

# Contents

## **Super-Kamiokande Neutrino Oscillations and the Supersymmetric Model**

A. Faessler .....	1
1 Introduction .....	1
2 Neutrino Oscillations .....	2
3 Atmospheric Neutrinos and the Super-Kamiokande Experiment .....	3
4 Supersymmetry and Neutrino Oscillations .....	7
5 Summary .....	12
References .....	13

## **New Developments in Neutrino Physics**

W.M. Alberico, S.M. Bilenky .....	15
1 Introduction .....	15
2 Neutrino Mixing .....	16
3 Neutrino Oscillations .....	19
4 The Status of Neutrino Oscillations .....	22
5 Neutrino Masses and Mixing from Oscillation Data .....	27
6 Conclusions .....	31
References .....	32

## **Neutrino Masses: from Fantasy to Facts**

J.W.F. Valle .....	35
1 Introduction .....	35
2 Mechanisms for Neutrino Mass .....	36
3 Neutrino Indications for New Physics .....	46
4 Reconciling the Neutrino Puzzles .....	57
5 Conclusion .....	60
References .....	61

**Perspectives of Double-Beta and Dark-Matter Search  
as Windows to New Physics**

H.V. Klapdor-Kleingrothaus .....	69
1 Motivation for the Search for Double-Beta Decay and a Future Perspective: GENIUS .....	69
2 Double-Beta Decay and Particle Physics .....	70
3 Double-Beta Decay Experiments: Present Status and Results .....	78
4 Double-Beta Experiments: The GENIUS Project .....	86
5 Conclusion .....	97
References .....	98

**Improved Tests of Muon and Electron Flavor Symmetry  
in Muon Processes**

W. R. Molzon .....	105
1 Introduction .....	105
2 Theoretical Motivation for LFV Searches .....	107
3 Overview of LFV Searches Using Muons .....	108
4 The MECO $\mu^- N \rightarrow e^- N$ Experiment .....	112
5 Summary .....	126
References .....	126

**Chiral Symmetries in Nuclear Physics**

D. Zschesche, P. Papazoglou, S. Schramm, Ch. Beckmann J. Schaffner-Bielich, H. Stöcker, W. Greiner .....	129
1 General Ideas .....	129
2 Why Chiral Symmetry? .....	130
3 $SU(3) \times SU(3)$ .....	131
4 The Non-linear Realization of Chiral Symmetry .....	133
5 Lagrangian .....	135
6 Mean-Field Approximation .....	142
7 Nuclear Matter .....	144
8 Nuclei and Hypernuclei .....	145
9 Hadronic Matter at High Temperature and Density .....	155
10 Conclusions .....	164
References .....	166

## **Fundamental Nuclear Structure Symmetries in Double-Beta Decay Processes**

O. Civitarese .....	169
1 Introduction .....	169
2 Spontaneous and Dynamical Breaking of Mean-Field Symmetries in the pn-QRPA and the Description of Double-Beta Decay Transitions .....	169
3 A Comparative Study on the Validity of the Renormalized Random Phase Approximation .....	176
4 Collective Description of Nuclear Double-Beta Decay Transitions .....	191
References .....	197

## **Recent Highlights on Neutrino–Nucleus Interactions**

E. Kolbe, T.S. Kosmas .....	199
1 Introduction .....	199
2 The Theory of Neutrino–Nucleus Interactions .....	201
3 The Latest Experimental Data and its Comparison with Theoretical Predictions .....	211
4 Implications to Astrophysical and Atmospheric Neutrinos .....	219
5 Conclusions and Outlook .....	222
References .....	223

## **Leptogenesis in Supersymmetric Hybrid Inflation**

G. Lazarides .....	227
1 Introduction .....	227
2 Hybrid Inflation .....	228
3 Baryogenesis via Leptogenesis .....	231
4 The ‘Left–Right’ Model .....	237
References .....	244

## **Phenomenological and Cosmological Aspects of the Breaking of the Electroweak and Global Symmetries in the MSSM and the NMSSM**

K. Tamvakis .....	247
1 The Effective Mixing Angle in the MSSM .....	247
2 Formulation of the Problem .....	249
3 Decoupling of $\log(M_{\text{SUSY}}/M_Z)$ in the Effective Mixing Angle .....	252
4 Numerical Analysis and Results .....	262
5 R-Symmetries and the NMSSM .....	274
References .....	281

**World-Volume Supermembrane Instantons  
in the Light-Cone Frame**

E.G. Floratos, G.K. Leontaris	285
1 Introduction	285
2 Matrix Model and Membranes	286
3 Self-Dual Membranes	289
4 Integrability	290
5 Multistring Solutions	294
6 Supersymmetries	296
References	298
<b>Index</b>	<b>301</b>

Symmetries in Intermediate and High Energy Physics

Faessler, A.; Kosmas, T.S.; Leontaris, G.K. (Eds.)

2000, XVI, 316 p., Hardcover

ISBN: 978-3-540-66698-1