

## **PART II. APPLICATIONS OF ACCELERATORS**

<b>9 APPLICATIONS OF ACCELERATORS IN SCIENTIFIC RESEARCH</b>	<b>679</b>
9.1 The Role of Accelerators in Modern Physics	679
9.1.1 Nuclear Physics	679
9.1.2 Production of New Particles and Elements	680
9.1.3 Accelerators in High-energy Physics	682
9.1.4 Accelerators in Heavy-ion Physics	690
9.1.5 Accelerators in Radiation Chemistry	694
9.1.6 Accelerators in Non-nuclear Research	695
9.2 Development of Applications of Accelerators	698
9.2.1 Directions of Development. Expenditures	698
9.2.2 International and Interregional Collaboration	701
9.2.3 Research Programs. Data Processing	709
9.3 Principal Research Methods	717
9.4 Scattering of High-energy Particles	718
9.5 The Discovery of New Particles	726
9.6 Production of Mesons	742
9.7 Applications of Heavy Ions	752
9.7.1 The State of the Art and the Prospects of Acceleration methods	752
9.7.2 Reactions with Heavy Ions. Transuranium Elements	757
9.7.3 Synthesis of Transuranium Elements	760
9.7.4 Searches for Stable Superheavy Elements	766
9.8 Synchrotron Radiation	771

<b>10 APPLICATIONS OF ACCELERATORS IN MEDICINE AND RADIobiology</b>	<b>785</b>
10.1 Radiotherapeutic Applications	785
10.1.1 Prevalence	785
10.1.2 Kinds of Particles Used	787
10.1.3 Accelerators for Medical Irradiation	802
10.1.4 Accessories for Medical Accelerators	812
10.1.5 Radiotherapeutic Laboratories	813
10.1.6 Accelerators for Unconventional Therapies	815
10.2 Radiation Sterilization	820
10.2.1 Principal Features and Development of Radiation Sterilization	820
10.2.2 Principal Parameters of Sterilization	821
10.2.3 Systems of Sterilization Accelerators	826
10.2.4 Extent of Use. Economics of Application	828
10.3 Production of Radioactive Isotopes	831
10.3.1 The Demand for Radioactive Isotopes	831
10.3.2 Kinds of Particles and Reactions Used	833
10.3.3 Isotope Production	834
<b>11 APPLICATIONS OF ACCELERATORS IN INDUSTRY AND ENGINEERING</b>	<b>839</b>
11.1 Radiation Processing	839
11.1.1 Principal Types of Processes	839
11.1.2 Processing Parameters. Irradiation Techniques	842
11.1.3 Radiation-Processing Accelerators	850
11.1.4 Prevalence. Examples of Applications	854
11.2 Ion Implantation	862
11.2.1 Main Types of Applications	862
11.2.2 Ion Implanters	867
11.3 Nuclear Filters	869
11.4 Neutron Production	872
11.4.1 The Physical Foundations of Production of Accelerator Neutrons	872
11.4.2 Neutron Generators	878
11.5 Materials Testing	886
11.5.1 Radiography	886

	CONTENTS	xi
11.5.1.1 X-ray Radiography	886	
11.5.1.2 Neutron Radiography	895	
11.5.1.3 Proton Radiography	898	
11.5.2 Activation Analyses	901	
11.5.2.1 Neutron Activation	901	
11.5.2.2 Heavy-particle Activation	903	
11.5.2.3 Photon Activation	904	
11.5.3 Simulation of Radiation Damage in Structural Materials	906	
11.6 Other Applications	912	
Supplement	931	
References	945	
Glossary	975	
Index	993	