

# Contents

Introduction . . . . .	1
1. Physics—A unique “value” and unique challenges . . . . .	1
2. Nuclear Matter in the Laboratory . . . . .	165
3. Nuclear and C-Shell Coulomb散射 in Relativistic Heavy-Ion Collisions . . . . .	165
4. Nucleus and Environment: A New Window of Opportunity . . . . .	233
5. Superheavy Elements . . . . .	233
6. Conclusion . . . . .	233
7. Acknowledgments . . . . .	233
8. References . . . . .	233
Dedication to Prof. Mikhail Itkis . . . . .	1
Walter Greiner	
Part I Superheavy Elements . . . . .	1
SHE Research at GSI—Historical Remarks and New Ideas . . . . .	9
Gottfried Münzenberg	
Opening New Lands on the Nuclear Map . . . . .	21
Valeriy Zagrebaev and Walter Greiner	
Superheavy Element Chemistry . . . . .	33
Robert Eichler	
Nucleon Transfer Reactions in Very Heavy Ion Systems . . . . .	45
H.W. Gäggeler	
Part II Nuclear Structure . . . . .	1
New Insights into the Structure of Neutron-Rich Nuclei . . . . .	1
A = 108 – 118 and $^{160-162}\text{Gd}$ . . . . .	57
J.H. Hamilton, Y.X. Luo, A.V. Ramayya, J.K. Hwang, E.H. Wang, N.T. Brewer, B. Doll, S.H. Liu, J.O. Rasmussen, I.Y. Lee, S. Frauendorf, G.M. Ter-Akopian, A.V. Daniel, Y.T. Oganessian, S.J. Zhu, Y. Shi, F.R. Xu and J.C. Batchelder	

<b>Paradigmatic Lessons from Nuclear Driplines . . . . .</b>	<b>69</b>
J.S. Vaagen, S.N. Ershov and M.V. Zhukov	
<b>Preliminary Results on Observation of New Shape Isomers . . . . .</b>	<b>79</b>
Yu.V. Pyatkov, D.V. Kamanin, A.A. Alexandrov, I.A. Alexandrova, N.A. Kondratyev, E.A. Kuznetsova, A.O. Strekalovsky, O.V. Strekalovsky and V.E. Zhuchko	
<b>Features of Nuclear Reactions with Light Weakly Bound Nuclei at Energies Near the Coulomb Barrier . . . . .</b>	<b>89</b>
N.K. Skobelev, Y.E. Penionzhkevich, S.M. Lukyanov, V. Kroha, A. Kugler and J. Mrázek	
<b>Stability Peninsulas in the Neutron-Rich Sector . . . . .</b>	<b>99</b>
K.A. Gridnev, V.N. Tarasov, D.K. Gridnev, X. Viñas and Walter Greiner	

### **Part III Nuclear Fission**

<b>Dynamics of Collinear Ternary Fission . . . . .</b>	<b>109</b>
Wolfram von Oertzen, K.R. Vijayaraghavan and M. Balasubramaniam	
<b>General Laws of Quantum and Statistical Mechanics Governing Fission . . . . .</b>	<b>121</b>
Karl-Heinz Schmidt and Beatriz Jurado	
<b>How Rare Is Cluster Decay of Superheavy Nuclei? . . . . .</b>	<b>131</b>
D.N. Poenaru, R.A. Gherghescu, W. Greiner and N.S. Shakib	
<b>New Kind of Nuclear Multi-body Decay (CCT)—Status and Perspectives of Studies . . . . .</b>	<b>141</b>
D.V. Kamanin, Yu.V. Pyatkov, A.A. Alexandrov, I.A. Alexandrova, N. Mkaza, N.A. Kondratyev, E.A. Kuznetsova, G.V. Mishinsky, V. Malaza, A.O. Strekalovsky, O.V. Strekalovsky and V.E. Zhuchko	
<b>Possible Production of Neutron-Rich Heavy Nuclei in Fissile Spallation Targets . . . . .</b>	<b>151</b>
Igor Mishustin, Yury Malyshkin, Igor Pshenichnov and Walter Greiner	

**Part IV Heavy Ion Physics**

<b>FAIR—Cosmic Matter in the Laboratory . . . . .</b>	165
H. Stöcker and C. Sturm	
<b>Turbulence in Low Viscosity Quark-Gluon Plasma . . . . .</b>	175
László P. Csernai	
<b>Parallelization of Kinetic Theory Simulations . . . . .</b>	183
Jim Howell, Wolfgang Bauer, Dirk Colbry, Rodney Pickett, Alec Staber, Irina Sagert and Terrance Strother	

**Part V Supercritical Fields**

<b>Probing Supercritical Fields with Real and with Artificial Nuclei . . . . .</b>	195
Joachim Reinhardt and Walter Greiner	
<b>Zepto-Second Atomic Clock for Nuclear Contact Time Measurements . . . . .</b>	211
Hartmut Backe	
<b>Superheavy Nuclear Molecules . . . . .</b>	223
Sophie Heinz	

**Part VI Astrophysics and Relativity**

<b>Compact Stars—How Exotic Can They Be? . . . . .</b>	235
S. Schramm, V. Dexheimer, R. Negreiros, J. Steinheimer and T. Schürhoff	
<b>Observational Tests of the Pseudo-complex Theory of GR Using Black Hole Candidates . . . . .</b>	245
Thomas Boller and Andreas Müller	
<b>Pseudo-complex General Relativity and Neutron Stars . . . . .</b>	255
Peter O. Hess, Isaac Rodríguez and Walter Greiner	
<b>An Introduction to the Mathematics of Pseudo-complex General Relativity . . . . .</b>	265
M. Schäfer, Walter Greiner and P.O. Hess	

<b>The Gauge Principle in Covariant Hamiltonian Field Theory . . . . .</b>	275
Hermine Reichau and Jürgen Struckmeier	
<b>Combining Quantum Electrodynamics and Electron Correlation . . . . .</b>	287
Ingvar Lindgren, Sten Salomonson, Daniel Hedendahl and Johan Holmberg	
<b>Ultra High Energy Neutrons and Other Fermions. . . . .</b>	297
B.G. Sidharth	
<b>Photographs . . . . .</b>	303