INTERNATIONAL CONFERENCE "QUANTUM GROUPS AND QUANTUM INTEGRABLE SYSTEMS" Kyiv, June 18–21, 2013

On June 18–21, 2013, the International conference "Quantum groups and quantum integrable systems" was held at the Bogolyubov Institute for Theoretical Physics (BITP) of the National Academy of Sciences of Ukraine (Kyiv). The conference was organized by the Bogolyubov Institute for Theoretical Physics of NAS of Ukraine and the Institute of Mathematics of NAS of Ukraine. The Chairman of the Organizing committee was Director of Bogolyubov Institute for Theoretical Physics of NAS of Ukraine, Academician of the NAS of Ukraine A.G. Zagorodny and the Vice-Chairmen were the Head of a Department of the Institute of Mathematics of NAS of Ukraine, Corresponding Member of the NAS Of Ukraine A.G. Nikitin and Head of a Department of the BITP Prof. O.M. Gavrilik.

More than 40 participants from Ukraine, Russia, Belarus, Australia, Italy, Turkey, Estonia, and the Netherlands took part in the conference. Among Ukrainian participants, there were the scientists from Universities and Institutes of Kyiv, Kharkiv, Lviv, Uzhgorod. The working language of the conference was English.

During the conference, 37 talks (among which 4 talks were plenary) were presented. The scientific topics of the conference covered several directions such as quantum groups, quantum/deformed algebras; representations of quantum algebras, q-special functions, knot theory; deformed oscillator algebras and their applications; deformed quantum systems in field theory, statistical and condensed matter physics, *etc.*; integrable systems and quantum symmetries; supersymmetry and integrable systems.

The direction concerning quantum groups and quantum/deformed algebras included the talks on the results of examination of classical and quantum problems related to the canonical deformed Heisenberg algebra. The two- and N-body problems were studied in the deformed space.

The topic on the representations of quantum algebras, q-special functions, and knot theory included the talk about proper generalizations of the HOMFLY polynomial invariants. These encompass the recently introduced two-variable extensions of the Alexander and Jones polynomial invariants jointly with the HOMFLY ones in the standard form. It was also demonstrated that the HOMFLY polynomial invariants in the standard form can be also obtained within the framework of the so-called $(q;p)$-calculus.

The topic concerning deformed oscillator algebras and their applications included the talks about an exotic quantum deformation of the one-dimensional fermionic oscillator algebra, called the Viswanathan–Parthasarathy–Jagannathan–Chaichian fermion model. The focus was specifically on the statistical mechanical consequences of the related deformed fermion gas model. Starting with a generalized fermionic distribution function, many of the thermodynamical characteristics of the model were derived in the case of high temperatures. By analyzing the behavior of the virial coefficients of the model, it was shown that such a model exhibits an interpolation between attractive and repulsive systems for some specific interval of the deformation parameter in two and three spatial dimensions. Consequently, this deformed fermion gas model without quantum group symmetry offers an alternative approach to studying the behavior of anyon-like systems.

The unified $(p;q;\alpha;\beta;l)$-deformation generalizing some well-known deformed oscillator algebras was constructed, and, on its basis, a respective five-parameter conformal field theory model was developed. The compatibility of variations in the primary field and the $(p;q;\alpha;\beta;l)$-operator product expansion of the energy-momentum tensor were established. The two-point correlation function of the generalized $(p;q;\alpha;\beta;l)$-deformed primary fields was calculated.

The topic on the deformed quantum systems in field theory, statistical physics, and condensed matter physics concerned the talks mainly about deformed analogs of the Bose gas model. The use of a q-deformed algebra was known to incorporate the effects of the interaction between particles of a gas. On the other hand, the mode-independent set of composite (quasi)bosons with certain wave functions admit, as it was shown, a realization by deformed oscillators with quadratic structure function. Due to that, both the

interaction of particles and their composite structure were taken into account jointly in efficient way.

The two-fermion composite bosons (or quasibosons) were realized in terms of deformed oscillators (deformed bosons) with the quadratic structure function of deformation. This fact enables one to study the quasiboson states and their bipartite (i.e., between two components) entanglement aspects, by using the well-developed formalism of deformed oscillators. The energy dependence of the entanglement entropy was studies.

The direction concerning integrable systems and quantum symmetries included the talks about the rational $sl(2)$ Gaudin model with non-zero magnetic field. The representation of the $sl(2)$ symmetry algebra of the model in terms of Laguerre polynomials was built. It was also shown that this representation gives a convenient form of the functional Bethe ansatz for the rational Gaudin model.

Using Sklyanin's boundary quantum inverse scattering method, the problem of obtaining a generalized Gaudin model, which arises in the quasiclassical limit, was discussed. In such approach, a remarkable connection was unveiled, in which the hyperbolic/trigonometric Gaudin systems can be obtained directly from the rational $su(2)$-invariant R-matrix solution of the Yang-Baxter equation.

The tau function $\tau(t)$ for the generic Painlevé VI equation was interpreted as a four-point correlator of the primary fields of arbitrary dimensions in $2D$ CFT with $c = 1$. Using the AGT combinatorial representation of conformal blocks and determining the corresponding structure constants, the full and completely explicit expansion of $\tau(t)$ near the singular points has been obtained.

The topics on the supersymmetry and integrable systems were reflected in the talks about a collection of matrix-valued shape-invariant potentials, which give rise to new exactly solvable problems of SUSY quantum mechanics. Some new versions of a q-deformation of the one-dimensional $N = 2$ supersymmetric quantum mechanics were considered.

Exactly solvable problems in quantum mechanics are very attractive. They can be described fully and in a straightforward way that is free of various complications caused by the perturbation method. The very existence of exact solutions of these problems is usually connected with their non-trivial symmetries, which are of particular interest by themselves. There are two properties of quantum mechanical systems which can make them exactly solvable: supersymmetry and superintegrability. Being formally independent, both of them are guide signs in the searches for exactly solvable problems. Moreover, some of the quantum mechanical systems, like a hydrogen atom or isotropic harmonic oscillator, are superintegrable and supersymmetric, and exactly such systems are, as a rule, very interesting and important. A certain classification of supersymmetric and superintegrable models of quantum mechanics was presented as well. Mathematically, the subject of this classification is the systems of coupled Schrödinger equations of some special form.

Using the thermodynamical Bethe ansatz method, an infinite set of integral non-linear equations for the spectrum of states/operators in AdS/CFT and for a general supersymmetric spin chain was derived.

For a few-particle system with pairwise interaction containing non-local terms, it was demonstrated that there is a necessity to generalize the known theorems concerning the symmetric properties of the lowest states and the nodal structure of the corresponding wave functions. It was shown that the presence of a non-local repulsion in the interaction potential containing also an attraction (no matter, local or non-local one) can result in such unusual effects as the presence of nodes in the ground-state wave function, degeneracy of the ground state, and its nontrivial permutational symmetry.

In the Lobachevsky hyperbolic space and the Riemann spherical space, the generalized potentials corresponding to a uniform electric field in the Minkowski space were introduced as solutions of the covariant Maxwell equations in these curved spaces. The exact solutions of the Schrödinger equation in the presence of an electric field were constructed in both models.

In the framework of the conference, the excursion to the National Museum of Folk Architecture and Life of Ukraine in Pirogovo was organized.

Organizing Committee of the Conference