## CONTENTS

Prefa	reface	
Chapter 1. The Hubbard Hamiltonian in Physics		
[1.1]	Effect of Correlation on the Ferromagnetism of Transition Metals	
	by M.C. Gutzwiller, Phys. Rev. Lett. 10, 159 (1963)	3
[1.2]	Electron Correlations in Narrow Energy Bands	
	by J. Hubbard, Proc. Roy. Soc. A276, 238 (1963)	7
[1.3]	The Hubbard Hamiltonian	
	by M. Cyrot, Physica 91B, 141 (1977)	27
[1.4]	The Resonating Valence Bond State in La <sub>2</sub> CuO <sub>4</sub> and	
	Superconductivity	
	by P.W. Anderson, Science 235, 1196 (1987)	37
[1.5]	SO <sub>4</sub> Symmetry in a Hubbard Model	
	by C.N. Yang and S.C. Zhang, Mod. Phys. Lett. B4, 759 (1990)	40
Chaj	oter 2. Rigorous Results and Exact Solutions for	
	Large Systems	49
[2.1]	Absence of Mott Transition in an Exact Solution of the Short-Range,	
	One-Band Model in One Dimension	
	by E.H. Lieb and F.Y. Wu, Phys. Rev. Lett. 20, 1445 (1968)	51
[2.2]	Exact Integrability of the One-Dimensional Hubbard Model	
	by B.S. Shastry, Phys. Rev. Lett. 56, 2453 (1986)	55
[2.3]	Excitation Spectrum in the One-Dimensional Hubbard Model	
	by A.A. Ovchinnikov, Sov. Phys. JETP 30, 1160 (1970)	58
[2.4]	Magnetic Susceptibility at Zero Temperature for the One-Dimensional Hubbard Model	
	by H. Shiba, Phys. Rev. B6, 930 (1972)	62

## viii

2.5]	Low-Temperature Specific-Heat of One-Dimensional Hubbard Model	
	by M. Takahashi, Prog. Theor. Phys. 52, 103 (1974)	71
2.6]	Exact Solution and Thermodynamics of the Hubbard Model	
	with Infinite-Range Hopping	
	by P. van Dongen and D. Vollhardt, Phys. Rev. B40, 7252 (1989)	83
2.7]	Ground State Energy of Hubbard Model	
-	by W.D. Langer and D.C. Mattis, Phys. Lett. 36A, 139 (1971)	87
2.8]	Two Theorems on the Hubbard Model	
-	by E.H. Lieb, Phys. Rev. Lett. 62, 1201 (1989); Errata 62,	
	1927 (1989)	89
2.9]	Rigorous Bounds on the Susceptibilities of the Hubbard Model	
	by K. Kubo and T. Kishi, Phys. Rev. B41, 4866 (1990)	93
hapt	ter 3. Approximate Results in the Strong-Coupling Limit	97
3.1]	Correlation of Electrons in a Narrow s Band	
01	by M.C. Gutzwiller, Phys. Rev. 137, 1726 (1965)	100
3.2]	New Functional Integral Approach to Strongly Correlated Fermi	100
0.2]	Systems: The Gutzwiller Approximation as a Saddle Point	
	by G. Kotliar and A.E. Ruckenstein, Phys. Rev. Lett. 57,	
	1362 (1986)	110
3.3]	Theory of the Quasi-One-Dimensional Electron Gas with	110
0.0]	Strong "On-Site" Interactions	
	by V.J. Emery, Phys. Rev. B14, 2989 (1976)	114
3.4]	Application of Gutzwiller's Variational Method to the	114
0. IJ	Metal-Insulator Transition	
	by W.F. Brinkman and T.M. Rice, Phys. Rev. B2, 4302 (1970)	120
3.5]	Attractive Interaction and Pairing in Fermion Systems with	120
0.01	Strong On-Site Repulsion	
	by J.E. Hirsch, Phys. Rev. Lett. 54, 1317 (1985)	123
3.6]	Ferromagnetism in a Narrow, Almost Half-Filled s Band	120
0.0]	by Y. Nagaoka, Phys. Rev. 147, 392 (1966)	127
3.7]	Instability of the Nagaoka Ferromagnetic State of the $U = \infty$	121
0.1]	Hubbard Model	
	by B.S. Shastry, H.R. Krishnamurthy, and P.W. Anderson,	
	Phys. Rev. B41, 2375 (1990)	141
3.8]		141
J.0]	Single Spin Flip in the Nagaoka State: Problems with the Gutzwiller Wave Function	
	by T. Kopp, A.E. Ruckenstein, and S. Schmitt-Rink,	140
3 0]	Phys. Rev. B42, 6850 (1990) Solution of the One Dimensional Hubbard Model for Arbitrary	146
3.9]	Solution of the One-Dimensional Hubbard Model for Arbitrary	
	Electron Density and Large U by L Cormele and D. Bearingul, Phys. Rev. <b>B27</b> , 7541 (1989)	140
	by J. Carmelo and D. Baeriswyl, Phys. Rev. B37, 7541 (1988)	149

ix

[3.10]	Strong-Coupling Hubbard Chain by G. Beni, T. Holstein, and P. Pincus, <i>Phys. Rev.</i> <b>B8</b> , 312 (1973)	157
Chapter 4. Results in Different Physical Limits		
[4.1]	Conserving Approximations for Strongly Correlated Electron Systems: Bethe-Salpeter Equation and Dynamics for the Two-Dimensional Hubbard Model	
	by N.E. Bickers, D.J. Scalapino and R.S. White, <i>Phys. Rev. Lett.</i> 62, 961 (1989)	165
[4.2]	Correlated Lattice Fermions in $d = \infty$ Dimensions by W. Metzner and D. Vollhardt, Phys. Rev. Lett. 62, 324 (1989)	169
[4.3]	The Linearized Hubbard Model: Dynamical Superalgebra and Supersymmetry by A. Montorsi, M. Rasetti, and A.I. Solomon, Int. J. Mod. Phys.	
F	<b>B3</b> , 247 (1989)	173
[4.4]	Electron Correlation and Ferromagnetism of Transition Metals by J. Kanamori, Prog. Theor. Phys. 30, 275 (1963)	191
[4.5]	Renormalization-Group Study of the Hubbard Model by J.E. Hirsch, Phys. Rev. B22, 5259 (1980)	206
Chap	oter 5. Numerical Monte Carlo and Exact Diagonalization Results	215
[5.1] [5.2]	Two-Dimensional Hubbard Model: Numerical Simulation Study by J.E. Hirsch, <i>Phys. Rev.</i> B31, 4403 (1985) A Novel Technique for the Simulation of Interacting Fermion	217
[5 2]	Systems by S. Sorella, S. Baroni, R. Car, and M. Parrinello, Europhys. Lett. 8, 663 (1989) Numerical Study of the Two Dimensional Hubbard Model	234
[5.3]	Numerical Study of the Two-Dimensional Hubbard Model by S.R. White, D.J. Scalapino, R.L. Sugar, E.Y. Loh, J.E. Gubernatis, and R.T. Scalettar, Phys. Rev. <b>B40</b> , 506 (1989)	240
[5.4]	Variational Monte-Carlo Studies of Hubbard Model. II by H. Yokoyama and H. Shiba, J. Phys. Soc. Jpn. 56, 3582 (1987)	251
[5.5]	Superconducting Instability in the Large- $U$ Limit of the Two-Dimensional Hubbard Model	201
[5.6]	by C. Gros, R. Joynt, and T.M. Rice, Z. Phys. B68, 425 (1987) Dynamics of Quasiparticles in the Two-Dimensional Hubbard Model by D.C. Mattis, M. Dzierzawa, and X. Zotos, Phys. Rev.	262
[5.7]	B42, 6787 (1990) Pairing in the Two-Dimensional Hubbard Model: An Exact Diagonalization Study	270
	by H.Q. Lin, J.E. Hirsch, and D.J. Scalapino, <i>Phys. Rev.</i> B37, 7359 (1988)	274