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CONDENSED MATTER PHYSICS

Foreword

My biography

I was born in Lviv on July 20, 1951 to the family of geologists. My father, Volodymyr Kalyuzhnyi, was a prominent scientist working in the field of mineralogy and geochemistry. For his life-long, outstanding professional activity in fluid inclusion research in 1993 he was awarded by the H.C. Sorby medal, introduced by the international fluid inclusion community. To a substantial degree the personality of my father had influenced my choice to become a scientist. After graduating from Ivan Franko Lviv State University in 1973, where I was studing physics, I started my scientific career in the Institute of Geology and Geochemistry in Lviv. The major task there was to provide a thermodynamical background for the theories of the gas and oil formation, which were being researched at the Institute. During the years, spent at the Institute, I became quite an expert in thermodynamics of the mineral oil and mastered the methods of computer programming, which appear to be very useful in my future work on the statistical mechanics of fluids. Another useful, albeit quite different experience received by me during these years is related to my participation in geological expeditions, which were undertaken each year by the Institute. During these expeditions I visited a number of different places in Ukraine and in the former Soviet Union, which include Sakhalin and Kuriles islands, Pamir mountains and Solovky islands in the White Sea. My work on thermodynamical properties of the mineral oil urged me to get a more profound understanding of the chemistry and physics of the liquid state of matter and in 1980 I became a PhD student of Prof. M. Holovko in the department "Theory of Solutions" of the Institute for Theoretical Physics. My PhD project was to extend site-site approach in the theory of the molecular fluids to the ion-molecular systems and to apply it to the description of electrolyte solutions. In 1987, my thesis work "Site-site approach in the theory of the ion-molecular systems" was successfully completed and I received my PhD degree. After PhD thesis defence I joined the group of Prof. Holovko on the permanent basis. Shortly thereafter Prof. Holovko brought to my attention a series of the papers on the multidensity theory of associating fluids, published by M. Wertheim during 1984-86. I was impressed by the elegancy and flexibility of the theory developed by Wertheim. These papers initiate a series of the studies carried out by me and by my coworkers in the field of strongly interacting systems. Further extension and modification of the multidensity integral equation theory allowed me and my coworkers to set up a basis for systematic investigation of ionic association in electrolyte solutions and to address the challenging task of describing strongly associating 2-2 electrolyte solutions and highly asymmetric electrolyte solutions. In particular, multidensity version of the mean spherical approximation (MSA) (the so-called associative MSA (AMSA)) was developed and used for the purpose of accurate prediction of the liquid-gas phase diagram of the restricted primitive model of electrolyte solution represented by the fluid of charged hard spheres of equal size. Later on the version of the theory referred to as the product-reactant Ornstein-Zernike approach (PROZA) was developed and applied to the description of the properties of dimerizing, polymerizing and network forming fluids and macromolecular fluids. These studies had been summarized and in 2000 I successfully defended Dr. Sci. thesis "Equilibrium statistical theory of the complex and associating liquids in the site-site approach". During the last decade I together with my coworkers have published a series of papers in which the problem of describing the phase behaviour of polydisperse fluids was addressed going beyond simple van der Waals level of description. Recently we elaborated a thermodynamic perturbation theory for associating fluid with central force associating potential. The theory was used to get a quantitatively accurate prediction for the liquid-gas phase diagram of the hard-sphere dipolar fluid.

Yurij Kalyuzhnyi

Main publications

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