Contents

General Principles of Ergodic Theory

1.	Intro	oduction	3
	1.1	The Aims of Ergodic Theory	3
	1.2	Ergodic Theory Contrasted with other General	
		Approaches to Statistical Mechanics	7
2.	The	General Form of Ergodic Theory	14
	2.1	The Ergodic Theorem	14
	2.2	Coarse-graining	17
	2.3	The Physical Significance of Time Averages	
		over Infinite Periods	23
	2.4	Isolated Physical Systems	32
	2.5	The Restriction to Macroscopic Systems	37
3.	Mat 3.1 3.2 3.3 3.4	thematical Results of General Dynamics	45 45 50 56 59
	3.5	Lewis's Theorem	63
	3.6	Theorems of von Neumann and of Hopf	68
	3.7	Trajectories and Sets of Positive Measure	72
4.	The	Application to Statistical Mechanics of Results	
	of C	General Dynamics	75
	4.1 4.2	The Ergodic and Quasi-ergodic Hypotheses . The Application of the Theorems of Birkhoff, Lewis, von Neumann and Hopf	75 78
	4.3	The Number of Constants of the Motion of a	
		Dynamical System	90

CONTENTS

5.	Alter	nativ	e Atte	mpts	on the	e Clas	ssical l	Ergod	ic The	orem	103
	5.1 5.2 5.3	Khir Uhlł A Fi	nchin's norn's unctio	s Asyı Phase nal-av	mptot e Spa veragi	ic Th ce of ng M	eorem an Ex lethod	n . perin	nent	• •	103 124 130
	E	rgodio	c Theo	ory in	Quan	tum-S	Statisti	ical N	/lechan	ics	
6.	Dyna	ımica	l Prop	oerties	of Q	uanta	l Syste	ems	•		137
	6.1	Line	ar Op	erator	rs and	Mot	ion in	Hilb	ert Spa	ice	137
7.	Von Theo	Neui rem	mann's	5 App	roach	to t	he Qu	antal	Ergo	lic	142
	7.1 7.2 7.3 7.4	Gen The Phas Criti	eral R Fine- se Cell icism	emarl graine s and of vor	ks d Erg Maci n Neu	odic ro-ob manr	Theor servab 1's Me	em oles thod	of Pro	of	142 142 146 152
8.	Alter	nativ	e App	roache	es to tl	he Qu	antal]	Ergod	lic The	orem	169
	8.1 8.2 8.3 8.4	Averaging over Initial States<									
Сог	nclusio	on			•						198
App App App	pendiz pendiz	x 1. x 2.	Dyna A Pro	mical oof of	Reve Birkl	rsibili 10ff 's Techi	ity Theor	rem for	Ouant	al	200 204
Ар	Jenui	. 5.	Ergo	tic Th	eoren	ns					220
Bib	liogra	phy			٠						227
Aut	thor I	ndex		·	•		٠				229
Subject Index											231

viii