PREFACE

We are very pleased to introduce the proceedings of the *Sixteenth International Conference on Geometry, Integrability and Quantization*. As always the Conference was held during 6-11 June 2014 in Sts. Constantine and Elena, Varna, Bulgaria, a location of pleasant surroundings providing a delightful place for the meeting. Notably, this Conference was dedicated to the 70th anniversary of Professor Jan J. Sławianowski from the Polish Academy of Sciences.

As for previous conferences, the theme was the deep connection between mathematics (especially differential geometry, partial differential equations and boundary conditions, Morse theory) and physics (especially foundations of quantum mechanics, integrable systems, gravitation, nonlinear systems and solitons). For the physicists and computational science researchers the interaction with mathematicians represented a source of enhancing specific and deeper technical knowledge and a platform for exchanging problems and for abstract research on fundamentals. This conference series is organized by the Bulgarian Academy of Sciences with gracious assistance at times from the European Mathematical Society, and many other universities in the world. This year the conference was organized by the Bulgarian Academy of Science in collaboration with Embry-Riddle Aeronautical University (Daytona, USA) and Tokyo University of Science (Tokyo, Japan).

The level of interest in the subject matter of the conference was maintained from previous events, and 28 suitable subjects were submitted for presentation at the conference. This required the program to be organized in a number of Lectures and Plenary Talks, each on a specific theme, to provide each subject with sufficient time for presentation and to accommodate all of them within the overall time allocated. The Conference provided the conditions for many fruitful discussions and exchanges that contributed to the success of the conference. Participants from 12 countries made the conference truly international in scope.

The talks were split almost equally between the three main conference areas, i.e., geometry, integrability and quantization. Almost all presentations are included in this proceedings volume.

There were three lectures series covering the different areas of the conference:

1. Toshiyuki Kobayashi (The University of Tokyo) talked on *Visible Actions and Multiplicity-Free Representations*

2. John Oprea (Cleveland State University) on *Applications of Lusternik-Schnirelmann Category and its Generalizations*, and

3. Jan J. Sławianowski (Institute of Fundamental Technological Research Polish Academy of Sciences) talked on *Group-Theoretical Models of Internal and Collective Degrees of Freedom. Bertrand Systems and their Generalization*.

Each of the three lecturers gave five very illuminating public lectures that drew a lot of interest and interesting discussions among the conference participants.

In addition, there were four Plenary Talks on ongoing current research on the conference topics, as follows:

1. Roman Cherniha (University of Nottingham) on *Lie and Conditional Symmetries of Boundary Value Problems*: *Definitions, Algorithms and Applications to Physically Motivated Problems*

2. Vasyl Fedorchuk (Institute of Mathematics, Krakow) on *On Symmetry Reduction of Some P(1,4)-invariant Differential Equations*

3. Vladimir S. Gerdjikov (Institute for Nuclear Research and Nuclear Energy of the Bulgarian Academy of Sciences) on *Riemann-Hilbert Problems and new Soliton Equations*, and

4. Magdalena Toda (Texas Tech University) on *Geometric Models for Secondary Structures in Proteins*.

Papers were sought in a wide spectrum of areas. For instance in gravitational theory there were contributions on nonsymmetric gravity theory (the dust shell), twistorial structure of the Kerr-Schild geometry in BH and spinning particles and strings, contributions to the Helfrich spontaneous-curvature model, or presentation of exact solutions in Coulomb and oscillator fields in spaces of constant curvature, to mention only few examples. In the area of mathematical physics there were talks on the theory of geometric invariants of knots, Lie symmetries of boundary value problems, symmetry reduction of differential equations, visible actions and multiplicity-free representations (Cartan decompositions), pre-symplectic structures on the space of connections, and at the co-boundaries between algebraic topology and differential geometry like the Lusternik-Schnirelmann invariant category. In the area on nonlinear systems and integrability there were talk on soliton equations, nonlinearity in quantum mechanics, recursion operators for soliton equations, or integrability of nonlinear Sigma Models among other very interesting talks.

Very interesting for this year's Conference, new interdisciplinary topics were present. For example on the stability of the solar system (A. Zhivkov), on the geometric models for structures in proteins (M. Toda), on the Mylar balloon (V. Pulov) or studies on Willmore surfaces in the Monge representation, connecting differential

geometry with nonlinear ODEs, 2D string theory, energy of cell membranes, and theory of carbon nano structures.

All in all, the XVIth ICGIQ in Varna was very successful. The lectures and talks bridged the gap between the different fields of mathematical physics, making it possible for experts in a given area to gain insight into new areas. Also, included among the speakers were several young scientists, namely, postdocs and students, who brought new perspectives to their fields. The next ICGIQ will take place in 2015 also in Varna. Given the rapidity with which science is advancing in all of the applied mathematics and theoretical physics areas we expect that this future Conference will be as stimulating as this most recent one was, as indicated by the contributions presented in this proceedings volume.

We wish to express our gratitude to the invited speakers and to all the authors and participants of the conference contributing to the great success of the conference. Thanks for all the constructive support, fast reports of the referees, sound advice by the organizing committee, and many more. We want to express our deep thanks to Dr. Mariana Hadzhilazova for her great help in organization and preparation of the Proceedings. Last but not least, we would like to thank to Tokyo Science University for the valuable support for publication of the present Proceedings volume.

The Editors