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CONDENSED MATTER PHYSICS

Foreword

Phase transitions and critical phenomena: universality and non-universal features

This special issue of the CMP is devoted to phase transitions and critical phenomena. Several recent decades of intensive, sometimes even frantic, and fruitful activities might produce an impression that all principal work in this field has already been completed and nothing really new can be found.[1] Of course, this is far from being true, and the aim of the present issue is to give an evidence that the field is still fertile and thankful to those who work hard on it. We hope that the readers will find this evidence in the presented papers for which we cordially thank their authors who share this aim of ours and our devotion to the subject. A specially pleasant mission of this issue is to pay tribute to our distinguished colleague and friend Mykhailo Kozlovskii, member of the CMP Editorial Board, who has been working in the theory of phase transitions for nearly 40 years. In August 2012, Mykhailo crossed a magic line of time, called a sixty years jubilee, and thus reached the age of maturity and wisdom. With this regard, we wish him good health and many years of fruitful and joyful life among his favorite collective variables, fishing, invariably beloved family, and faithful friends. We also wish him to open new horizons and to explore further bystreets in statistical physics, to meet new friends, colleagues and followers.

Like any jubilee, this one is a good occasion for us to say a few words of the man and of the time we have been together. Mykhailo Kozlovskii was born on August, 30, 1952, in a Volyn village near Horokhiv (Ukraine), where he spent the first seventeen years of his life. Perhaps the very nature of this beautiful and chaste land formed Mykhailo's character, which together with his innate abilities led him to finishing a secondary school with the highest merits. In 1969, Mykhailo came to Lviv to study physics at the Physics Faculty of Lviv University. It was an industrious youngster, desirous of new knowledge and new experience. A couple of years later he met two individuals who have had a decisive impact on his whole subsequent life. In 1973, Mykhailo married Iryna Nenchuk, with whom he spent all these years, which brought a number of diplomas, degrees, titles, and monographs, as well as yielded a son and two charming grandchildren. In 1974, Mykhailo graduated from the University with merits and then got a PhD- postgraduate student position at a new rapidly developing research institution – Department for Statistical Physics of Condensed States (STeCS) of the Institute for Theoretical Physics, led by an outstanding Ukrainian physicist Ihor Yukhnovskii who became a life-long mentor to all of us. Mykhailo perfectly matched the mainstream of the research conducted by Ihor Yukhnovskii at that time. This was an approach to describing fundamental rules of critical phenomena based on the collective variables' method developed by him in the years preceding the burst of activities in this domain of statistical physics. Such an application was evoked in the early seventies mostly by the perspective of going beyond the mean-field description related to new ideas, such as scale invariance and universality.[2] At that time, due to the works by Yukhnovskii's team, Lviv became one of the world's centers where theories of criticality were successfully cultivated. The group consisted of a number of ambitious and well-educated young men, eager for success and strongly competing with each other. However, it soon became clear that it was Mykhailo who

[1] One of typical discussions on this subject may be found in: Bakai A., Ciach A., Chalyi A., Folk R., et al., Materials of the round table "Phase transitions and critical phenomena: past, present, and future", Condens. Matter Phys., 2001, **4**, 165–181.

[2] See: Yukhnovskii I.R., Phase Transitions of the Second Order. Collective Variables Method, World Scientific, Singapore, 1987.

played one of the leading roles in developing the theory of the critical point of a 3D Ising model based on the use of collective variables. In 1978, he completed his PhD Thesis and got the corresponding degree. The same year a boy was born to his family, and thus the adult life began.

The abundance of physical theories of a critical point of a 3D Ising model existed at that time was caused by the fact that all of them were based on some approximations – explicit or hidden, whereas different approximations led to different results and even to different concepts. Thus, the art of a theoretical physicist, especially at that stage, consisted in finding a 'right approximation', which would capture the main features of the described phenomenon and, at the same time, would allow for obtaining its comprehensive and valuable theory. Step by step, Mykhailo mastered this art and thereby became the main successor and continuator of the direction in the theory of criticality originated and developed by Ihor Yukhnovskii. In 1990, he got the next degree – this time Doctor of Science in theoretical and mathematical physics. His Dissertation *Thermodynamics of a phase transition in a 3D Ising model in the collective variables' method*, became a milestone in the application of the collective variables' techniques in the theory of this phenomenon. In the subsequent years, he and his followers went on developing this theory. Their results appeared as publications in the leading journals and in a number of PhD works defended under Mykhailo's supervision. One of them – Ihor Pylyuk, continued developing this branch of the theory and later on defended a Doctor of Science Dissertation, based on the joint research with M. Kozlovskii. In 2001, the results obtained by I. Yukhnovskii, M. Kozlovskii, and I. Pylyuk appeared in the form of a monograph, entitled *A Microscopic Theory of Phase Transitions in Three-Dimensional Systems* (Lviv, Eurosvit, 2001, 592 pp.). In the subsequent years, Mykhailo receives a number of titles and awards including the title of Professor in Theoretical Physics (2005). He also holds a number of top administrative positions, among which is the Executive Director of the Western Scientific Center of the National Academy of Science of Ukraine. At present, he heads the department from which the whole history of Yukhnovskii's school of statistical physics originated – the Department of Statistical Theory of Condensed Matter of the Institute for Condensed Matter Physics of the National Acad. Sci. of Ukraine, formerly headed by Ihor Yukhnovskii. Before 1990, when the Institute for Condensed Matter Physics was created, this department was a part of the Institute for Theoretical Physics.

The recent years of Mykhailo's life have brought new fundamental research results published in his monograph *Influence of an External Field on the Critical Behavior of Three-Dimensional Systems* (Lviv, Halytsjkyj Drukar, 2012, 330 pp.). Nowadays, he started studying phase transitions in continuum systems, such as gases or fluids – a new challenge in statistical physics. Therewith, he participates in a number of international research projects, among which there is an FP7–IRSES project STREVCOMS.

Since the time of his joining STeCS, Mykhailo has been known as a man full of desire to dig the rocky ground of the theory of phase transitions – friendly and modest, and firm and persistent at the same time, which undoubtedly helped him to become a renowned specialist in theoretical physicists of modern Ukraine with achievements recognized worldwide. If one looks at Mykhailo on his photos from the seventies, almost no difference from his actual appearance can be detected. This also refers to his behavior and the way of living. We wish Mykhailo to keep going further and further on this way, as well as we wish ourselves to witness this progress of his. Good luck and many happy returns of the day, dear friend.

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