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Vladimir Il'ich Talanov (on his 80th birthday)

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We are paying tribute here to the 80th birthday, on 9 June 2013, of the outstanding Russian physicist Academician Vladimir Il'ich Talanov.

V I Talanov was born in the town of Gorky (now Nizhny Novgorod). On graduating from the Faculty of Radiophysics at the N I Lobachevsky Gorky State University in 1955, he continued his studies as a postgraduate student. Between 1957 and 1977, V I Talanov worked at the Research Institute of Radio Physics (NIRFI in *Russ. abbr.*). After the Institute of Applied Physics was established by the USSR Academy of Sciences (AS) in 1977, his entire future scientific career became inseparable from this Institute, where Vladimir Il'ich headed the Department of Nonlinear Oscillations and Waves, and later the Division of Hydrophysics and Hydroacoustics. In 1987, V I Talanov was elected Corresponding Member of the USSR AS, and in 1992 he was elected Full Member of the Russian Academy of Sciences. At present, V I Talanov is one of the councilors of the RAS.

When working on his first results, Talanov chose the line of inquiry in microwave electrodynamics. His supervisor was Professor M A Miller. Even these early papers clearly demonstrated one of the characteristic features of his scientific style — the tendency to obtain a rigorously analytical result and, at the same time, to implement the new experimental possibilities opened in consequence of his theoretical finding. In the second half of the 1950s, V I Talanov obtained analytical solutions to a series of problems linked to diffraction and excitation of surface electromagnetic waves; these results were the cornerstone of his PhD thesis defended in 1959. The theory of antennas with modulated surface impedance that he constructed subsequently allowed the staff members of NIRFI to design and manufacture high-efficiency pencil-beam emitters with frequency control of the radiation directivity pattern.

In the early 1960s, V I Talanov successfully applied the parabolic equation method to constructing the quasioptical theory of open resonators and waveguides. This was also the period when Vladimir Il'ich's scientific school began to mature, in which quasioptics — first linear, and then nonlinear — grew to be a kind of methodological foundation.

During the same 1960s, a particular actuality was gained by problems of nonlinear interaction and self-action of high-power optical radiation in various media, especially in connection with the advent of the laser. It was precisely this avenue of research that brought V I Talanov greatest satisfaction in those 'nonlinear years' when new areas of wave physics were rapidly appearing and maturing. He obtained a number of widely known results which formed the foundation of the theory of self-focusing of wave beams in media with cubic nonlinearity. Among them were self-similar solutions of the nonlinear parabolic equation (nonlinear Schrödinger equation) for such beams, a new class of invariant transformations, and an analogue of the virial theorem for this equation, the fundamental result concerning transverse instability of plane waves in a nonlinear media that is often referred to in publications as the B-integral criterion.

Vladimir Il'ich Talanov

V I Talanov submitted at that point and defended his Habilitation thesis based on a wide scope of research works on quasioptics (1967).

In parallel with results of high theoretical importance, V I Talanov and his colleagues achieved a number of priority-class experimental results in nonlinear optics. Virtually coincident with an analogous work of American researchers, he discovered the spectral continuum (supercontinuum) generation effect in the course of self-focusing of nanosecond light pulses in media with electronic nonlinearity (1970). Later on, in the mid-1970s, V I Talanov performed a wide scope of applied research on the propagation of high-power laser beams through atmospheric gases, which created the cornerstone of a new field in optics — nonlinear optics of the atmosphere. Experimental results obtained by researchers at

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Livermore National Laboratory (USA), published much later, fully confirmed the results obtained by V I Talanov's group at NIRFI.

The investigations into self-focusing phenomena for electromagnetic waves brought V I Talanov the Lenin Prize (as member of a group in 1991). A series of his papers in this area formed the basis of a monograph written jointly with S N Vlasov, *Self-Focusing of Waves* (1997). Later on, in the 2000s, they developed a method of wave equation decomposition that made use of pseudodifferential operators, allowing an analysis of the effects of self-focusing and of broadband beam modulation instability (in the angle and frequency variables).

In 1977, as the Institute of Applied Physics of the USSR Academy of Sciences (currently IAP RAS) was being set up, V I Talanov concentrated his attention on a new field of research, which became one of the key fields for the new institute, namely, wave processes in the ocean and methods of their diagnostics. Here another characteristic feature of V I Talanov's talent manifested itself — his ability to rapidly become master in a new field and to formulate the problems that would be the most important for achieving the goal.

One such challenge was then to identify physical mechanisms by which hydrodynamic processes deep in the ocean produce phenomena on the ocean surface. The adiabatic approach to solving the general problem of interaction between waves with essentially different time and space scales led V I Talanov and his students to developing a kinematic model of the effect produced by high-intensity internal waves on wind-generated surface waves. This model was later confirmed many times in natural experiments carried out by the staff of IAP RAS in various parts of the oceans and coastal waters, and to work out on this foundation new radiophysical methods of remote diagnostics of the surface layer of the ocean.

In parallel to this, V I Talanov made a considerable contribution to designing at IAP RAS a truly modern hydrophysical experimental base. He suggested an original principle of laboratory-scale modeling of oceanic stratification. The construction of an experimental laboratory tank based on this idea made it possible to design a unique facility, known as the Large Thermostratified Test Tank of IAP RAS, which started operations in 1991 after successful test runs in a number of smaller-scale laboratory tanks. V I Talanov and his younger colleagues used this facility (regarded as a unique facility of national importance) to complete a wide range of fundamental and application-scale projects for the physical simulation and diagnostics of wave processes in the upper layer of the ocean.

In the mid-1980s, V I Talanov played an important role in conducting at IAP a series of high-level applications-oriented programs in low-frequency acoustics of the ocean; this work generated unique experimental results and justified proposals for developing promising systems of acoustic illumination of the underwater environment. In this work, which at a first glance shared little with the experience of his earlier research fields, Vladimir Il'ich found a way to efficiently apply his rich quasioptical 'armory'. One of the important results was the theory of antenna synthesis that he developed for multimode waveguides, whose role in the ocean is played by underwater acoustic channels.

In 1989, V I Talanov received the Order of the Red Banner of Labor for research in hydrophysics and hydroacoustics and, in 1996, received the medal '300th Anniversary of the Russian Navy'.

Beginning in the mid-1990s, the experience with research and development in acoustical diagnostics of the ocean, which had been accumulated at IAP RAS, started to 'drift', on V I Talanov's suggestions, in the new direction of coherent seismoacoustics. The experimental results obtained in this area, including those of very recent years, seemed to point to developing the promising systems of seismoacoustic diagnostics with high spatial resolution, based on efficient radiophysical approaches, such as synthetic aperture techniques, phase measurements, and correlation processing of weak signals.

Since practically the very beginning of his research career, V I Talanov has combined research with teaching at his *alma mater*, viz. at the Faculty of Radiophysics in Nizhny Novgorod University, where he has delivered both a course of lectures on the general theory of electromagnetic field and an original course on asymptotic methods of wave theory. For nearly 30 years, Professor V I Talanov headed one of the leading units at the Faculty of Radiophysics — Department of Electrodynamics, thus having picked up the baton from this teacher, Professor M A Miller.

It would not be an exaggeration to say that Vladimir Il'ich Talanov is one of the brightest representatives of the Nizhny Novgorod school of radiophysics; for many a field in modern radiophysics, his contribution has proven to be critical. A profound understanding of wave physics in its most various manifestations, the ability to identify the major link in a new problem and to offer a decisive path to its resolution, his kindness and attention to the opinion of every party in a discussion make any talk with him exceptionally useful and stimulating.

Colleagues, students, and friends wish Vladimir Il'ich all the best from the bottom of their hearts and wish him good health, creative ideas, and many happy years of life.

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