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Chronicle

Academician Leonid Maksimovich Brekhovskikh – 100th Anniversary of the Birth

06.05.1917 – 15.01.2005

May 6, 2017 marked the 100th anniversary of the birth of Leonid Maximovich Brekhovskikh, widely internationally recognized outstanding Russian physicist, the founder of the scientific school of Ocean Acoustics, Doctor of Physics and Mathematics Sciences, Professor, Academician of the Russian Academy of Sciences.

L.M. Brekhovskikh was born on May 6th, 1917 in a large family of peasants in the village of Strunkino, the Arkhangelsk region in the north of Russia. In 1939 he graduated from Perm University. In the same year he entered the post-graduate course of the Lebedev Physical Institute of the USSR Academy of Sciences (FIAN), where he was led by academician M.A. Leontovich. In 1941 he graduated from the graduate school, defending his PhD thesis on the topic 'Scattering of X-rays in crystals'. After defending the thesis, Brekhovskikh was recruited to the Acoustical Laboratory of the Lebedev Physical Institute in the group of corresponding member of USSR Academy of Sciences N.N. Andreyev, who worked on creating methods and means of protecting ships from German acoustic mines. Brekhovskikh completed his doctoral studies of the Lebedev Physical Institute (1944–1947) by defending a doctoral dissertation on the theory of propagation of sound and electromagnetic waves in layered media (1947). In 1948, for a series of works, outlined in the thesis, he was awarded the N.D. Papaleksi Prize.

In 1946, Brekhovskikh, analyzing the results of the experiments of L. Rozenberg, N. Sigachev and B. Karlov, conducted in the Sea of Japan, discovered the phenomenon of an underwater waveguide (later called an underwater sound channel), which was comprehensively studied in his subsequent theoretical studies. These works were of fundamental importance for the entire development of underwater acoustics both from the point of view of the theory of wave propagation in the ocean and practical applications. Later it became known that American acousticians, while conducting classified works, simultaneously discovered the same phenomenon. In 1951, for a series of scientific research and practical developments, the team of the above-mentioned scientists, together with L.M. Brekhovskikh, was awarded a state premium of the 1st degree.

During the formation of ocean acoustics (late 40's and early 50's), L.M. Brekhovskikh developed a theory of propagation of radio and sound waves in layered media. In 1957 his monograph 'Waves in layered media' was published. Soon it was translated into English and Chinese languages and gained worldwide fame. This book is an encyclopedia on the theory of wave prop-

agation, and up to now it has been widely recognised by hydroacousticians and specialists in related fields.

Engaged in scattering problems, Brekhovskikh proposed a method for solving the problem of wave scattering on uneven surfaces with large irregularities in comparison with the length of the sound (or electromagnetic) wave – the so-called 'approximation of the tangent plane'. This method, also called the 'Kirchhoff method', is currently one of the most advanced methods for calculating sound waves on uneven boundaries.

L.M. Brekhovskikh became the first director of the Acoustics Institute of the Academy of Sciences of the USSR, formed in 1953 on the basis of the Acoustical Laboratory of the FIAN. At the Acoustics Institute, he created a laboratory of acoustical methods of ocean research and, together with I.E. Mikhal'tsev, organized the construction of specialized acoustic-oceanological research vessels 'Sergei Vavilov' and 'Peter Lebedev'. Brekhovskikh led the first ocean expeditions on these ships. He was the head of the Acoustical Institute until 1961 – the time of transfer of the Institute from the USSR Academy of Sciences into the industrial ministry. After he left the post of director, Brekhovskikh led the department of Ocean acoustics of the Acoustics Institute for almost twenty years. In 1953, L.M. Brekhovskikh was approved in the rank of professor and elected a corresponding member of the USSR Academy of Sciences. In 1968 he was elected a full member of the Academy of Sciences of the USSR, and in 1969 he became Academic Secretary of the Division of Oceanology, Atmospheric Physics and Geography of the USSR Academy of Sciences, which he led until 1991.

In 1970 in recognition of his scientific management of the development of the sonar complex 'Rubin', he was awarded the Lenin State Prize. In the same year LM. Brekhovskikh headed the conduct of the hydrophysical experiment 'Polygon-70' in the Atlantic Ocean at the r/v 'Akademik Kurchatov', which resulted in one of the largest discoveries of the 20th century in the Earth sciences – the 'synoptic vortex' in the ocean was discovered. This discovery radically changed the existing ideas about the dynamics of ocean waters. Continuation of work on this problem was the Soviet-American experiment POLIMODE (1977–1979).

The results of numerous experiments in the ocean at the research vessel 'Sergei Vavilov' and 'Petr Lebedev' were generalized by L.M. Brekhovskikh, his collegues and students from the Acoustics Institute (N.S. Ageeva, I.B. Andreeva, V.I. Volovov, Yu.Yu. Zhitkovsky, Yu.P. Lysanov, A.V. Furduev, R.F. Shvachko) in the book 'Ocean Acoustics' for which in 1976 the author's collective was awarded the State Prize.

In 1980 L.M. Brekhovskikh moved from the Acoustics Institute to the P.P. Shirshov Institute of Oceanology and headed there the Ocean Acoustics Department where he worked until his death in 2005. For years of research activity, he participated as a chief or scientific supervisor in 15 oceanological expeditions on research vessels: Sergey Vavilov, Petr Lebedev, Akademik Kurchatov, Dmitry Mendeleev, Academik Mstislav Keldysh, Academik Sergey Vavilov, Academik Ioffe, the main task of which was to study the propagation and scattering of sound in the ocean.

L.M. Brekhovskikh created an extensive school of students in the acoustics of the ocean. More than a dozen of them became doctors of sciences and a few dozen PhD (candidates). He gave lectures to students of the physical-technical and then physical faculty of the MV Lomonosov Moscow State University (1953–1966), from 1975 to 1997 headed the department 'Physics of the Hydrocosmos' of the Moscow Physico-Technical Institute. Much attention was paid to the regular holding, organized by him in 1980, the School-Seminar 'Ocean Acoustics', whose work is still ongoing.

L.M. Brekhovskikh published more than 200 publications devoted to various problems of acoustics and oceanology. He is the author of many monographs. In addition to the books 'Waves in layered media' (1957, 2nd edition – 1973), and 'Acoustics of the ocean' (1974), he was co-authored with the monograph: 'Theoretical foundations of ocean acoustics' (with Yu.P. Lysanov, 1982), 'Introduction to the mechanics of continuous media' (with V.V. Goncharov, 1982), 'Acoustics of layered media' (with O.A. Godin, 1989), 'Acoustics of inhomogeneous media' in two volumes (with O.A. Godin, 2007, 2009). In 1987 he published the popular scientific book 'The Ocean and Man: The Present and the Future'.

L.M. Brekhovskikh was elected a member of the Polish Academy of Sciences (1977) and a member of the National Academy of Sciences of the USA (1991). He received the highest international award for acoustics scientists – the Great Gold Medal of the Rayleigh Institute of Acoustics of Great Britain (1978). In 1986 he was awarded the International Prize named after A.P. Karpinsky, established for the outstanding merits of scientists in the fields of science, having special significance for the future of mankind. In 1996 he received Walter Munk Award. Since 1999 he was an honorary member of the American Acoustical Society.

In acknowledgement of his outstanding achievements in the development of Russian science and the training of scientific personnel in 1987, Leonid Maksimovich Brekhovskikh was awarded the title of Hero of Socialist Labour. He was awarded three Orders of Lenin (1971, 1975, 1987), the Order of the Red Banner of Labour (1963), the Order of Merit for the Fatherland III degree (1997), and many other valuable medals.

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