

Evgeny Evgrafovich Meshkov

Experimentalist Evgeny Evgrafovich Meshkov, a legend in fluid dynamics, died of natural causes in Sarov, Russia, on 1 March 2020. His name is attached to a phenomenon about which hundreds of papers are published annually in scientific, mathematical, and engineering journals.

Meshkov was born on 31 January 1937 in the Soviet Union, near the city of Sevastopol, Crimea. During his childhood, he saw the horrors of Nazi occupation. Only after the Great Patriotic War ended in 1945 was Meshkov able to begin his education. He passed school grades in rapid succession and in 1954 entered the Moscow Engineering Physics Institute, also known as the National Research Nuclear University MEPhI. He graduated in 1960 with a master's degree in engineering physics.

Over the next 50 years, Meshkov worked at the All-Russian Scientific Research Institute of Experimental Physics in Sarov, the famous "closed town" of Arzamas-16. He started there as a junior researcher in 1960, earned his PhD in physics and mathematics, and then continued as the head of the hydrodynamic laboratory until his formal retirement in 2009. During 2010–20, he was a professor at the Sarov Institute of Physics and Technology, where he conducted experiments, mentored students, and interacted with colleagues until the very end.

Meshkov's most celebrated work was his experimental discovery in 1969 of the instability of the interface between two fluids with different densities when they are impulsively accelerated by a shock

wave. The instability, predicted theoretically by Robert Richtmyer in 1960, is now known as the Richtmyer–Meshkov instability. It has a key role in a broad range of processes in nature and technology, including supernovae, plasma fusion, combustion, and nanofabrication. Meshkov's direct observation, which was made possible by the experimental methodology he developed in the mid 1960s, started a new era in experimental research of unsteady gas-dynamic flows. In conversations, Meshkov would recall those years as the most creative of his life.

In the 1970s and 1980s, Meshkov was involved in research in inertial gas-dynamic fusion. In 1982 he and his colleagues achieved the record value of $5 \times 10^{13} \text{ s}^{-1}$ for the neutron yield and the so-called ρR parameter of 0.8 g cm^{-2} in an inertial fusion facility. Meshkov also participated in research for underground weapons testing. Those studies led to the development of experimental methods for investigating material properties at high energy densities and profoundly influenced modern science and technology.

As an experimentalist, Meshkov had a remarkable gift for finding simple and elegant solutions to complex problems. That talent was best illustrated by a series of experiments on stability of air bubbles in water, which he designed and conducted in the 1980s to observe and diagnose fluid instabilities and interfacial mixing under conditions relevant to, for instance, supernova explosions. The unique data also display the subdiffusive character of fluid mixing in supernovae as predicted by the theory.

Meshkov had a great ability to get to the heart of a phenomenon, abstract and generalize it, and then lucidly obtain the essentials. That indispensable quality was exhibited in the jelly experiments, which he and his colleagues conducted in the 1990s to investigate properties of Rayleigh–Taylor instabilities and the interfacial mixing they cause—the sister phenomena of Richtmyer–Meshkov dynamics. The experiments enabled the study of fluid instabilities and interfacial mixing in a broad range of setups in tightly controlled environments. Through them, he and his team achieved record Reynolds numbers of about 3.2×10^6 and unambiguously observed the essentially interfacial and anisotropic character of Rayleigh–Taylor mixing. Although the results were surpris-



MESHKOV FAMILY COLLECTION

Evgeny Evgrafovich Meshkov

ing—canonical turbulence was expected—they were recently explained by group theory, which revealed that Rayleigh–Taylor mixing may exhibit order and laminarize. The effect of the accelerated shear on the laminarization of Rayleigh–Taylor mixing was the focus of Meshkov's research in the past few years.

Meshkov authored more than 300 scientific papers and technical reports, had more than 30 inventions and patents, and shared his unique expertise in his books on fluid dynamics experiments. From about 2000, he educated students and researchers, worked to increase international cooperation, and helped organize international conferences, including the series Turbulent Mixing and Beyond. His achievements were recognized by the international scientific community, and the government of Russia bestowed on him the Order of Friendship in 2011. He cared immensely for science, and he loved life and his family, collaborators, students, and friends. With his passing, science has lost one of its great minds and sensitive hands.

We are grateful to Evgeny Meshkov's family, friends, and colleagues for sharing with us their reminiscences of him.

Snezhana I. Abarzhi
University of Western Australia
Perth
Katepalli R. Sreenivasan
New York University
New York City **NY**

RECENTLY POSTED NOTICES AT www.physicstoday.org/obituaries

- Frederick Reif
24 April 1927 – 11 August 2019
- Bruno Eckhardt
25 March 1960 – 7 August 2019
- Fred Ribe
14 August 1924 – 19 June 2019
- Paul David Luckey
18 May 1928 – 1 April 2019
- Alfred E. Glassgold
7 August 1930 – 4 January 2019
- Frank Turkot
9 May 1931 – 27 October 2018