



## ***A Special Issue on*** **Electron Correlation in Nanostructures**

The International Conference “Electron correlation in nanostructures” was held in Yalta (Crimea, Ukraine) from 3–6 October 2013. Forty scientists from fifteen countries participated: Canada, China, Belarus, Italy, England, Switzerland, Germany, Estonia, Poland, Russia, Slovenia, South Korea, USA, Japan and Ukraine. The proceedings of the conference emerged as a result of many presentations and discussions between conference participants.

The Yalta conference focused on several open problems in the electron correlation in nanostructures, nanomaterials and superconductivity. The programme of the conference allowed presentations and opened discussions on several emerging modern research topics. In the session of superconductivity, the physical properties of iron-based and cuprate superconductors were discussed.

There was intensive discussion of the mechanism and pairing symmetry in iron and cuprate superconductors as well as of the origin of the pseudogap.

Recent advances in nanoscience have demonstrated that fundamentally new physical phenomena are found when systems are reduced in size down to dimensions, comparable to the fundamental microscopic length scales of the investigated material.

Latest developments in nanotechnology and measurement techniques facilitate experimental investigation of the transport properties of nanosystems.

Special focus sessions were devoted to contemporary topics in nanophysics, such as carbon nanotubes, graphene, magnetic nanostructures, transport through coupled quantum dots, spintronics, molecular electronics, and quantum information problem. The conference addressed a range of topics rather wider than is usual.

We are grateful to many members of the International Advisory Committee, in particular J. Akimitsu, D. Logan, T. Pruschke, T. Tohyama, S. Feng for their consistent help and suggestions.

We had a number of excellent reports (including from J. Freeriks, H. Fehske, R. Melnik, Y. Asano, A. Maeda).

We would also like to thank the National Academy of Science of Ukraine, the J. Stefan Institute, Ljubljana, Slovenia for their generous support.

*Guest Editors*

**Janez Bonča, Sergei Kruchinin**  
Ljubljana, Kiev

### **ABOUT THE GUEST EDITORS**



been awarded many awards. In 2012 he has been the recipient of the highest Slovene state award, the Zois award for outstanding scientific achievements. He has mentored five doctoral students. Two were as well recipients of eminent awards for their Ph.D. thesis, and all of them are becoming renowned scientists in their fields of expertise.

**Janez Bonča** (1960)—is a professor and one of the leading scientists at the Physics department of the Faculty of Mathematics and Physics, University of Ljubljana and the Department for Theoretical Physics at the J. Stefan Institute, Ljubljana, Slovenia. Bonča has published a large body of high-impact scientific works in the area of solid-state physics, in particular on the subject of strongly correlated electron systems, interaction of electron with the lattice, superconductors, frustrated magnetic materials, nanophysics, heavy fermions and dynamics of correlated systems far from the equilibrium. He has specialized on the development of various numerical methods for the solution of correlated many-body systems in equilibrium as well as far from the equilibrium. He is the author and co-author of more than 90 scientific works published in leading scientific journals, 17 were published in the prestigious *Physical Review Letters*. He has organized three international conferences in Slovenia and co-organized four in Yalta, Ukraine together with professor S. Kruchinin. For his scientific achievements he has



**Sergei Kruchinin** (1957)—is leading scientist of the Bogolyubov Institute for Theoretical Physics, NASU (Kiev, Ukraine). Professor of at the National Aviation University. S. P. Kruchinin has published significant original works in the fields of nuclear physics and many-particle systems, solid-state physics, superconductivity, theory of nonlinear phenomena, nanophysics. He is the author and co-author of more than 100 scientific works which have been published in leading scientific journals. He has been using advanced mathematical methods to solve the posed problems. Since the time high-temperature superconductors were discovered, S. P. Kruchinin has intensively studied their physical properties. In particular, it is worth noting the work carried out jointly with A. S. Davydov “Interlayer Effects in the Newest High-T<sub>c</sub> Superconductors” (*Physica C*, 1991), where the theory of the non-monotonous dependence of the critical temperature of superconductivity on the number of cuprate layers in the elementary cell of high-temperature superconductors was developed. This work has remained up to date in connection with the search for new superconductors operating at room temperature. Kruchinin’s works on superconductivity were included in the monograph “Modern aspects of Superconductivity: Theory of Superconductivity” (World Scientific, Singapore, 2010, jointly with H. Nagao) which shows the contemporary status of the problems of high-temperature superconductivity. Kruchinin was the organizer of seven international conferences on the current problems of high-temperature superconductivity and nanosystems. Six books in Springer and one book in World Scientific publishing houses were published under his guidance. Kruchinin Sergei is the co-editor of the following journals: “*Quantum Matter*” (USA), “*Reviews in Theoretical Science*” (USA), “*Progress in Nanotechnology and Nanomaterials*” (USA).