

## *Preface*

# **Professor S. S. Moiseev – some facts from his biography and scientific activity stages**

This special issue of “Nonlinear Processes in Geophysics” is devoted to the memory of Prof. S. S. Moiseev, a well-known scientist in the world scientific community, who left us in 2002. In connection with the 75th anniversary of his birthday, the International Conference “Mode conversion, coherent structures and turbulence” was held in November 2004 at the Space Research Institute of RAS (Moscow, Russia). Reports related to the main topics of S. S. Moiseev’s researches were presented at this meeting.

It is well known that S. S. Moiseev dedicated the last years of his life to the solution of a large class of geophysics problems. That is why the “Nonlinear Processes in Geophysics” have made a decision to prepare a special issue devoted to Prof. S. S. Moiseev’s memory, which should include papers on geophysical problems. These papers should represent both a kind of generalization of S. S. Moiseev’s results and their further developments, in particular, connected with the hydrodynamic turbulence spectra, the coherent structure generation, the influence of helicity on geophysical medium dynamics, for example, on the large-scale magnetic fields excitation in the Earth core, and so on.

Let us mention the most important facts of both S. S. Moiseev’s life and his scientific activity. The development of S. S. Moiseev as a scientist started in the period from 1960 to 1967, when he was working under R. Z. Sagdeev’s supervision in G. I. Budker Institute for Nuclear Physics of the USSR Academy of Sciences (Novosibirsk, Russia). There he investigated the theoretical problem of plasma stability in thermonuclear devices. The results obtained allowed him to defend his PhD and Doctor of Science theses.

In 1967 S. S. Moiseev moved to Kharkov (Ukraine), to the Physico-Technical Institute of the Ukrainian Academy of Sciences. There, working in Ya. B. Fainberg’s Department, he carried out plasma theory studies; in particular, he investigated the stability of plasma-beam systems and the electromagnetic waves generation in the latter. Simultaneously, he was studying the processes of non-equilibrium charged particles distributions formed under the forcing of powerful energy sources with the application of this research results to the elaboration of a new type of radioisotope sources of current with an enhanced efficiency of the nuclear energy conversion into the electric one. He also performed the studies of the mode conversion processes in inhomogeneous, non-



**Fig. 1.** Prof. S. S. Moiseev.

stationary and nonlinear media. At this period of S. S. Moiseev’s life, the area of his scientific interests broadened and included the problems of nonlinear dynamics of coherent structures and turbulence generation in hydrodynamics.

In 1981, on the invitation of Academician R. Z. Sagdeev, he came to Moscow, to the Space Research Institute (SRI) of the USSR Academy of Sciences. At SRI he became a leader of the researches of nonlinear processes in geophysics related to the theory of turbulence, structures generation, natural crisis processes forecasting and helical dynamics. In the course of these researches, the mechanism of large-scale instability development in the near-equatorial atmosphere conditioned by the presence of intense small-scale helical turbulence was discovered. On the basis of estimates performed for tropical atmosphere parameters, it was proven that such instability can make a significant contribution to the rise of powerful vortices, such as tropical cyclones (TC). On the initiative of S. S. Moiseev, sea research expeditions to the Pacific Ocean regions were organized in order to study the atmosphere characteristics at the stages before typhoons formation. These measurement data confirmed that before TC formation, an enhanced intensity of atmospheric

helical motions was observed. Thus, the data obtained testify to the helical mechanism of large-scale vortices generation. Theoretical and experimental studies performed have allowed S. S. Moiseev to formulate and substantiate the physical system of indicators and precursors of large-scale natural catastrophes.

Simultaneously, S. S. Moiseev continued working on the non-Kolmogorov regimes of hydrodynamic turbulence excited by an external random force. It was shown that the structural properties of the external force correlator determine the spectrum of turbulent pulsations generated. He also conducted the studies of passive admixture transport processes in the presence of non-Kolmogorov turbulence. He studied the influence of mean helicity on turbulence energy transport from large- to the small-scale region, where the viscous dissipation occurs. S. S. Moiseev investigated the possibility of the negative viscosity effect appearance in geophysical processes. These investigations are also connected with the problem of hydrodynamic drag reduction (in a gas or liquid flow around bodies) stipulated by vortical structures generation in boundary layers.

The helicity effects studied by S. S. Moiseev in hydrodynamics were further generalized by him to the cases of plasma and magnetics.

It is of great interest to mention the series of works initiated by Prof. S. S. Moiseev and related to the study of the chirality influence on plasma-like media stability and their dynamics. In the last years of his life, S. S. Moiseev investigated the possibilities of the chiral effect manifestations in the geophysics, in particular, he presented a number of lectures related to this topic at the EGS and EGU General Assemblies. It is necessary to note that S. S. Moiseev participated very actively in these events, for example, being more than once a convener of sessions concerning nonlinear and turbulent processes in geophysics.

For his outstanding contribution to the scientific researches development and important results obtained, Prof. S. S. Moiseev was conferred high awards and titles, namely, the Ukrainian Republic State Prize of 1977 in the field of science and technique, the USSR State Prize of 1987 in the field of science and technique, the Distinguished Scientist of Russian Federation, the honorary member of the Russian Academy of Astronautics, the Russian outstanding scientist grant, the medal in honor of the 850th anniversary of Moscow, four medals from the Astronautics Federation of Russia.

Besides around 280 papers published in scientific journals, S. S. Moiseev had also published three following monographs (where one can find references to his main papers):

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Below the reader can see the list of some of Prof. S.S. Moiseev's basic papers related to the hydrodynamics and geophysics, which clearly demonstrate the scope of his scientific interests and his contribution to these sciences

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