

# *Contents*

## *Introduction*

### **Constructing This World, and Others**

1. The World's Numerical Recipe
2. Analysis and Synthesis 1: What Matters for Matter
3. Analysis and Synthesis 2: Universal Characteristics
4. Analysis and Synthesis 3: Cosmic Groundwork
5. Analysis and Synthesis 4: Limits and Supplements

### **Musing on Mechanics**

6. Whence the Force of  $F = ma$ ? 1. Culture Shock
7. Whence the Force of  $F = ma$ ? 2. Rationalization
8. Whence the Force of  $F = ma$ ? 3. Cultural Diversity

### **Making Light of Mass**

9. The Origin of Mass
10. Mass without Mass 1: Most of Matter
11. Mass without Mass 2: The Medium is the Mass-age

### **QCD Exposed**

12. QCD Made Simple
13.  $10^{12}$  Degrees in the Shade
14. Back to Basics at Ultrahigh Temperatures

### **Breathless at the Heights**

15. Scaling Mount Planck 1: A View from the Bottom
16. Scaling Mount Planck 2: Base Camp
17. Scaling Mount Planck 3: Is That All There Is?

### **At Sea in the Depths**

18. What is Quantum Theory?

19. Total Relativity: Mach 2004
20. Life's Parameters

### **Once and Future History**

21. The Dirac Equation
22. Fermi and the Elucidation of Matter
23. The Standard Model Transcended
24. Masses and Molasses
25. In Search of Symmetry Lost
26. From 'Not Wrong' to (Maybe) Right
27. Unification of Couplings

### **Methods of Our Madness**

28. The Social Benefit of High Energy Physics
29. When Words Fail
30. Why are There Analogies Between Condensed Matter and Particle Theory?
31. The Persistence of Ether
32. Reaching Bottom, Laying Foundations

### **Inspired, Irritated, Inspired**

33. What Did Bohr Do?
34. Dreams of a Final Theory
35. Shadows of the Mind
36. The Inflationary Universe
37. Is the Sky Made from Pi?

### **Big Ideas**

38. Quantum Field Theory
39. Some Basic Aspects of Fractional Quantum Numbers

### **Grand Occasions**

40. From Concept to Reality to Vision
41. Nobel Biography
42. Asymptotic Freedom: From Paradox to Paradigm
43. Advice to Students

### **Breaking Into Verse**

44. Virtual Particles
45. Gluon Rap

46. Reply in Sonnet Form
47. From Beneath an e-Avalanche
48. Frog Sonnet
49. Archaeopteryx

### **Another Dimension**

Nobel Blog: A Year in the Life