

## Preface

The present 41st volume of the Nuclear Theory series contains articles based on presentations given at the Forty First International Workshop on Nuclear Theory (IWNT-41) held from 30th of June to 6th of July 2024 in the Rila Mountains, Bulgaria. This year the Workshop was organized again in a hybrid form combining talks of on-site and on-line participants. For a sixth year the venue of the Workshop was Hotel Lion in Borovetz Resort. Since 1980 the Workshop has been annually organized by the Nuclear Theory Laboratory (NTL) of the Institute for Nuclear Research and Nuclear Energy (INRNE) of the Bulgarian Academy of Sciences (BAS). The Organizing Committee with the help of the Advisory Committee and the members of the Laboratory make continuous efforts to enlarge the scientific field covered by the Workshop. Two sessions of the Workshop were devoted to the memories of Professor Ruprecht Machleidt from University of Idaho, Moscow, USA, who passed away in December 2023, and Professor Emeritus of Physics Anthony Cowley from Stellenbosch University, Cape Town, South Africa, a member of the Advisory Committee of the Workshop, who passed away in October 2022.

Our aim is to sustain the interest of the participants in the contemporary developments and problems in the fundamental theory and experiment in nuclear physics studies, as well as, in applications which are of utmost importance for the whole society.

The main topics of the 2024 Workshop:

- nuclear structure and reactions;
- nuclear equation of state and symmetry energy;
- nucleon correlations in nuclei;
- symmetries and dynamics;
- collective and intrinsic motions of nuclei;
- exotic nuclei;
- few-body and many-fermion systems;
- nuclear astrophysics and related topics,

are part of the NTL's program for basic nuclear physics research. This broad range of subjects makes it possible for the participants to cover the most actual areas relating the theory with experiment, providing interpretation and predictions, bridging interdisciplinary topics related to nuclear structure and reactions.

The Workshop was attended totally by 52 participants (including the organizers) from 14 countries: Bulgaria, China, Croatia, France, Germany, India, Lithuania, Morocco, Romania, South Africa, Spain, Türkiye, Ukraine, USA. The scientific program contained totally 24 oral talks (14 of them remote).

## *Preface*

The Workshop proved once more time itself as a fruitful ground for exchanging ideas not only between nuclear physics scientists from different fields and institutions, but also between the experienced scientists and the new coming generation of young physicists. During IWNT-41 a number of young scientists and students were introduced to real scientific activities including the newest trends in the experimental and theoretical nuclear physics as well as in the prospective related fields of research providing them a variety of ideas for a possible career development.

The beautiful mountain nature and the friendly atmosphere at the Workshop provided a nice opportunity for a direct communication between participants. We were able to realize our full social program with an excursion to the ancient city Heraclea Sintica and town of Petrich located in south-western Bulgaria.

The Workshop was organized and the proceedings are published partly by the donation of the Kozloduy Nuclear Power Plant and the financial support of the Bulgarian National Science Fund under Contract No.KP-06-MNF/7. Having this support we were able to help the participation of a number of international young and first-time visitors, as well as of our retired colleagues who are prominent specialists in the subject of the Workshop.

The editors of the volume would like to express their gratitude to the colleagues from the Organizing Committee, as well as to all members of the of Nuclear Theory Laboratory for their help and invariable support during the organization of the Workshop. We are also grateful to the members of the International Advisory Committee for the valuable suggestions and ideas about the organization of the Workshop.

Finally, we would like to thank all the participants of IWNT-41 for their contribution to the nice scientific atmosphere as well as the participants who contributed to the present volume. We hope that the scientific level and the quality of the papers included prove the vitality and the future perspectives of the nuclear physics and its related areas.

The next 42nd issue of the International Workshop on Nuclear Theory is planned to be held in Borovetz, Rila Mountains, Bulgaria, from 29th June to 5th of July 2025.

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Sofia, November 2024