic radiation in a plasma were published in the monograph *Nonequilibrium and Resonant Processes in Plasma Radiophysics* (Nauka, Moscow, 1982), written together with his colleagues. For his research in plasma physics, Moiseev was awarded the 1987 USSR State Prize in Science and Technology.

Simultaneously, he worked in the field of hydrodynamics. An important result of these investigations was the discovery of a helical mechanism for the generation of large-scale tropical vortices. This made it possible to develop a new approach to the important problems of

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forecasting hurricanes, typhoons, and extratropical cyclones and monitoring cyclogenesis zones. Based on these theoretical results, two expeditions to the Pacific Ocean were organized to carry out in situ measurements in the zones of intensive cyclogenesis. The theory developed at the Institute of Space Research allowed Moiseev to elaborate a system of physical precursors and indicators of tropical cyclones. These studies laid the theoretical foundations of the contemporary methods for forecasting large-scale crisis processes in the atmosphere, such as typhoons and extratropical cyclones. The experimental data from the expeditions showed that these indicators may be abnormal fluctuations of the background atmospheric parameters, such as infrasonic activity, the dynamics of fractal parameters, and the helicity of atmospheric turbulence. Later, he and his pupils investigated this field of research in more detail: they analyzed the formation of non-Kolmogorov turbulent spectra, examined the structural properties of hydrodynamic turbulence and the mechanisms for helicity generation, and studied the influence of turbulence helicity on the particle and energy transport. In essence, he founded a new line of investigation—the helical dynamics of nonlinear media. The results of his studies in the fields of plasma physics and hydrodynamics were published in the monographs *Nonlinear Instabilities in Plasmas and Hydrodynamics* (IOP, Bristol, 1999), written together with V.N. Oraevsky and V.G. Pungin, and *Turbulence and Structures. Chaos, Fluctuations, and Helical Self-Organization in Nature and the Laboratory* (Academic, New York, 1999), written together with H. Branover, A. Eidelman, and E. Golbraikh.

Along with these studies, Moiseev, together with his colleagues from KIPT and KSU, prolonged investigations of nonequilibrium power-law particle distributions in solid-state plasmas and developed the principles of their applications for direct and more efficient nuclear-to-electric energy conversion. In particular, based on theoretical and experimental results, they proposed a new secondary-emission radioisotope current source, which has obvious advantages (with respect to the efficiency, lifetime, environmental safety, etc.) in comparison with available nuclear batteries. The creation of a prototype of such a battery will stimulate the development of prospective future technologies of fabricating multilayer thin-metal-film structures.

In recent years, Moiseev investigated very interesting chiral effects, which play an important role, e.g., in producing new materials with unusual electrodynamic characteristics. These studies are related to another promising area of investigation—the electrodynamics of bianisotropic media.

For his major contribution to science and the training of qualified specialists, Moiseev was awarded the title of an Honored Scientist of the Russian Federation.

Due to Moiseev's talent for intuiting new, promising directions in physics, his works stimulated a number of new lines of investigations, which have been further developed by his pupils and colleagues. Many of his results were confirmed experimentally and gained worldwide recognition. Although Moiseev was a theorist, he always tried to initiate the experimental testing of the results obtained.

His style of work, kindness, sociability, respect for the scientific opponent's opinion, and striking spiritual power deeply impressed those around him. Under his supervision, many of his pupils have defended doctoral theses, achieved great success, and gained wide recognition in the scientific community. Now, they constitute Moiseev's scientific school, continuing the studies initiated by him and developing his ideas.

Moiseev spent a great deal of time and energy on the development of international collaboration. He worked at various renowned science centers, such as the MHD Research Center of Ben-Gurion University (Israel) and the Nieuwegein Institute of Plasma Physics (Netherlands). For a long time, Moiseev convened one of the sections of the General Assemblies of the European Geophysical Society; he was a member of the organizing committees of several large international conferences.

The memory of Semen Samoĭlovich Moiseev, a scientist caught up in his work; a skillful organizer; an exclusively reliable person; and a modest, friendly, kind, and cheerful man with a sense of humor will always remain in the hearts of his friends, colleagues, and pupils.

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