CONTENTS

INTRODUCTION ix

I. INTERACTIONS
I.1. Classical lattice systems 3
I.2. The pressure 7
I.3. Quantum lattice systems 15
I.4. Physical equivalence of interactions 22

II. TANGENT FUNCTIONALS AND THE VARIATIONAL PRINCIPLE
II.1. P-bounded functionals 32
II.2. The mean entropy 37
II.3. The variational principle 46

III. DLR EQUATIONS AND KMS CONDITIONS
III.1. The DLR equations 55
III.2. Invariant equilibrium states and the DLR equations 59
III.3. Time evolution and the KMS conditions 64
III.4. Physical equivalence and strict convexity 74
III.5. The KMS condition for classical interactions 79

IV. DECOMPOSITION OF STATES
IV.1. Ergodic states 83
IV.2. Non-commutative ergodic theory 85
IV.3. Integral representations 93
IV.4. Orthogonal decomposition 105

V. APPROXIMATION BY TANGENT FUNCTIONALS: EXISTENCE OF PHASE TRANSITIONS
V.1. The theorem of Bishop and Phelps 112
V.2. "Anti-phase transitions" in $\mathcal{B}$ 116
V.3. Existence of phase transitions 120

VI. THE GIBBS PHASE RULE
VI.1. Baire category, Hausdorff dimension and the phase rule 130
VI.2. Some point-set topology 134
VI.3. Proof of the phase rule 138

APPENDIX A. Hausdorff Measure and Dimension 143

APPENDIX B. Classical Hard-Core Continuous Systems 153

BIBLIOGRAPHY 163

INDEX 166