

Preface

This special volume of *Journal of Physics: Conference Series* is dedicated to the proceedings of “International Conference on Quantum Science and Applications (ICQSA-2016)”. The conference was organized by the Centre for Quantum Research and Applications at Eskisehir Osmangazi University, Eskisehir, Turkey. It was held in Eskisehir Osmangazi University Congress and Culture Centre during May 25-27, 2016 (<http://icqsa2016.ogu.edu.tr>). It gathered actively 143 participants from different disciplines in natural and applied sciences coming from 16 different countries from all over the world. It was the first international conference in its content on the scientific research fields of quantum science and applications in Turkey. It also consisted of 12 plenary lectures and 119 contributed oral presentations covering interdisciplinary fields of research.

The ICQSA-2016 conference focused on recent modern theoretical and experimental developments of quantum science in multi-disciplinary aspects of areas of mathematics, physics, statistics, chemistry, biology, computer science, electronics, informatics, medicine, education, etc. It served as an interaction platform for students, researchers, public, and private sector delegates for sharing new scientific and technological ideas on quantum applications in science and technology.

The topics of the conference were: Quantum theory and quantum computing, quantum information theory and its applications, quantum statistics and its applications, quantum thermodynamics, quantum cryptography, classical and quantum symmetries, quantum calculus in science, engineering, medicine, education, etc., classical and quantum integrable systems, modeling and numerical methods in quantum systems, other modern mathematical methods in science and technology.

Each of the submitted papers for this special volume of the proceedings of ICQSA-2016 has been reviewed by external referees. There are 36 accepted papers. Besides, it is worth pointing out that a great deal of interest shown by the participants of the ICQSA-2016 conference gives hope for the continuation of this meeting in the following years.

The conference organization was sponsored by Eskisehir Osmangazi University (ESOGU), Eskisehir Tepebasi Municipality, the Scientific and Technological Research Council of Turkey (TUBITAK) under the project number 113F226. Other supporters of this organization were: Eskisehir Metropolitan Municipality, Eskisehir Governorship Provincial Directorate of Culture and Tourism, Pegem Academy Publishing Company. In addition, this special volume is supported by the Scientific and Technological Research Council of Turkey (TUBITAK) under the project number 113F226.

Finally, our special thanks go to the Scientific and Organizing Committee members, to the sponsors and supporters, and to all of the participants.

We hope this special volume will provide a useful resource for students, experts, and other participants, who are interested in interdisciplinary fields of quantum science and applications.

Guest Editors: A. Algin¹, M. Arik² and A. M. Gavrilik³

¹Department of Physics and Center for Quantum Research and Applications, Eskisehir Osmangazi University, Eskisehir, Turkey

²Department of Physics, Bogazici University, Bebek, Istanbul, Turkey

³Department of Mathematical Methods in Theoretical Physics, Bogolyubov Institute for Theoretical Physics (BITP), Kiev, Ukraine



ICQSA-2016 Conference (May 25-27, 2016), ESOGU-Eskisehir, TURKEY**Chair:** Hasan Gonen, Prof.Dr. (Rector of Eskisehir Osmangazi University)**Co-chair:** Abdullah Algin, Prof.Dr. (Eskisehir Osmangazi University)**Committees:****Scientific Committee**

M. Arik (Bogazici U., Istanbul, Turkey)
N. M. Atakishiyev (Universidad Nacional Auto-Noma de Mexico, Cuernavaca, Mexico)
D. Baleanu (Cankaya U., Ankara, Turkey)
N. Berker (Sabanci U., Istanbul, Turkey)
F. G. S. L. Brandao (Caltech, California, USA)
F. Buyukkilic (Ege U., Izmir, Turkey)
S. Catto (CUNY Graduate School and the Rockefeller University, New York, USA)
R. Chakrabarti (CMI, Chennai, India)
W. S. Chung (Gyeongsang National U., Jinju, South Korea)
D. Demirhan (Ege U., Izmir, Turkey)
S. Durukanoglu Feyiz (Sabanci U., Istanbul, Turkey)
A. M. Gavrilik (BITP, Kiev, Ukraine)
Mo-Lin Ge (Nankai U., Tianjin, China)
N. Imoto (Osaka U., Osaka, Japan)
M. Keskin (Erciyes U., Kayseri, Turkey)
M. R. Kibler (Universite de Lyon, Lyon, France)
A. Lavagno (INFN, Torino, Italy)
A. Mostafazadeh (Koc U., Istanbul, Turkey)
O. E. Mustecaplioglu (Koc U., Istanbul, Turkey)
R. Norte (Delft University of Technology, Delft, The Netherlands)
M. Ozer (YTU, Istanbul, Turkey)
O.K. Pashaev (IYTE, Izmir, Turkey)
R. Sever (METU, Ankara, Turkey)
I. Siap (YTU, Istanbul, Turkey)
U. Tirnakli (Ege U., Izmir, Turkey)
C. Tsallis (CBPF, Rio de Janeiro, Brazil)
M. R. Ubriaco (U. of Puerto Rico, San Juan, USA)

Plenary Speakers

M. Arik (Turkey)
D. Baleanu (Turkey)
S. Catto (USA)
W. S. Chung (South Korea)
S. Durukanoglu Feyiz (Turkey)
A. M. Gavrilik (Ukraine)
N. Imoto (Japan)
O. E. Mustecaplioglu (Turkey)
R. Norte (The Netherlands)
O.K. Pashaev (Turkey)
I. Siap (Turkey)
M. R. Ubriaco (USA)

Organizing Committee

Programme Committee

H.K. Aksoy (Eskisehir Osmangazi U., Eskisehir, Turkey)
A. Algin (Co-Chair, Eskisehir Osmangazi Univ., Eskisehir, Turkey)
E. Algin (Eskisehir Osmangazi U., Eskisehir, Turkey)
A. A. Altintas (Okan U., Istanbul, Turkey)
H. Anilan (Eskisehir Osmangazi U., Eskisehir, Turkey)
A.S. Arikan (Sakarya U., Sakarya, Turkey)
T.E. Cosan (Eskisehir Osmangazi U., Eskisehir, Turkey)
N. Degirmenci (Anadolu U., Eskisehir, Turkey)
R. Edizkan (Eskisehir Osmangazi U., Eskisehir, Turkey)
A. Odabas (Eskisehir Osmangazi U., Eskisehir, Turkey)
D. Peker (Eskisehir Osmangazi U., Eskisehir, Turkey)
E. Uslu (Eskisehir Osmangazi U., Eskisehir, Turkey)
A. Yazici (Eskisehir Osmangazi U., Eskisehir, Turkey)
C. Yuce (Anadolu U., Eskisehir, Turkey)

Local Organizing Committee

N. Akkurt (Eskisehir Osmangazi U., Eskisehir, Turkey)
C. Asici (Eskisehir Osmangazi U., Eskisehir, Turkey)
K.O. Ay (Eskisehir Osmangazi U., Eskisehir, Turkey)
H. Cetinkaya (Dumlupinar U., Kutahya, Turkey)
E. Dil (Sinop U., Sinop, Turkey)
M. Kaya (Eskisehir Osmangazi U., Eskisehir, Turkey)
A. Olkun (Eskisehir Osmangazi U., Eskisehir, Turkey)
M. Ozgur (Eskisehir Osmangazi U., Eskisehir, Turkey)
M. Senay (Eskisehir Osmangazi U., Eskisehir, Turkey)
E. Silik (Eskisehir Osmangazi U., Eskisehir, Turkey)
G. Topcu (Ankara, Turkey)