To the 75th Birthday of Professor Andrzej Jeżowski

This Special Issue honors the 75th birthday of Professor Andrzej Jeżowski, a renowned expert in the thermal conductivity of solids, especially cryocrystals and nanocomposites.

Professor Jeżowski is not only a leading scientist in his field but also a long-standing collaborator and close friend of the B. Verkin Institute for Low Temperature Physics and Engineering of the National Academy of Sciences of Ukraine (ILTPE NASU) in Kharkiv. He has been a committed advocate for Polish-Ukrainian scientific cooperation for many decades.

This issue is our way of expressing our deep gratitude to Professor Jeżowski for his significant contributions to science and his long-term participation in developing the journal.

Professor Jeżowski received his degree in physics from the University of Wrocław in 1975. He earned his Ph.D. in 1983 from the Institute of Low Temperature and Structure Research of the Polish Academy of Sciences (ILTSR PAS) in Wrocław, where he also completed his habilitation in 1991. In 1998, he was awarded the title of Professor of Physical Sciences by the President of Poland.

His entire professional career has been closely associated with ILTSR PAS. Since 1985, he has held key leadership roles there, serving as head of the Low Temperature and Superconductivity Group, and later leading both a department and a division. From 2001 to 2010, he was Deputy Director for Scientific Affairs, and from 2011 to 2022, Director of ILTSR PAS. Since 2023, he has been leading a laboratory in the Department of Low Temperatures and Superconductivity.

Professor Jeżowski has been or is a member of numerous national and international scientific organizations, including:

- Commission A1 of the International Institute of Refrigeration in Paris (2000–2020);
- The Editorial Board of Low Temperature Physics (since 2002);
- The Scientific Council of the Institute of Molecular Physics PAS in Poznań (2011–2022);
- The Scientific Council of the International Laboratory of High Magnetic Fields and Low Temperatures in Wrocław (2011–2016);
- Chair of Scientific Council Wroclaw Research Centre EIT+ (2013–2016);
- Chair of the Presidium of the Center of Research for Advanced Materials and Intelligent Structures.

Throughout his career, Professor Jeżowski has made significant contributions to the development of international cooperation in the field of low-temperature physics. His research activities have involved collaborations with leading research centers abroad, including as a visiting scientist at Umeå University in Sweden, and as a participant in international scientific organizations and advisory boards.

One of the most important directions of scientific cooperation under Prof. Jeżowski's supervision has been a long-standing partnership between ILTSR PAS and B. Verkin ILTPE of NASU. This partnership dates back to 1971 and was initiated by Prof. Włodzimierz Trzebiatowski (Director of ILTSR PAS) and Prof. Boris Verkin (Director of ILTPE NASU). The collaboration has encompassed a wide range of joint research initiatives, exchange of scientific expertise, and co-publications. Since 2002, Professor Jeżowski has served on the editorial board of Low Temperature Physics, published by B. Verkin ILTPE NASU and the American Institute of Physics.

Following the full-scale russian invasion of Ukraine in 2022, ILTSR PAS, under the leadership of Prof. Jeżowski, has provided strong and targeted support to ILTPE NASU. This assistance has helped preserve the institute's research capacity and ensure the continuity of its scientific mission. ILTSR PAS has also contributed to the regular publication of *Low Temperature Physics / Fizyka Nyzkykh Temperatur*, offering vital technical and administrative support.

In 2023, Prof. Andrzej Jeżowski, Prof. Adam Pikul, and Prof. Alexander Krivchikov coordinated the preparation of a Special Issue titled «New trends in low temperature physics dedicated to Poland and Ukraine: in scientific solidarity» (*Low Temp. Phys. / Fiz. Nyzk. Temp*. Vol. 49, 2023). This publication stands as a testament to scientific solidarity and the enduring collaboration between the Polish and Ukrainian Academies of Sciences.

Professor Jeżowski has frequently served as an organizer and co-organizer of international conferences. He is also one of the founding figures behind the International Conference on Cryocrystals and Quantum Crystals (CC), which was held in Poland from 1997 to 2018.

The roots of this conference go back to 1979, when the first seminar on cryocrystals was held in Estonia, Finland, initiated by V. Manzhelii (ILTPE NASU) and A. Prykhodko (Institute of Physics, NAS of Ukraine). Subsequent seminars were held in various Ukrainian cities. In 1995, the meeting gained international status thanks to co-chairs Prof. V. Manzhelii (Ukraine) and Prof. Horst Meyer (USA).

Professor Jeżowski co-organized several of the Polish editions, including CC-1997, CC-2000, CC-2004, CC-2008, and CC-2018, working alongside such distinguished physicists as Horst Meyer, N. Sullivan, I. Silvera, R. Pohl, R. Hemley, V. Loktev, V. Bondybey, P. Leiderer, H. J. Jodl, R. Jochemsen, T. Momose, V. Manzhelii, Yu. Freiman, M. Strzhemechny, A. Dolbin, and others.

Professor Jeżowski is the co-author of several monographs and over 260 scientific articles published in peer-reviewed journals indexed in Web of Science and Scopus. He has also presented numerous talks at international scientific conferences.

Under his supervision, several doctoral dissertations have been successfully defended. One of his students, Dr. Daria Szewczyk, continues his scientific legacy. As a co-author on several publications and participant in international projects, she plays an active role in promoting cooperation between Ukrainian and European scientists.

Their collaborative research has advanced the understanding of low-temperature quantum nanoscale phenomena and the thermal properties of carbon-based materials. In partnership with the B. Verkin ILTPE of NASU (Prof. Alexander Krivchikov and Prof. Alexander Dolbin *et al.*), V. N. Karazin Kharkiv National University (Ukraine), Osaka University (Japan), and Universidad Autónoma de Madrid (Spain), they co-organized the Thermal Kharkiv Seminars. These recurring online events, supported by the NRFU project No. 2023.03/0012, have become a key platform for advancing research in this field. The leadership of Professor Jeżowski and Dr. Szewczyk as co-organizers of these seminars highlights their strong commitment to fostering international collaboration. Under Professor Jeżowski's mentorship, Dr. Szewczyk has actively supported the participation of Ukrainian researchers, helping to ensure the continuity and growth of these vital scientific exchanges.

Prof. Jeżowski has emphasized that thermal transport remains one of the central challenges in both fundamental science and applied research. This area is especially relevant

to the ongoing search for advanced functional materials, including disordered solids (such as glasses and amorphous structures), complex crystals, and metamaterials with tunable thermal properties. Phenomena discovered in this context opened new avenues for designing materials with tailored thermal parameters, offering applications across a wide range of emerging technologies.

The temperature dependence of thermal conductivity is closely linked to the nature of energy transfer, which is governed by ballistic propagation and the thermal diffusivity of collective excitations in disordered solids. However, despite a wealth of intriguing results, including data on quantum mechanisms of heat conduction, the origin of the observed quantum anomalies in such diverse systems remains an open question.

This Special Issue includes both new research findings and review articles, reflecting the lasting impact of Professor Jeżowski's work in the field of low-temperature physics. Together, these papers provide a broad and insightful snapshot of current developments at the intersection of condensed matter physics, materials science, and low-temperature phenomena.

The issue begins with the article by O. A. Korolyuk and colleagues, who delve into the complexities of multi-channel heat transfer in molecular crystals and their solutions, developing a refined model that captures thermal conductivity behaviors deviating from conventional expectations at high temperatures. Next, A. L. Soloviov *et al*. present a comprehensive analysis of the pseudo gap in high-temperature superconductors, revealing the persistent nature of the BEC–BCS crossover temperature and the influence of magnetic layers on pseudo gap formation. Their findings suggest a strong superconducting component to the pseudo gap and highlight the role of magnetism in modulating superconducting properties.

Properties of superconductors are also addressed by E. Maievskyi and colleagues, who present a study on energy dissipation in high-temperature superconducting tapes under collinear variable and constant magnetic fields, combining experiments with finite-element method modeling. Their identification of ac-loss minima contributes to improved understanding of flux trapping and shielding current dynamics in superconducting tapes. In turn, N. A. Azarenkov *et al*. investigate phase transitions in granular high-temperature superconductors with a focus on the role of magnetoactive atoms. Their work identifies these atoms as key contributors to dissipation processes in weak links and demonstrates their influence on the superconducting transition.

In his article, P. Stachowiak offers a retrospective review of three decades of thermal conductivity studies in cryocrystals at the Wrocław Institute, emphasizing the significance of simple molecular crystals as model systems for foundational physics due to their weak intermolecular forces and clean lattice structures. Thermal conductivity is also a subject of the article by J. Amrit and co-authors, who address phonon heat transport in two-dimensional nanoconductors, proposing explicit analytical formulas for thermal conductivity as a function of nanoribbon dimensions. Their multifaceted approach sets a new benchmark for theoretical modelling in nanoscale thermal transport.

The article by A. Kowal and A. Szmyrka-Grzebyk, who review the progress in low-temperature thermometry, from historical foundations to the redefinition of the kelvin. Their work underscores the importance of metrology in scientific accuracy and the role of the ILTSR PAS in international standards development. Next, D. Szewczyk contributes a phenomenological analysis of heat capacity scaling in lead halide perovskites, revealing a universal boson peak and supporting a new classification for materials exhibiting glass-like low-temperature behavior, extending our grasp of disorder-induced excess heat capacity.

N. A. Vinnikov *et al*. report dimensional effects in the thermal expansion of carbon fiber-reinforced plastics, revealing strong anisotropy and negative thermal expansion along fiber directions. These results underscore the complex vibrational behavior of carbon-based composites. In turn, M. V. Olenchuk and colleagues present a method for studying the thermal profile of 2D-MoS_2 nano powders using thermally induced relaxation under light irradiation. Their analysis reveals complex relaxation dynamics tied to cooperative structural changes.

The next two articles are devoted to spectroscopic studies. In particular, M. Oleszko and collaborators explore the magnetic field enhancement of white light emission from graphene foam, presenting experimental evidence for the inverse-square-law dependence of the emission on magnetic field strength. This finding opens intriguing questions on the role of magnetic fields in the optical properties of nanostructured carbon. In turn, J. Baran *et al*. examine the impact of bromine substitution in benzophenones on vibrational and thermal properties. Their work correlates substitution positions with melting points and spectroscopic shifts, offering insights into molecular structure-property relationships.

A problem of defects in crystals is addressed by L. Bochenek *et al*., who provide compelling experimental support for the two-channel Kondo effect in $ZrAs_{1.58}Se_{0.39}$, attributed to arsenic vacancies. Their thermal annealing studies reinforce the non-magnetic origin of the scattering centers and the exotic resistivity behavior, extending the landscape of Kondo physics in crystalline systems.

The issue closes with three theoretical articles. In the first one, Yu. P. Monarkha provides a theoretical insight into negative conductivity in 2D electron gases on liquid helium under cyclotron resonance, proposing a two-fraction electron model that accounts for nonuniform cyclotron resonance excitation and observed experimental anomalies. The second paper, by T. I. Zueva and S. S. Sokolov, tackles the self-localization of electrons in dense helium vapour, using a self-consistent approximation method that respects conservation principles. Their approach refines earlier variational models and deepens the understanding of electron states in quantum fluids. Finally, V. H. Tran *et al*. conduct a first-principles study on $EuFe_{2-x}Ni_xAs_2$, showing how Ni substitution alters structure, magnetism, and electronic states. Their results highlight evolving Fermi surface topologies and enhanced interband scattering at higher doping levels, contributing to the broader field of iron-based superconductors.

We invite readers to delve into this issue, confident that the articles presented will inspire future research and serve as a valuable resource for the scientific community.

Alexander Krivchikov,
Adam Pikul,
Oleksandr Dolbin