

Mikhail Yakovlevich Marov (on his 90th birthday)

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July 28, 2023 was the 90th birthday of Academician of the Russian Academy of Sciences (RAS) Mikhail Yakovlevich Marov, the outstanding Soviet and Russian scientist in the field of mechanics and physics of space, astrophysics and planetary studies, and mathematical simulation of cosmic and natural media.

Mikhail Marov was born in 1933 in Moscow. His father, Yakov Semenovich Marov, was an active Komsomol and Party worker, secretary of the Party Bureau of the Moscow Electric Bulb Plant, and then one of the secretaries of the Stalin district committee. In 1939, he went as a volunteer to Khalkhin-Gol and then participated in the Finnish Campaign and the Great Patriotic War. He was badly wounded and died rather early. His mother, Maria Ivanovna Ignatova, graduated from the Stalin Institute of Physical Culture and Sports and worked all her life at the Department of Physical Culture and Sports at the Moscow Institute of Chemical Engineering. In the 1930s, she was a Moscow sports gymnastics champion. Mikhail's father and mother were always very busy, and Misha was brought up mainly by his maternal grandmother, Pelageya Andreevna, a deeply religious woman to whom Mikhail owed his first lessons in virtue and morality. During the hard war years, Mikhail, his mother, and grandmother were in evacuation (first in Astrakhan and then in the Udmurt Republic), met with many hardships and privations, and survived by a miracle.

In 1952, M Ya Marov finished Secondary School No. 330 (the former Elizabethan Gymnasium) with a gold medal. The gymnasium retained many wonderful traditions of Russian education, including the study of the Latin language and Roman literature. Mikhail was fond of literature and engineering sciences. Here, he took to astronomy for the first time, got acquainted with the well-known book by Kamil Flammarion and some other popular publications, but developed a passion for astronomy only much later, coming to it through the cosmos, which became his focus throughout his life.

In 1958, M Ya Marov graduated with honors from the Bauman Moscow Higher Technical School (now Moscow State Technical University), where he was engaged in problems of nonlinear oscillations under the guidance of the well-known scientist and professor of classical mechanics, A N Obmorshev. In 1958–1962, M Ya Marov worked first in the atomic and then in the space-rocket field, where he graduated from the outstanding school of scientific research at the Obninsk Institute of Physics and Power Engineering and S P Korolev OKB-1. In 1962, on M V Keldysh's invitation, he began working in the USSR Academy of Sciences (and then RAS), where he has been working ever since.

Beginning in 1962, M Ya Marov headed the sector and then, in the period from 1967 to 2007, the Department of



Mikhail Yakovlevich Marov

Applied Mechanics, Aeronomy, and Planetary Physics of the M V Keldysh Institute of Applied Mathematics (IAM) RAS and was simultaneously an academic secretary (till 1978) of the Interdepartmental Scientific and Technical Council for Space Research (ISTC for SR) of the USSR Academy of Sciences, the most authoritative organ for planning, coordinating, and implementing scientific and applied work on space research, with M V Keldysh as chair and S P Korolev as vice-chair.

In 1964, M Ya Marov graduated from the postgraduate course and defended his candidate thesis. The supervisor of the postgraduate course and his candidate thesis was a remarkable scientist, one of the cosmic pathfinders, professor Valeryan Ivanovich Krasovsky, who trained many talented space researchers. Under his guidance, M Ya Marov carried out studies of the structure of and variations in the parameters of Earth's upper atmosphere, depending on the solar radiation intensity and geomagnetic activity, using the results of analyses of the evolution of orbits of artificial Earth satellites (AESs). In 1970, Mikhail Yakovlevich defended his doctoral thesis based on the results of measurements (on Soviet descent modules) of the Venusian atmospheric pressure and temperature and detailed investigations of the

planet's thermal regime and dynamics on this basis. Since 1977, M Ya Marov has been a professor, in 1990 he was elected a corresponding member of the USSR Academy of Sciences in the Division of Mechanics and Control Processes, and in 2008, a full member of RAS in the Division of Earth Sciences. Since 2007, M Ya Marov has been head of the Department of Planetary Studies and Cosmochemistry at the V I Vernadsky Institute of Geochemistry and Analytical Chemistry RAS.

M Ya Marov was a pioneer of space research in our country. He worked closely with M V Keldysh, S P Korolev, and members of the legendary Korolev Board of Design Managers, who provided the country's historical achievements in the first decades of the space era. His great Teacher was M V Keldysh, with whom he worked for nearly 20 years. Under his guidance, M Ya Marov took an active part in organizing and implementing the many-year program of space research in the USSR and in the investigation of planets of the Solar System. As one of the scientific leaders (project scientists) of these planetary missions, he played the leading role in the preparation and realization of studies of the Moon, Venus, and Mars on Moon-planetary automatic robotic vehicles designed at G N Babakin KB. The soft landings on the listed planets, which were the first in the world, made provision for the leading position of our country in space. The above-mentioned culmination period of domestic space exploration with a detailed analysis of technical characteristics of spacecraft and flight strategy was presented in a unique monograph, *Sovetskie Roboty v Solnechnoi Sisteme. Tekhnologii i Otkrytiya (Soviet Robots in the Solar System. Mission Technologies and Discoveries)*, written by M Ya Marov jointly with his American colleague W T Huntress (Fizmatlit, 2nd edition, Moscow, 2017). The tag line of this book, issued first in the English language (Springer-Praxis, 2011), is the title of the first chapter: "First on the Moon, first on Venus, and first on Mars."

M Ya Marov and his colleagues were the first in the world to perform direct measurements in the atmosphere and on the surface of Venus and Mars. He was awarded the 1970 Lenin Prize for revealing Venus's atmospheric parameters.

M Ya Marov made a great contribution to working out the system of measures for solving the complex problem of providing operability of the Venera landing units on the planet's surface at high environment temperatures and pressures, which made it possible to transmit to Earth the first black-and-white and then color Venus surface panoramas and to measure the elemental composition of surface rocks. These achievements, marked by the USSR State Prize, are unique and have never been repeated anywhere in the world. He participated in implementing flights to Halley's comet and Mars's satellite Phobos, in particular, in the examination of nongravitational perturbations in the comet's motion due to sublimation from the icy nucleus, and in the study of thermophysical properties of the lunar ground brought from the Moon's surface. At the present time, M Ya Marov is taking an active part in work on promising projects of detailed investigations and Moon exploration on the basis of the new generation of spacecraft, and is supervising work on cosmogonic problems and the examination of extraterrestrial substance from the unique meteorite collection of GEOKHI RAS.

Along with the outstanding experimental studies of the Moon and planets, M Ya Marov implemented a suite of theoretical investigations on the key problems of radiation

mechanics, geophysical hydrodynamics, turbulence of inhomogeneous media, and the kinetics of nonequilibrium processes in application to space exploration. He made a fundamental contribution to the development of a new branch of planetology and space physics—planetary aeronomy. A large series of studies is devoted to the migration of planetesimals, asteroids, and comet nuclei in the Solar System, which suggested the important role of exogenous sources of water and volatile substances in the origin of Earth's oceans and the presence of ancient oceans on Venus and Mars. He analyzed the formation and early evolution of the Moon and its relation to the formation of Earth. He developed the fundamental conceptions of V I Vernadsky's theory concerning biosphere, biogeochemistry, and the origin of life and their contribution to the development of astrobiology and the comprehension of the modern concept of noosphere.

M Ya Marov has published personally and in co-authorship about 300 papers in reviewed scientific journals and over 20 monographs in leading Russian and foreign publishing houses. Among them is *Kosmicheskie Issledovaniya (Space Research)* (together with M V Keldysh, Moscow: Nauka, 1981); *Planety Solnechnoi Sistemy (Planets of the Solar System)* (2nd edition, Moscow: Nauka, 1986) (the book was translated into German and Spanish and reissued in 2021 in URSS publishing house under the rubric Masterpieces of Popular Scientific Literature). His book devoted to one of the most topical branches of modern astronomy, *Ekzoplanety. Fizika, Dinamika, Kosmogoniya (Exoplanets. Physics, Dynamics, Cosmogony)* (together with I I Shevchenko) has been published quite recently (Moscow: Fizmatlit, 2022). Also published were excellent reviews in the journal *Uspekhi Fizicheskikh Nauk* (see *Usp. Fiz. Nauk* **175** 668 (2005) [*Phys. Usp.* **48** 638 (2005)]; *Usp. Fiz. Nauk* **188** 233 (2018) [*Phys. Usp.* **61** 217 (2018)] (jointly with V I Shematovich); *Usp. Fiz. Nauk* **190** 897 (2020) [*Phys. Usp.* **63** 837 (2020)] (with Shevchenko); *Usp. Fiz. Nauk* **193** 2 (2023) [*Phys. Usp.* **66** 2 (2023)] (with S I Ipatov)).

The works of M Ya Marov, systematized in the cited sources, contain an in-depth description of physical and chemical processes in space and key natural mechanisms on planets and comet nuclei. At the same time, they contribute to a closer integration of space research with mechanics, computational mathematics, and Earth sciences.

In his wonderful popular scientific books, M Ya Marov presents in an entertaining style the most urgent problems of modern astronomy from the physics of planets, exoplanets, and astrobiology to the physics and evolution of galaxies and cosmology. His excellent book, *Kosmos. Ot Solnechnoi Sistemy Vglub' Vselennoi (Cosmos. From the Solar System Deep into the Universe)* (Moscow: Fizmatlit) went through three editions (2016, 2018, 2021) and continues wonderful domestic traditions of popularizing astronomy laid down by our outstanding predecessors B A Vorontsov-Vel'yaminov and I S Shklovsky.

M Ya Marov successfully combines scientific work with organizational activity, actively participating in the work of Russian and international scientific organizations. He is a member of the Bureau of the RAS Space Council, chair of the RAS commission for the study of the scientific heritage of K E Tsiolkovsky, deputy chair of the Scientific Council of RAS on Astrobiology, editor-in-chief of the scientific journal of RAS, *Astronomicheskii Vestnik. Issledovaniya Solnechnoi Sistemy (Solar System Research)*, and a member of editorial

boards of several international scientific journals. He was elected an academician of the International Academy of Astronautics and a member of the British Royal Astronomical Society and was elected president of the Division of Planetary Sciences (Division F) of the International Astronomical Union. He is head of the Space Heritage Working Group of the UNESCO World Heritage Committee (WHC).

M Ya Marov is a talented pedagogue and a professor at Lomonosov Moscow State University (MSU) and the International Space University (ISU, Strasburg). He takes an active part in propagating scientific knowledge, giving talks, delivering lectures, and contributing to printing publications. His brilliant popular scientific lectures, with their special clear and convincing style, always produce an ineffaceable impression on the audience.

The scientific merits of M Ya Marov and his contribution to space research have been marked by high state awards and prestigious national and international prizes. He is a laureate of the Lenin Prize, the USSR State Prize, and the Demidov Prize. He received the International Galaber Prize in Astronautics, the Prize of the International Academy of Astronautics, the Alvin Seiff Prize for pioneering planetary research, the NASA (USA) Diploma for the leading role in Solar System research, and the William Nordberg medal of the international committee on space research (COSPAR) for his great contribution to scientific and applied space research. He has been awarded the Orders of Honor, Friendship, the Red Banner of Labor, and Aleksandr Nevsky, as well as medals. He was awarded the M V Keldysh Gold Medal of RAS "For outstanding scientific work in the field of applied mathematics and mechanics, as well as theoretical research on space exploration."

With his creative activity, excellent human qualities, and superior scientific results, Mikhail Yakovlevich has earned the great respect of his colleagues. It should be noted that he has a broad scientific outlook, the brilliant talent of a researcher, and the ability to find optimal approaches to solving difficult scientific and organizational problems.

Colleagues and friends of Mikhail Yakovlevich heartily wish him health, happiness, and new creative achievements on his remarkable day.

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