H.N.P.S.: Advances in Nuclear Physics and Related Areas

Proceedings of the 9th Hellenic Symposium on Nuclear Physics

Ioannina, September 30 - October 5, 1998

Editors
T.S. Kosmas and N.G. Nicolis
COMMITTEES

Conference A. Arima (Japan) K. Kubotera (USA)
International G.E. Brown (USA) T.T.S. Kuo (USA)
Advisory J.P. Deutsch (Belgium) R. Mohapatra (USA)
Committee H. Ejiri (Japan) E. Oset (Spain)
A. Faessler (Germany) S. Pittel (USA)
E. Fiorini (Italy) A. van der Shaaf (Switzerland)
W. Greiner (Germany) K. Tamvakis (Greece)
M. Grypeos (Greece) A. Thomas (Australia)
W. Haxton (USA) H. Toki (Japan)
K.T. Hecht (USA) J.D. Vergados (Greece)
E.M. Henley (USA) H.C. Walter (Switzerland)
J. Iliopoulos (France)

Organizing Committee N.G. Nicolis (Chairman)
for the 9th Symposium of the T.S. Kosmas (Co-Chairman)
Hellenic Nuclear Physics Society C. Kalfas (NCSR-Democritos, Athens)
S. Harissopulos (NCSR-Democritos, Athens)
The 9th Symposium of the Hellenic Nuclear Physics Society took place in Ioannina on September 30 till October 5, 1998. It coincided with the International Conference on *Symmetries in Intermediate & High Energy Physics and Applications* hosted by the Hellenic Nuclear Physics Society. This volume contains contributions presented in both the Conference and the Symposium. The organization provided a good opportunity for interaction between the participants.

The benefit of this joint meeting is evident from the wide range of the topics covered in the presentations. The topics included

- Weak Interactions
- Neutrino Physics
- New Physics Beyond the Standard Model
- Non - Baryonic Dark Matter
- Novel Issues in Nuclear Physics - Applications
- Nuclear Structure and Reactions
- Atomic and Nuclear Clusters
- Radioecology

During the days of the Conference there were excursions at the Ancient Theater of Dodoni and the Cave of Perama. In addition, the participants visited the Historical Wax Museum of Vrelii.

We would like to thank the assistance of Dr. G. Katomeris and Mr. D. Giout-sos who contributed to the publication procedure of the present book of proceedings.

Ioannina 2000

T.S. Kosmas
N.G. Nicolis
Contents

Z. Ren, A. Faessler and T.S. Kosmas
Study of the exotic μ – e conversion in nuclei using RQRPA 1

A. Faessler
Super-Kamiokande neutrino oscillations and the supersymmetric model 14

S. Lola
Neutrino masses and interactions from Super-Kamiokande 29

W.M. Alberico and S.M. Bilenky
New developments in neutrino physics 40

E. Kolbe and T.S. Kosmas
Recent highlights on neutrino-nucleus interactions 63

W.R. Molzon
Improved tests of muon and electron flavor symmetry in muon processes 93

M.E. Gómez
Proton decay in general SU(5) models 119

H.V. Klapdor–Kleingrothaus
Perspectives of double beta and dark matter search as windows to new physics 130

Chiral symmetries in nuclear physics 170

M.E. Grypeos and Th.E. Liolios
A new application of the quantum mechanical hypervirial theorems technique 210

O. Civitarese
Fundamental nuclear structure symmetries in double beta decay processes 211

N.I. Kaloskamis, C.N. Papanicolas and the OOPS Collaboration
Study of the proton deformation using the Out-Of-Plane Spectrometers 244

G.A. Lalazissis
Applications of the relativistic mean-field model to finite nuclei 256

E. Mavrommatis, S. Athanassopoulos, A. Dakos, K.A. Gernoth and J.W. Clark
Statistical modeling with neural nets: nuclear masses and half-lives 266
H.C. Moustakidis and S.E. Massen  
_Systematic study of the effect of short range correlations on the form factors and densities of s–p–d shell nuclei_ 279

P. Papakonstantinou, E. Mavrommatis and T.S. Kosmas  
_Description of the generalized momentum distribution in finite nuclei within the independent-particle shell model_ 290

N.G. Nicolis and C.A. Papachristodoulou  
_Alpha particle transmission coefficients from a global optical potential_ 299

B.A. Kotsos and M.E. Grypeos  
_The variation of the fu with the particle number and the appearance of “kinks” for atomic clusters_ 306

B.A. Kotsos, Th.E. Liolios, M.E. Grypeos, C.G. Koutroulos and S.E. Massen  
_On a single particle potential for atomic clusters_ 307

_Mass determination of the charged pion, using high precision X-ray spectroscopy_ 308

X.A. Aslanoglou, E. Evangelou, N. Konofaos, Ch. Dimitriades, E. Kossionides and G. Kaliampakos  
_Heavy–ion RBS characterization of multilayer TiN_x–SiO_2–Si structures_ 315

D.T. Karamanis, P.A. Assimakopoulos and N.H. Gangas  
_Radioactive contaminants binding on pillared layered clays_ 322

C.A. Papachristodoulou, P.A. Assimakopoulos, N.H. Gangas and D.T. Karamanis  
_Modification of pillared layered clays for scavenging radiostrontium from acidic aqueous environments_ 331

K.C. Stamoulis, P.A. Assimakopoulos and K.G. Ioannides  
_Strontium-90 in human bones and teeth in Greece: Measurements and predictions using an age-dependent model_ 342

C. Syros  
_New developments in Time-Asymmetry of Quantum Field Theories_ 357

C. Syros, G.S. Ioannidis and G. Raptis  
_Liouville’s theorem and quantum mechanics – time quantization and reality_ 395
LIST OF PARTICIPANTS

1) Alberico, Wanda,
INFN
Torino
ITALY
E-mail: alberico@to.infn.it

2) Anagnostatos, Gerassimos,
NCSR Demokritos,
Aghia Paraskevi,
Attiki, GR15310,
GREECE
E-mail: anagnos@
cyclades.nrcps.ariadne-t.gr

3) Argyres, E.
NCSR Demokritos,
Aghia Paraskevi,
Attiki, GR15310,
GREECE

4) Aslanoglou, Xenophon,
Department of Physics,
University of Ioannina,
Ioannina 45110,
GREECE
E-mail: xaslanog@cc.uoi.gr

5) Assimakopoulos, Panayotis,
University of Ioannina,
Ioannina 45110,
GREECE
E-mail: pasimak@cc.uoi.gr

6) Bilenky, Samoil,
Joint Institute for
Nuclear Research
DUBNA,
RUSSIA
E-mail: Samoil.Bilenky@Physik.TU-Muenchen.DE

7) Civitarese, Osvaldo,
Department of Physics,

8) Daskaloyannis, Constantine,
Department of
Theoretical Physics
University of Thessaloniki,
54006 Thessaloniki
GREECE
E-mail: daskalo@ccf.auth.gr

9) Divari, Paraskevi,
NCSR Demokritos,
Aghia Paraskevi,
Attiki, GR15310,
GREECE

10) Evangelou, John,
Department of Physics,
University of Ioannina,
Ioannina 45110,
GREECE
E-mail: ievaggel@cc.uoi.gr

11) Faessler, Amand,
University of Tuebingen,
Institute for
Theoretical Physics,
Auf der Morgenstelle 14,
Tuebingen,
GERMANY
E-mail: Amand.Faessler@
uni-tuebingen.de

12) Floratos, Manolis,
NCSR Demokritos,
Aghia Paraskevi,
Attiki GR15310,
GREECE
13) Giapitzakis, John,
University of Patras,
School of Engineering
GREECE
E-mail: anagnos@
cyclades.nrcps.ariadne-t.gr

14) Ginis, Panos,
University of Patras,
School of Engineering
GREECE
E-mail: anagnos@
cyclades.nrcps.ariadne-t.gr

15) Gioutsos, D.V.,
Department of Physics,
University of Ioannina,
Ioannina 45110,
GREECE,
E-mail: dgioutso@cc.uoi.gr

16) Gomez, Mario,
Technical University of
Thessaloniki,
Thessaloniki
GREECE

17) Greiner, Walter,
Institut fuer
Theoretische Physik,
JWG Universitaet
Frankfurt/Main,
GERMANY
E-mail: greiner@
th.physik.uni-frankfurt.de

18) Grypeos, Michael,
Department of
Theoretical Physics,
Aristotle University of
Thessaloniki,
54006 Thessaloniki
GREECE

19) Harissopulos, Sotirios,
NCSR Demokritos,

20) Hasioti, Vasiliki,
Department of Physics,
University of Ioannina,
Ioannina 45110,
GREECE

21) Hecht, Ted,
Department of Physics,
University of Michigan,
Ann Arbor,
Michigan 48109,
U.S.A.
E-mail: khecht@umich.edu

22) Herczeg, Peter,
Group T-5, Mail Stop B238,
Los Alamos
National Laboratory,
Los Alamos, NM87545
U.S.A
E-mail: herczeg@t5.lanl.gov

23) Ioannidis, George,
Engineering-Science
Department,
University of Patras,
GR 26110 Patras,
GREECE
E-mail: gsoianni@upatras.gr

24) Ioannides, Kostas
Nuclear Physics Laboratory
Department of Physics
University of Ioannina
Ioannina 45110
GREECE
E-mail: kioannid@cc.uoi.gr

25) Kalfas, Kostas,
NCSR Demokritos,
26) Karamanis, Dimitrios,
Nuclear Physics Laboratory
Department of Physics,
University of Ioannina,
Ioannina 45110
GREECE
E-mail: dkaraman@cc.uoi.gr

27) Kaloskamis, Nikolaos,
Bates - MIT
Linear Accelerator Center,
E-mail: nikos@ralph2.mit.edu

28) Klapdor-Kleingrothaus,
Hans Volker,
Max Planck Institute,
Heidelberg,
GERMANY
E-mail: Hans-Volker.
Klapdor-Kleingrothaus@mpi-hd.mpg.de

29) Kokkas, Panagiotis,
CERN, Geneva,
SWITZERLAND
E-mail: kokkas@rsplus06.cern.ch

30) Kolbe, Edwin,
Department fuer Physik und
Astronomie der Uni Basel,
Klingelbergstrasse 82,
CH-4056 Basel,
SWITZERLAND
E-mail: kolbe@
quasar.physik.unibas.ch

31) Kosmas, Theocharis,
Department of Physics,
University of Ioannina,
Ioannina 45110,
GREECE
E-mail: hkosmas@cc.uoi.gr

32) Kotsos, Bill,
Department of
Theoretical Physics,
Aristotle University of
Thessaloniki,
54006 Thessaloniki
GREECE

33) Koutroulos, Christos,
Department of
Theoretical Physics,
Aristotle University of
Thessaloniki,
54006 Thessaloniki
GREECE
E-mail: koutroul@ccf.auth.gr

34) Lagaris, Isaac,
Department of Physics,
University of Ioannina,
Ioannina 45110,
GREECE
E-mail: lagaris@ecn.purdue.edu

35) Lalazissis, George,
Technical University of
Thessaloniki,
Thessaloniki,
GREECE
E-mail: Georgios_Lalazissis@
Physik.TU-Muenchen.DE

36) Lazarides, George,
Technical University of
Thessaloniki,
Thessaloniki,
GREECE
E-mail: Lazaride@eng.auth.gr

37) Leontaris, George,
Department of Physics,
University of Ioannina,
Ioannina 45110, GREECE
E-mail: leonta@cc.uoi.gr

38) Liolios, Th.,
Department of Theoretical Physics,
Aristotle University of Thessaloniki,
54006 Thessaloniki GREECE

39) Lola, Smaragda,
CERN - Theory Division,
Geneva 23, CH-1211,
SWITZERLAND
E-mail: magda@mail.cern.ch

40) Manthos, Nikolaos,
Department of Physics,
University of Ioannina,
Ioannina 45110, GREECE

41) Mavrommatis, Eirene,
Division of Nuclear and Particle Physics,
Physics Department,
University of Athens,
Athens 15771 GREECE
E-mail: emavrom@atlas.uoa.gr

42) Melnikov, Kirill,
Institute of Theoretical Physics,
University of Karlsruhe,
GERMANY
E-mail: melnikov@ttpux2.physik.uni-Karlsruhe.de

43) Molzon, William,
Department of Physics and Astronomy,
University of California,
Irvine, California 92697-4575
U.S.A.
E-mail: molzon@ucihep.ps.uci.edu

44) Moustakidis, Haralambos,
Department of Theoretical Physics,
Aristotle University of Thessaloniki,
54006 Thessaloniki GREECE
E-mail: moustaki@ccf.auth.gr

45) Nicolis, Nikolaos,
Department of Physics,
University of Ioannina,
Ioannina 45110, GREECE
E-mail: nnicolis@cc.uoi.gr

46) Pantis, George,
Department of Physics,
University of Ioannina,
Ioannina 45110, GREECE
E-mail: gpantis@cc.uoi.gr

47) Papachristodoulou, Christina,
Nuclear Physics Laboratory,
Department of Physics,
University of Ioannina,
Ioannina 45110 GREECE
E-mail: xpapaxri@cc.uoi.gr

48) Papakonstantinou, Panayota,
Division of Nuclear and Particle Physics,
Physics Department,
University of Athens,
Athens GREECE

49) Panos, Constantine,
Department of Physics, 
Technological Educational 
Institute of Piraeus, 
Petrou Ralli and Thivon 250, 
Aegaleo GR-12244 
GREECE

50) Papanikolas, Kostas, 
Division of Nuclear and 
Particle Physics, 
Physics Department, 
University of Athens, 
Athens 15771 
GREECE 
E-mail: cnp@cc.uoa.gr

51) Paradelis, Themistoklis, 
NCSR Demokritos, 
Aghia Paraskevi, 
Attiki GR15310 
GREECE

52) Petcov, Serguey, 
SISSA, Via Beirut 2 - 4, 
I-34013 Trieste, 
ITALY 
E-mail: petcov@susy.sissa.it

53) Petridou, Theodora, 
Department of 
Theoretical Physics, 
Aristotle 
University of Thessaloniki, 
54004 Thessaloniki 
GREECE 
E-mail: theopet@cc.auth.gr

54) Raptis, G., 
Engineering-Science 
Department, 
University of Patras, 
GR 26110 Patras, 
GREECE 
E-mail: c.syros@upatras.gr

55) Ren, Zhongzhou, 

Institute of Theoretical Physics, 
University of Tubingen, 
D-72076 GERMANY 
E-mail: Zhongzhou.Ren@ 
uni-tuebingen.de

56) Rizos, John, 
Department of Physics, 
University of Ioannina, 
Ioannina 45110, 
GREECE 
E-mail: irizos@cc.uoi.gr

57) Stamoulis, K.C. 
Nuclear Physics Laboratory, 
Department of Physics, 
University of Ioannina, 
Ioannina 45110 
GREECE 
E-mail: kstamoul@cc.uoi.gr

58) Savvidis, George, 
NCSR Demokritos, 
Aghia Paraskevi, 
Attiki GR15310, 
GREECE 
E-mail: savvidy@ 
argo.ncrps.ariadne-t.gr

59) Sinatkas, Ioannis, 
Technical University of 
Kastoria, 
Kastoria GR-52050, 
GREECE

60) Skouras, Leonidas, 
NCSR Demokritos, 
Aghia Paraskevi, 
Attiki GR15310, 
GREECE

61) Suvorova, Olga, 
Academy of Nuclear Science, 
Moskow, 
RUSSIA 
E-mail: olga.Suvorova@
62) Syros, Constantine,
   Engineering-Science
   Department,
   University of Patras,
   GR 26110 Patras,
   GREECE
   E-mail: c.syros@upatras.gr

63) Tamvakis, K.,
   Department of Physics,
   University of Ioannina,
   Ioannina 45110,
   GREECE

64) Triantafillospoulos, E.,
   Department of Physics,
   University of Ioannina,
   Ioannina 45110,
   GREECE

65) Triantis, F.,
   Department of Physics,
   University of Ioannina,
   Ioannina 45110,
   GREECE
   E-mail: ftrianti@cc.uoi.gr

66) Valle, Hose,
   Department of
   Theoretical Physics,
   University of Valencia,
   46100 Burjassot, Valencia,
   SPAIN
   E-mail: valle@nac2.ific.uv.es.

67) Vayonakis, C.,
   Department of Physics,
   University of Ioannina,
   Ioannina 45110,
   GREECE

68) Vergados, John,
   Department of Physics,
   University of Ioannina,
   Ioannina 45110,
   GREECE
   E-mail: vergado@cc.uoi.gr

69) Walter, Hans-Christian,
   Paul Scherrer Institut,
   PSI-West,
   CH-5232 Villigen,
   SWITZERLAND
   E-mail: Chris.Walter@psi.ch
Author Index

Alberico W.M., 40
Anagnostopoulos D.F., 308
Aslanoglou X.A., 315
Assimakopoulos P.A., 322, 331, 342
Athanassopoulos S., 266
Augsburger M., 308
Beckmann W.Ch., 170
Belmiloud D., 308
Bilenky S.M., 40
Borchert G., 308
Chatellard D., 308
Civitarese O., 211
Clark J.W., 266
Dakos A., 266
Daum M., 308
Dimitriadis Ch., 315
Egger J.-P., 308
El-Khoury P., 308
Evangelou E., 315
Faessler A., 1, 14
Gangas N.H., 322, 331
Gernoth K.A., 266
Gomez M., 119
Gorke H., 308
Gotta D., 308
Greiner W., 170
Grypeos M.E., 210, 306, 307
Hauser P., 308
Indelicato P., 308
Ioannides K.G., 342
Kaliampacos G., 315
Kaloskamis N.I., 244
Karamanis D.T., 322, 331
Kirch K., 308
Klapdor-Kleingrothaus H.V., 130
Kolbe E., 63
Konofaos N., 315
Kosmas T.S., 1, 63, 290
Kossionides E., 315
Koutroulos C.G., 307
Lalazissis G.A., 256
Lenz S., 308
Liolios Th.E., 210, 307
Lola S., 29
Massen S.E., 279, 307
Mavrommatis E., 266, 290
Molzon W., 93
Moustakidis H.C., 279
Nelms N., 308
Nicolis N.G., 299
Papachristodoulou C.A., 299, 331
Papakonstantinou P., 290
Papanicolas C.N., 244
Papazoglou P., 170
Ren Z., 1
Schaffner-Bielich J., 170
Schramm S., 170
Siems Th., 308
Simons L.M., 308
Stöcker H., 170
Stamoulis K.C., 342
Syros C., 357
Zschiesche D., 170

xiii