

XXII Ural International Winter School on Physics of Semiconductors

This special issue publishes the articles presented by the participants of the sessions of the 23rd Ural International Winter School on Semiconductor Physics. The Ural winter schools, which took the name “school” for business scientific meetings in suburban conditions, put in this name the idea of the free informal discussions of problems and achievements of physical researches, combining both elements of a scientific conference and the features of an informal forum seeking to bring together the close professional communication and the development of learning by participating in solving serious scientific problems. The School on Semiconductor Physics, which is held in the Urals continuously every two years for thirty years in February, has basically kept the originally mentioned principles of organizing the Ural schools at a high scientific level. The successful development of School work is largely ensured by the permanent representation of authoritative research centers in the field of semiconductor physics in Moscow, St. Petersburg, Nizhny Novgorod, and Novosibirsk, as well as in Poland and Italy, having formed among the participants thanks to the existing constant creative contacts of the Semiconductor Laboratory of the Yekaterinburg Institute for Metal Physics with these centers.

The sessions of the Ural Winter School on Semiconductor Physics were held from 17 to 22 February 2020 in the Samotsvet sanatorium near the Alapayevsk town of Sverdlovsk Region. The School program included about 40 invited and oral reports, the topics of which was related to the established profile of the school, reflecting the main areas of the physical investigations of the semiconductor systems. The headings of the subject of the school were formulated in accordance with the titles of the given areas. They are the following:

1. Electronic properties and quantum transfer phenomena in low-dimensional semiconductor structures. The quantum Hall effect.

2. The structure and properties of semiconductors with impurities of transition elements: electronic states of the transition element impurities, the spin ordering of electron systems

3. New electron phenomena and materials: complex semiconductor compounds, alloys and structures, topological insulators, high-temperature superconductivity, physics of superconducting systems.

Since the studies of the low-temperature phenomena are essentially the foundation of the semiconductor physics, the same is also true for school work profile, so that the articles, submitted for publication in the special issue of the Low Temperature Physics/Fizika Nizkikh Temperatur, are mainly devoted to the low-temperature studies.

Together with the growth of scientific achievements the content of reports and presented articles is filled with complex details of new terminologies, evidences and justifications of the results. The most articles, presented in special issue, are devoted to the presentation of works, in which there studies a wide range of physical properties of new objects with complex atomic structure and composition. The authors are interested in new effects and unusual specific behaviors, which are manifested, for example, in spontaneous magnetism, conductivity anomalies, and even in various theoretical predictions. This group of articles, which belongs to the third section in the above list of thematic sections, includes the series of articles by V. Kulbachinsky *et al.* in which the synthesis was performed and the superconducting properties of complex organometallic compounds are studied, and also the cycles of the articles by

V. Marchenkov *et al.*, in which one carried out detailed studies of the thermodynamic and kinetic properties of multicomponent metal alloys in order to reveal the manifestations of the special role of atoms of transition elements both in magnetism and in other effects.

Another part of the researches, related to the first section of the school subject, contains the problems of the physics of the low-dimensional objects, semiconductor heterostructures and the intensively developing field of electronic quantum phenomena. The scope of this section includes successful solutions of a number of significant experimental and theoretical problems in studying the electronic energy spectrum, thermodynamic and kinetic specific behaviors, presented in the articles by Z. Kwon *et al.*, V. Neverov and N. Shelushinina *et al.*, K. Moiseev *et al.*, S. Gudina and A. Savelyev *et al.*

The physics of semiconductors with the impurities of transition elements is a widely developed area of the researches, in the framework of which the effects of the spin polarization of impurity electrons are studied. The articles

in this area belong to the second section of the school subject matter. In the article by E. Skipetrov *et al.* there studied the electronic structure of the nickel impurity in the lead-tin-tellurium compound. In the article by V. Sokolov *et al.* there studied the luminescence of zinc oxide crystals doped with manganese.

The journal contains the articles, written for a special issue. In the end the 23rd Ural Winter School on Semiconductor Physics has presented a large scientific material from more than 80 invited, oral, poster reports and round tables with the participation of the leading researchers from Russia and from Poland and Italy as well. These materials are available on the Internet or by contact with the organizing committee of the school. School participants will be happy to arouse the interest of the readers of the authoritative journal Low Temperature Physics/Fizika Nizkikh Temperatur.

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