

Cambridge University Press

978-0-521-57816-5 - The Rise of the Standard Model: Particle Physics in the 1960s and 1970s

Edited by Lillian Hoddeson, Laurie Brown, Michael Riordan and Max Dresden

Table of Contents

[More information](#)

Contents

<i>Contributors</i>	<i>page</i> ix
<i>Editors' Acknowledgments</i>	xiii
<i>Photographs of the Symposium</i>	xvi
<i>Abbreviations and Acronyms</i>	xxii
<i>Mathematical Notation</i>	xxvi

Part One: Introduction

1 The Rise of the Standard Model: 1964–1979 <i>Laurie M. Brown, Michael Riordan, Max Dresden, and Lillian Hoddeson</i>	3
2 Changing Attitudes and the Standard Model <i>Steven Weinberg</i>	36
3 Two Previous Standard Models <i>J. L. Heilbron</i>	45

Part Two: Quarks and Leptons

4 From the Psi to Charmed Mesons: Three Years with the SLAC–LBL Detector at SPEAR <i>Gerson Goldhaber</i>	57
5 The Discovery of the Tau Lepton <i>Martin Perl</i>	79
6 The Discovery of the Upsilon, Bottom Quark, and <i>B</i> Mesons <i>Leon M. Lederman</i>	101

vi

Contents

- | | | |
|---|--|-----|
| 7 | The Discovery of <i>CP</i> Violation
<i>James Cronin</i> | 114 |
| 8 | Flavor Mixing and <i>CP</i> Violation
<i>Makoto Kobayashi</i> | 137 |

Part Three: Toward Gauge Theories

- | | | |
|----|---|-----|
| 9 | The Path to Renormalizability
<i>Martinus Veltman</i> | 145 |
| 10 | Renormalization of Gauge Theories
<i>Gerard 't Hooft</i> | 179 |
| 11 | Asymptotic Freedom and the Emergence of QCD
<i>David Gross</i> | 199 |
| 12 | Quark Confinement
<i>Leonard Susskind</i> | 233 |
| 13 | A View from the Island
<i>Alexander Polyakov</i> | 243 |
| 14 | On the Early Days of the Renormalization Group
<i>Dmitrij V. Shirkov</i> | 250 |

Part Four: Accelerators, Detectors, and Laboratories

- | | | |
|----|--|-----|
| 15 | The Rise of Colliding Beams
<i>Burton Richter</i> | 261 |
| 16 | The CERN Intersecting Storage Rings: The Leap into the Hadron Collider Era
<i>Kjell Johnsen</i> | 285 |
| 17 | Development of Large Detectors for Colliding-Beam Experiments
<i>Roy Schwitters</i> | 299 |
| 18 | Pure and Hybrid Detectors: Mark I and the Psi
<i>Peter Galison</i> | 308 |
| 19 | Building Fermilab: A User's Paradise
<i>Robert R. Wilson and Adrienne Kolb</i> | 338 |
| 20 | Panel Session: Science Policy and the Social Structure of Big Laboratories
<i>Catherine Westfall</i> | 364 |
| 21 | Some Sociological Consequences of High-Energy Physicists' Development of the Standard Model
<i>Mark Bodnarzuk</i> | 384 |

Cambridge University Press

978-0-521-57816-5 - The Rise of the Standard Model: Particle Physics in the 1960s and 1970s

Edited by Lillian Hoddeson, Laurie Brown, Michael Riordan and Max Dresden

Table of Contents

[More information](#)*Contents*

vii

- 22 Comments on Accelerators, Detectors, and Laboratories
John Krige

394

Part Five: Electroweak Unification

- 23 The First Gauge Theory of the Weak Interactions
Sidney Bludman

403

- 24 The Early History of High-Energy Neutrino Physics
Melvin Schwartz

411

- 25 Gargamelle and the Discovery of Neutral Currents
Donald Perkins

428

- 26 What a Fourth Quark Can Do
John Iliopoulos

447

- 27 Weak-Electromagnetic Interference in Polarized
 Electron–Deuteron Scattering
Charles Prescott

459

- 28 Panel Session: Spontaneous Breaking of Symmetry
*Laurie M. Brown, Robert Brout, Tian Yu Cao,
 Peter Higgs, and Yoichiro Nambu*

478

Part Six: The Discovery of Quarks and Gluons

- 29 Early Baryon and Meson Spectroscopy Culminating in the
 Discovery of the Omega-Minus and Charmed Baryons
Nicholas Samios

525

- 30 Quark Models and Quark Phenomenology
Harry Lipkin

542

- 31 From the Nonrelativistic Quark Model to QCD and Back
Giacomo Morpurgo

561

- 32 Deep-Inelastic Scattering and the Discovery of Quarks
Jerome Friedman

566

- 33 Deep-Inelastic Scattering: From Current Algebra
 to Partons
James Bjorken

589

- 34 Hadron Jets and the Discovery of the Gluon
Sau Lan Wu

600

Part Seven: Personal Overviews

- 35 Quarks, Color, and QCD
Murray Gell-Mann

625

Cambridge University Press

978-0-521-57816-5 - The Rise of the Standard Model: Particle Physics in the 1960s and 1970s

Edited by Lillian Hoddeson, Laurie Brown, Michael Riordan and Max Dresden

[Table of Contents](#)[More information](#)

viii

Contents

36	The Philosopher Problem <i>Paul Teller</i>	634
37	Should We Believe in Quarks and QCD? <i>Michael Redhead</i>	637
38	A Historical Perspective on the Rise of the Standard Model <i>Silvan Schweber</i>	645
	<i>Index</i>	685