

Contents

1	Basics of QCD and Lattice QCD	1
1.1	QCD	1
1.2	Confinement	2
1.3	Chiral Symmetry Breaking	5
1.3.1	Banks–Casher Relation	6
1.4	Lattice QCD	8
1.5	Motivation and Outline of this Thesis	10
	References	11
2	Relation Between Confinement and Chiral Symmetry Breaking	13
2.1	Polyakov Loop	13
2.1.1	Operator Formalism and Dirac Modes on Lattice	13
2.1.2	The Relation Between Polyakov Loop and Dirac Modes on the Temporally Odd-Number Lattice	15
2.1.3	The Relation Between Polyakov Loop and Dirac Modes on the Even Lattice	19
2.1.4	Modified Kogut–Susskind Formalism for Temporally Odd-Number Lattice	21
2.1.5	The Relation Between the Dirac Matrix Element and the KS Dirac Matrix Element	26
2.1.6	Numerical Analysis	28
2.1.7	New “positive/negative Symmetry” on Dirac Matrix Element in Confinement Phase	32
2.2	Polyakov Loop Fluctuations	36
2.2.1	Properties of Polyakov Loop Fluctuations	37
2.2.2	The Polyakov Loop Fluctuations and Dirac Modes	38
2.2.3	Numerical Results	40
2.3	Wilson Loop	43
	References	46

3	Generalization to Chiral Fermion on the Lattice	47
3.1	Lattice Fermion and Fermionic Doubler Modes	48
3.2	The Relation Between Polyakov Loop and Low-Lying Modes of Overlap-Dirac Operator	50
3.2.1	Wilson-Dirac Operator	50
3.2.2	Overlap-Dirac Operator	52
	References	55
4	Summary and Outlook	57
	References	59

Lattice QCD Study for the Relation Between
Confinement and Chiral Symmetry Breaking
Doi, T.

2017, XII, 59 p. 18 illus. in color., Hardcover
ISBN: 978-981-10-6595-8