

## *To the 75th Anniversary of the Birthday of Leonid BULAVIN*



On August 18, 2020, the outstanding Ukrainian physicist Leonid Anatoliyovych Bulavin turns 75 years old. As a rule, when emphasizing the importance of a person, a list of his titles is presented: Doctor, Academician, Laureate, and so forth. We do not need to do this because the Hero of the jubilee is among those persons whose deeds (outstanding scientific achievements and achievements as a Master) and individual uniqueness evidence for him.

After graduating from the Faculty of Physics of the T.G. Shevchenko Kyiv State University (KSU). (now the Taras Shevchenko National University of Kyiv) in 1967, L.A. Bulavin began his fruitful way to great science. He entered the graduate school at the KSU and went to work on his dissertation to the Joint Institute for Nuclear Research (JINR, Dubna). At the JINR Laboratory of Neutron Physics headed by the Nobel Laureate Il'ya Mikhailovich Frank, L.A. Bulavin performed his conceived experiment aimed at studying the self-diffusion near the critical point. At that time, the world-

famous scientist and a graduate from the Kyiv University Mykola Mykolayovych Bogolyubov was the director of the JINR. It was a desired school for the starting scientist because Dubna accumulated a large part of the domestic scientific elite and foreign scientists.

By transmitting slow neutrons, L.A. Bulavin began to study the gravitational effect that appears near the liquid-vapor critical point. Such a research was performed for the first time. It allowed the scale theory of critical phenomena, which appeared at that time, to be verified experimentally. It was a very attractive subject of research. The challenging character of the problem, as well as the attention of world-renowned scientists, favored the high level of performed works. At the same time, the communication with world-class scientists developed a general culture of Leonid Anatoliyovych, his democratic standpoint, and, which is especially important, a responsibility for the fulfillment of the tasks set before the researcher. For technical reasons, the IBR-30 reactor was stopped in 1973, and, by the decision of M.M. Bogolyubov and I.M. Frank, the experimental setup created by L.A. Bulavin at the Laboratory of Neutron Physics was transferred to the KSU.

The energetic young scientist returned from Dubna to Kyiv in 1973. He knew exactly what and how he would do in his life. His installation was transported to Kyiv and, in accordance with the agreement between the Academy of Sciences of Ukraine and the KSU, was arranged at the 4th horizontal channel of the WWR-M reactor at the Institute for Nuclear Research of the Academy of Sciences of Ukraine. So, weekdays filled with the inspired work and research started. Then there appeared articles aimed at determining the role of the collective transfer in self-diffusion processes in liquids and electrolytes. But they were not standard articles reporting on data experimentally obtained for the self-diffusion coefficients. In those articles, it was experimentally proved for the first time in the world literature that the collective contributions to the self-diffusion coefficient do exist and are significant, with their relative magnitude reaching 25–30%. It was a great success. Alas, we are talking about the events that occurred in the

second half of the 1980s, at the beginning of USSR's collapse. We think that, at other times, the author of those works – together with I.Z. Fisher, the first who theoretically developed the concept of collective transfer in fluids – would have been awarded honorary state and international awards.

Later, the ability to resolve the collective component in the self-diffusion coefficient played an important role in joint works carried out with the R.E. Kavetskyi Institute of Experimental Pathology, Oncology, and Radiobiology of the Academy of Sciences of Ukraine. Leonid Anatoliyovych put forward a hypothesis that the molecules in the bodies of healthy and sick persons make different contributions to the self-diffusion coefficient. Really, the experiment performed together with the scientists from this Institute confirmed this hypothesis. Furthermore, provided a proper drug treatment of the patients, the process of their recovery was observed at the cellular level.

Not less interesting was a result obtained by Leonid Anatoliyovych while studying the dependence of the self-diffusion coefficient of water molecules on the size of confined systems. Aerogel pores filled with water were used for this purpose. If the pore diameter was larger than 120 nm, the self-diffusion coefficient did not depend on system's size. But if the pore size was smaller, the self-diffusion coefficient decreased by a factor of three! In essence, it was the first experiment in the nanophysics of liquids.

In the late 1980s, L.A. Bulavin was elected the Head of the Department of Molecular Physics and, later, the Dean of the Faculty of Physics of the KSU. He excellently coped with a lot of tasks that fell on his shoulders. In particular, the scope of scientific issues studied at the Department was extended, and the number of its students increased. The authority of Leonid Anatoliyovych in scientific circles and the educational community was growing rapidly. In 1990, L.A. Bulavin organized a specialized scientific council for the defense of doctoral and candidate dissertations in the specialties of theoretical physics, thermophysics, molecular physics, and, later, biophysics.

Since the mid-1990s, L.A. Bulavin has organized regular international scientific conferences “Physics of Liquids: Modern Problems”.

In order to understand the depth of Leonid Anatoliyovych's thought, we will mention only two scientific problems that the physics of solutions and biophysics faced for many decades. As early as in the sixties of the last century, it was observed that the properties of the alcoholic solutions of electrolytes come to equilibrium only in a few days after the solution preparation. It seemed incredible and was subject to criticism and skepticism. Almost 40 years later, the physicists at the I.I. Mechnikov Odesa National University faced a similar problem. And Leonid Anatoliyovych made a decisive step: he became a scientific adviser of the Doctoral dissertation of one of the Odesa researchers. Was it risky? Of course, it was! But the problem has been solved.

Another problem seems to lie on the surface. Humans and all other mammals differ substantially, but they inevitably die, if the temperature of their bodies exceeds 42 °C. There arose a hypothesis that this fact is associated with the properties of water. Indeed, the careful purposeful research showed that the dwell time of water molecules changes drastically in the vicinity of 42 °C.

Those were only two examples of the jubilee person's triumph. Everything else was a hard diligent work, sleepless nights, and the belief that a correct interpretation of the problem would undoubtedly appear! The deed of Leonid Anatoliyovych Bulavin is successfully continued by his disciples at a lot of universities and research institutions in Ukraine and abroad.

*O.I. BILOUS, D.A. GAVRYUSHENKO,  
V.I. GARAMUS, V.YA. GOTSULSKYI,  
YU.F. ZABASHTA, M.P. MALOMUZH,  
V.V. KLEPKO, O.A. KYZYMA,  
V.L. KULINSKYI, M.P. KULISH,  
V.I. PETRENKO, YU.O. PLEVACHUK,  
V.V. RYAZANOV, V.M. SKLYARCHUK,  
V.I. SLISENKO, D.V. SOLOVYOV,  
O.V. CHALYI, K.O. CHALYI*