

CONTENTS

Chapter 1

LIGHT FRONT QUANTIZATION

Matthias Burkardt

1.	Introduction	1
1.1.	Deep Inelastic Scattering	1
1.2.	Advantages of Light-Front Coordinates	4
1.3.	Outline	6
2.	Canonical Quantization	7
2.1.	Quantization in Light-Front Coordinates	7
2.2.	ε -Coordinates on Finite Light-Front Intervals	10
2.3.	Examples for Canonical Light-Front Hamiltonians	12
3.	The Light-Front Vacuum	19
3.1.	The Physical Picture	19
3.2.	Examples for Zero Modes	21
3.3.	Zero Modes and the Vacuum in ε -Coordinates	27
3.4.	Vacuum Condensates and Sum Rules	37
4.	Perturbative Renormalization	39
4.1.	Scalar Fields	41
4.2.	Fermions	44
4.3.	Gauge Theories	48
4.4.	Summary	49
5.	Nonperturbative Calculations	49
5.1.	Discrete Light-Cone Quantization	49
5.2.	Functional Integration on a Longitudinal Lattice	53

5.3. Hamiltonian Monte Carlo on a Transverse Lattice	54
5.4. Light-Front Tamm–Dancoff	59
6. Summary, Conclusions, and Outlook	62
7. Appendix: The Dirac–Bergmann Formalism	65
References	70

Chapter 2

NUCLEON KNOCKOUT BY INTERMEDIATE ENERGY ELECTRONS

James J. Kelly

1. Introduction	75
2. One-Photon-Exchange Approximation	78
2.1. Definition of the Response Tensors for $A(e, e'x)B$	78
2.2. Basic Response Functions for Electron Scattering	82
2.3. Electron Polarization	88
2.4. Response Functions for Recoil Polarization	90
2.5. Recoil Polarization Observables	97
2.6. Target Polarization	99
2.7. Basic PWIA for $A(e, e'x)B$	101
2.8. Kinematical Conventions	102
2.9. Electron Scattering from a Moving Nucleon	104
3. Nucleon Form Factors	106
3.1. Sachs Form Factors	106
3.2. Unpolarized Measurements of Nucleon Form Factors	110
3.3. Polarized Measurements of Nucleon Form Factors	120
3.4. Summary	128
4. Proton Knockout Experiments on Few-Body Systems	129
4.1. The $D(e, e'p)$ Reaction	131
4.2. The ${}^3\text{He}(e, e'p)$ Reaction	135
4.3. The ${}^4\text{He}(e, e'p)$ Reaction	137
5. Distorted Wave Analysis of $(\vec{e}, e'\vec{N})$ Reactions	139
5.1. Distorted Wave Amplitude	139

5.2.	Distorted Momentum Distributions	142
5.3.	Bound State Wave Functions	142
5.4.	Ejectile Distortion	144
5.5.	Nonrelativistic Models of the Nuclear Current	172
5.6.	Electron Distortion	188
5.7.	Relativistic Distorted Wave Models	192
5.8.	Summary	194
6.	Spectral Functions from $(e, e' p)$ on Complex Nuclei	195
6.1.	Definition of the Spectral Function	196
6.2.	Dispersive Optical Models	206
6.3.	Quasiparticle Hamiltonian Model	210
6.4.	Distorted Momentum Distribution	212
6.5.	Experimental Definition of Distorted Momentum Distributions	214
6.6.	Distorted Momentum Distributions for Valence Orbitals . .	216
6.7.	Ejectile-Energy Dependence of Missing Momentum Distributions	223
6.8.	Occupation Probabilities	225
6.9.	High Momentum Components	229
6.10.	Summary	236
7.	Studies of the Reaction Mechanism for Nucleon Knockout	238
7.1.	Enhancement of R_T/R_L	239
7.2.	The Swollen Nucleon Hypothesis	248
7.3.	Interference Response Functions for Complex Nuclei	249
7.4.	Meson Exchange and Isobar Currents	251
7.5.	Channel Coupling in $(e, e' N)$ Reactions	262
7.6.	Evidence for Multinucleon Knockout	272
7.7.	Summary	280
8.	Conclusions	282
	References	285
	<i>Index</i>	295