

Valerian Il'ich Tatarskii (on his 90th birthday)

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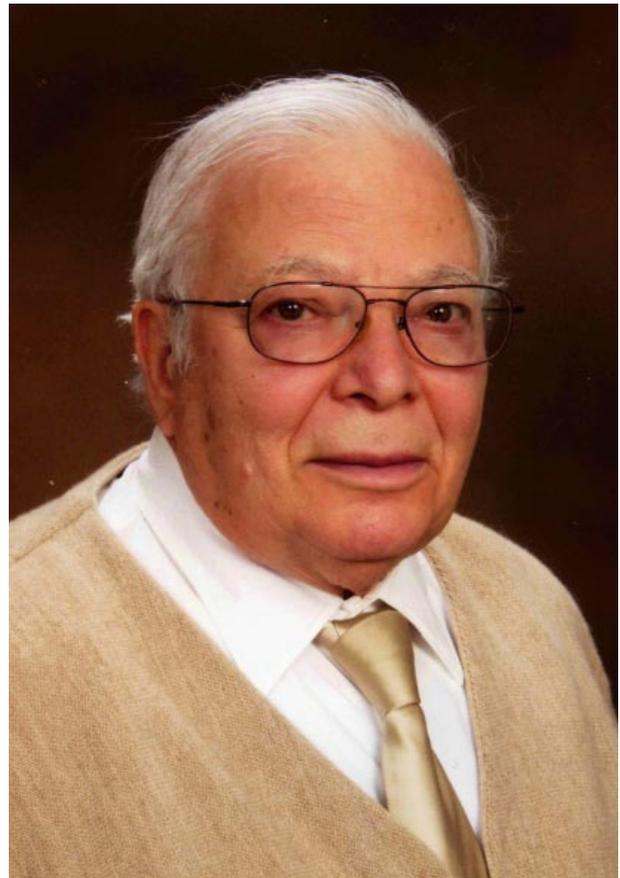
October 13, 2019 was the 90th birthday of Valerian Il'ich Tatarskii, a prominent physicist and a corresponding member of the Russian Academy of Sciences.

V I Tatarskii is world renowned and acknowledged for his fundamental contributions on the theory of wave propagation in randomly inhomogeneous media. The results of these studies have been applied to of fundamental problems of turbulence and organized structures in the lower, middle, and upper atmosphere. The asymptotic formulations obtained by V I Tatarskii are widely used to solve applied problems of long-range radio communication and radio navigation, to estimate the influence of atmospheric turbulence on laser radiation propagation and on the image of astronomical objects in telescopes, to develop methods and systems of adaptive optics, scintillometry, and acoustic and radioacoustic ground-based sensing of the atmospheric boundary layer and satellite radio occultation of Earth's and other planets' atmospheres.

Valerian Il'ich Tatarskii was born in Kharkov. His father was an engineer and in the 1920s–1930s took part in building many large industrial enterprises in the USSR. For this reason, the Tatarskiis often moved from one place to another (his mother was a homemaker). Valerian went to school in Kharkiv and finished with a gold medal in Krasnoyarsk, where his family was evacuated from Kharkiv at the beginning of the war, together with the plant at which his father worked. Immediately after school, Valerian entered the Physical Faculty of Moscow State University (MSU).

While studying at the Physical Faculty of MSU (1947–1952), V I Tatarskii already became interested in the influence of turbulent inhomogeneities on sound propagation. This problem underlaid his diploma work, which he did under the guidance of Professor V A Krasil'nikov. On graduating from MSU, he went to work at the Geophysical Institute of the USSR Academy of Sciences at the Laboratory for Turbulence Research, where he continued working in this field under the guidance of A M Obukhov. V I Tatarskii significantly developed theories of sound scattering and propagation of acoustic and electromagnetic waves in random media, which were originally proposed by A M Obukhov in the 1940s–1950s, and covered a wider range of topics.

To solve these problems, V I Tatarskii modified and put to wide use the method of smooth perturbations proposed earlier by S M Rytov to solve the problem of light diffraction by ultrasound and then used by A M Obukhov to allow for diffraction in the propagation of acoustic and light waves in a turbulent medium. These results lay the basis for his



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candidate thesis and his monograph, “The theory of fluctuation phenomena upon wave propagation in a turbulent atmosphere,” published in 1959 and then abroad in English in 1961 (Tatarskii V I *Wave Propagation in a Turbulent Medium* (New York: McGrawHill, 1961)).

Continuing his work at the Institute of Atmospheric Physics, which split in 1956 from the Geophysical Institute, V I Tatarskii went on developing his approaches in the theoretical description of wave scattering and propagation in randomly inhomogeneous media using increasingly powerful mathematical methods. These approaches were reflected in his doctoral thesis (1964) and in the monograph, “Wave propagation in a turbulent atmosphere,” whose issue in English in 1971 (Tatarskii V I *The Effects of the Turbulent Atmosphere on Wave Propagation* (Springfield: National Technical Information Office, 1971)) became very popular among foreign specialists.

V I Tatarskii did not confine himself to purely theoretical studies, working fruitfully with his colleagues and experimentalists, in particular with A S Gurvich. He participated

directly in measurements and in planning measurements of statistical characteristics of signals propagating in a turbulent atmosphere and their subsequent interpretation. Such collaboration not only provided an experimental confirmation of the theoretical results obtained, but also led to new outstanding discoveries, such as saturation of strong fluctuations and the effect of amplification of inverse wave scattering in a randomly inhomogeneous medium.

In the late 1960s, V I Tatarskii, together with V I Klyatskin, worked out the so-called Markov process approximation in wave propagation problems, which made it possible to statistically describe waves in random media from a unified standpoint for regimes inaccessible to classical approaches. These studies were covered in the review, “Diffusive random process approximation in certain nonstationary statistical problems of physics” [*Usp. Fiz. Nauk* **110** 499 (1973); *Sov. Phys. Usp.* **16** 494 (1974)]. Further on, analytical and numerical solutions of the equations obtained were the subject of a large number of publications in world scientific periodicals.

V I Tatarskii has always had the surprising ability, on the one hand, to fearlessly use analytical methods from quantum field theory and, on the other hand, to find simple qualitative illustrations for the applied methods and to explain comprehensibly the results obtained with their help, even to a layperson. Perhaps this is the reason for the popularity of Tatarskii’s review, “The Wigner representation of quantum mechanics” [*Usp. Fiz. Nauk* **139** 587 (1983); *Sov. Phys. Usp.* **26** 311 (1983)], which after thirty six years is being read and cited all over the world.

The pedagogical talent of V I Tatarskii fully came to life in the second volume of the book (written by him together with S M Rytov and Yu A Kravtsov), *The introduction to statistical radiophysics*, issued in the USSR in 1987. When translated into English and edited in four volumes [Rytov S M, Kravtsov Yu A, and Tatarskii V I *Principles of Statistical Radiophysics* Vol. 1–4 (Berlin: Springer Verlag, 1989)], the book enjoyed worldwide popularity among physicists in very different fields. It remains important up to the present day.

The range of problems interesting to V I Tatarskii during the whole period of his creative activity was not limited to wave propagation in randomly inhomogeneous media. The list of his publications contains work on the theory of electromagnetic wave scattering by rough surfaces, statistical and adaptive optics, quantum statistics of photocounts, turbulence theory, mathematical and statistical physics, etc.

V I Tatarskii’s students highly appreciate him as a remarkable tutor and pedagogue who has gone together with them through all their successes and failures, has always been engaged in the discussion of the problems he stated, and has helped in their solution. At the same time, he demands that his students be self-sufficient and the quality of their research work correspond to the world level. Many of V I Tatarskii’s students and followers continue successful research activity in different fields of physics.

From 1978 to 1990, V I Tatarskii was head of a laboratory and then a department at the Institute of Atmospheric Physics of the USSR Academy of Sciences and from 1990 he was head of a department at the P N Lebedev Physical Institute of the USSR Academy of Sciences (FIAN).

In the early 1990s, V I Tatarskii was invited to the Laboratory of Wave Propagation of the National Oceanic and Atmospheric Administration (Boulder, Colorado, USA). In that period, his scientific interests began to encompass

problems occurring in the theory of radiowave scattering by a rough sea surface. He obtained and published some important results, applying both analytical and numerical methods for solving these problems. From 2006, he carried out research work in the company Radio-Hydro-Physics, LLC.

The scientific and public activities of V I Tatarskii included his duties as a member of the editorial board of the journal *Uspekhi Fizicheskikh Nauk* (1985–1996), vice editor-in-chief of the international journal *Waves in Random Media* (1991–1998), and a member of the editorial board of the international journal *Journal of Electromagnetic Waves and Applications* (2001–2008). V I Tatarskii is a corresponding member of the Russian Academy of Sciences (since 1976), a member of the Optical Society of America (since 1994), and a member of the National Academy of Engineering, USA (since 1994).

In 1990, for their scientific achievements, V I Tatarskii and his colleagues (A S Gurvich, V I Shishov, S M Rytov, V I Klyatskin, Yu A Kravtsov, and L A Chernov) were given the State Prize of the USSR “for the study of the basic laws of wave propagation through turbulent media.” The same year, he received a prestigious award from the American Optical Society—the Max Born Medal—“for his outstanding seminal contributions to the theory of wave propagation through random media, particularly optical propagation through atmospheric turbulence, as well as for his fundamental contributions to the fields of statistical and quantum optics.”

On the day of the 90th birthday of Valerian Il’ich, his friends and colleagues and those who have been lucky enough to know him wish him all the best on this remarkable date. We heartily wish him sound health and longevity.

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M E Gorbunov, V U Zavorotny, M A Kallistratova,
Yu A Kravtsov, V E Ostashev, L A Ostrovsky,
L P Pitaevskii, I M Fuks, I G Yakushkin*