

Contents *

$\pi\pi$ Theories	
J. L. BASDEVANT	1
The Nucleon Resonances	
A. DONNACHIE	25
The Dynamics of Some πN Resonances	
G. GUSTAFSON/J. HAMILTON	49
Are Regge Cuts Still Worthwhile?	
B. SCHREMPP-OTTO and F. SCHREMPP	68
Rising Cross-Sections	
R. OEHME	109
On the Problem of the Sigma Terms in Meson-Baryon Scattering. Comments on Recent Literature	
B. RENNER	120
Local Properties of σ -Terms: A Review	
H. GENZ	130
Polarization of Recoil Nucleons from Single Pion Photoproduction. Experimental Methods and Results	
P. BRINCKMANN	137

* This volume was edited in cooperation with Dr. FRANK STEINER.

$\pi\pi$ Theories*

J. L. BASDEVANT

Contents

I.	Introduction	1
II.	Rigorous Results	3
	a) Roskies' Sum Rules	4
	b) Martin's Inequalities	4
	c) Roy's Relations	5
III.	Integral Equations	7
	a) Roy's Equations	7
	b) Atkinson's Program	8
	c) Chew-Mandelstam Equations	8
IV.	Bootstrap	10
V.	Phenomenological Models	12
	a) Phenomenological Analyses	12
	b) Use of Theoretical Tools	13
	c) Phenomenological Input	13
	d) Current Algebra Input	14
VI.	Duality	15
	a) F.E.S.R. Bootstrap	15
	b) Lovelace-Veneziano Model	16
VII.	Pade Approximation	17
	a) φ^4 Interaction	18
	b) σ Model	19
	c) ϱ Exchange model	19
VIII.	Concluding Remarks	20
	References and Footnotes	22

The Nucleon Resonances*

A. DONNACHIE

Contents

1. Scattering and Photoproduction Formalism	25
2. Pion-Nucleon Two Body Reactions.	29
3. Pseudoscalar Meson Photoproduction	36
4. Many Body Final States	42
References.	46

The Dynamics of Some πN Resonances*

G. GUSTAFSON and J. HAMILTON

Contents

Introduction	49
The Use of Partial Wave Dispersion Relations	50
I. The Main Sequences of πN Resonances	50
The Spin and Charge Ratios	51
The Exchange Signature	52
Ranges and Magnitudes	52
Unitary Limit	54
Comments	55
II. Other πN Resonances below 2 GeV	55
The Resonance $S_{11}(1535)$	56
Singularity Structure	57
The Resonance $S_{31}(1650)$	59
The ϱN Hypothesis	60
The Multi-Mass Formalism	61
Results for $S_{31}(1650)$	62
Other ϱN S-waves	63
The Amplitude D_{13}	65
Speculations on ϱN P-waves	65
The Resonance $P_{13}(1860)$	65
Comment	66
References	67

Are Regge Cuts Still Worthwhile?* **

B. SCHREMPP-OTTO and F. SCHREMPP

Contents

Abstract	68
1. Introduction	69
2. Flexibility of Regge-Cut Models	70
2.1. General Considerations	70
2.2. Different Stages of Flexibility in Regge-Cut Models	73
3. Theoretical and Decisive Experimental Constraints	78
3.1. Zero, Dip and Bump Mechanisms	78
3.2. The New Polarization Data in πN -Charge Exchange	87
3.3. Crossover	92
3.4. Regge Cuts in the Helicity-Flip Amplitudes	93
3.5. Fixed t -Dispersion Relations	94
3.6. Duality and Exchange Degeneracy	95
3.7. Low-Energy Information	96
3.8. Regge-Pole Residues	99
4. Conclusions	104
References	106

Rising Cross-Sections★ ★

REINHARD OEHME

Contents

Abstract	109
I. Introduction	109
II. Rising Cross-Sections and Shrinkage	110
III. Explicit Amplitudes	112
IV. Limiting Cases	115
V. Conclusions	117
References	118

On the Problem of the Sigma Terms in Meson-Baryon Scattering Comments on Recent Literature*

B. RENNER

Contents

Abstract	120
1. Introduction	120
2. Comments on the Kim and von Hippel Value	123
3. Comments on the Cheng and Dashen Value	125
3.1. Discussion of $\langle N u_0 N \rangle$	125
3.2. Discussion of c	125
3.3. Discussion of $\langle N u_8 N \rangle$	127
4. Conclusions	128
References	129

Local Properties of σ -Terms: A Review*

H. GENZ

Contents

Abstract	130
1. Introduction	130
2. Consequences of the Algebra of Current Components	132
3. Dimensional Arguments and Use of T_{00}	134
4. Appendix	135
References	136

Polarization of Recoil Nucleons from Single Pion Photoproduction

Experimental Methods and Results

PAUL BRINCKMANN

Contents

1. Introduction	137
2. Description of Single Pion Photoproduction	138
2.1. Photoproduction Amplitudes	138
2.2. Observables of the Photoproduction Reaction.	139
2.3. Significance of the Recoil Nucleon Polarization Measurements	141
3. Measurement of the Polarization of High Energy Proton and Neutron Beams	141
3.1. Theory	141
3.2. Analyzing Power: Proton-Helium	143
3.3. Analyzing Power: Proton-Carbon	145
3.4. Analyzing Power: Proton-Hydrogen	146
3.5. Analyzing Power: Neutron-Hydrogen	148
4. Experiments on Recoil Nucleon Polarization from Single Pion Photoproduction	149
4.1. Survey of Polarization Experiments	149
4.2. Experiments on Recoil Nucleon Polarization using Helium as Analyzer	150
4.3. Experiments on Recoil Nucleon Polarization using Carbon as Analyzer	152
4.4. Experiments on Recoil Proton Polarization using Hydrogen as Polarization Analyzer.	154
4.5. An Experiment on Recoil Neutron Polarization from the Reaction $\gamma p \rightarrow \pi^+ n$ using Hydrogen as Polarization Analyzer	156
5. Results of Polarization Experiments	157
5.1. Polarization of Recoil Protons from the Reaction $\gamma p \rightarrow \pi^0 p$	157
5.2. Polarization of Recoil Neutrons from the Reaction $\gamma p \rightarrow \pi^+ n$	161
References	162