

# Contents

---

FOREWORD	ix
PREFACE	xiii
1. PRELIMINARY CONCEPTS	1
1.1. The Interactions of Subnuclear Particles	1
1.2. The Isospin Symmetry of Strong Interactions	6
1.3. The $SU_3$ -Symmetry Model	10
1.4. Quarks and the $SU_6$ -Model	15
2. THE BASIC IDEAS OF CURRENT ALGEBRAS	19
2.1. Current Commutators	19
2.2. The $SU_3 \times SU_3$ Algebra	22
2.3. A Quark Model for the $SU_3 \times SU_3$ Algebra	25
2.4. Lepton Scattering Sum Rules	27
2.5. Some Remarks on the Mathematical Description of Currents and Charges	32
3. APPROXIMATE $SU_3$ SYMMETRY IN CURRENT ALGEBRA THEORY	34
3.1. The Description of an Approximate Symmetry	34
3.2. The Momentum Dependence of Direct Sum Rules	38
3.3. Corrections to $SU_3$ Results	41
4. THE DISPERSION THEORY OF CURRENT ALGEBRAS, I	44
4.1. A Covariant Derivation of Sum Rules	44
4.2. The Relationship between Direct Sum Rules and Dispersion Sum Rules	49
4.3. Sum Rules for Vertex Functions	57
5. CURRENT ALGEBRA SUM RULES WITH PCAC	59
5.1. The Principle of PCAC or Pion Pole dominance	59
5.2. The Adler-Weisberger Relation	62
5.3. Generalized Adler-Weisberger Relations	66
5.4. A Photoproduction Sum Rule for the Nucleon Magnetic Moments	71
5.5. On the Existence of Axial Vector Mesons	76
	vii

6. LOW-ENERGY THEOREMS	79
6.1. General Considerations	79
6.2. The $K$ -meson Leptonic Decays	83
6.3. Scattering Lengths of Mesons	86
6.4. Vector Meson Decays	91
6.5. Non-leptonic Weak Decays	95
7. EXTENSIONS OF THE $SU_3 \times SU_3$ CURRENT ALGEBRA	104
7.1. The Chiral $SU_6 \times SU_6$ Algebra	104
7.2. The Connections of the Static $SU_6$ Algebra with $SU_3 \times SU_3$	107
7.3. The Baryon Magnetic Moments and Mixing Schemes	110
7.4. The $U_{12}$ Current Algebra	114
7.5. Other Extensions	117
8. SCHWINGER TERMS	118
8.1. The Existence of Schwinger Terms	118
8.2. Alternative Approaches to Schwinger Terms	122
9. THE DISPERSION THEORY OF CURRENT ALGEBRAS, II	125
9.1. The Dispersion Theory of Local Current Commutators	125
9.2. General Sum Rules for Spinless Particles	129
9.3. The Sum Rule of Cabibbo and Radicati	133
9.4. Sum Rules for Finite Momentum Transfer, Superconvergence Relations	137
9.5. On the Asymptotic Behaviour of Current Commutator Matrix Elements	140
9.6. Other Classes of Dispersion Sum Rules	145
10. POSSIBLE CONNECTIONS OF CURRENT ALGEBRAS AND DYNAMICS	151
APPENDIX. SOME DETAILS ON LSZ REDUCTION FORMULAE	153
CONVENTIONS	157
BIBLIOGRAPHY ON CURRENT ALGEBRAS	159
SELECTED GENERAL REFERENCES	173
INDEX	175