



## CONTENTS

PREFACE	vii
1. INTRODUCTION	
1.1. History	1
1.2. The Basic Phenomena	2
1.2.1. Probability of fission	2
1.2.2. Mass yield	6
1.2.3. Charge yield	9
1.2.4. Energetics (kinetic, excitational, radiations)	10
1.3. The Models	11
2. LIQUID DROP MODEL: STATICS	
2.1. Parameterization of the Nuclear Surface	14
2.2. Constraints	16
2.3. Small Deformation	17
2.4. Fission and Scission Energy Release	20
2.5. Map of the Potential Surface	27
2.5.1. Expansion about spherical shape	27
2.5.2. Expansion about spheroidal shape	30
2.5.3. Numerical calculations	31
2.6. Asymmetric Fission	37
2.7. Comparison with Experiment	40
2.7.1. Asymmetric fission thresholds	40
2.7.2. Symmetric fission thresholds	41
3. LIQUID DROP MODEL: DYNAMICS	
3.1. Small Deformation	43
3.2. Effect of Rotation on Energy Surface	45
3.3. Finite Deformation	46
3.3.1. Qualitative features	46
3.3.2. A numerical calculation	47
3.4. Quantum Effects	49
3.4.1. Quantization of the hydrodynamical equations	49
3.4.2. Barrier penetration	50
4. ADIABATIC MODEL	
4.1. Collective and Particle Coordinates	53
4.2. An Idealized Programme	55
4.3. Phenomenological Models	58
4.3.1. Nilsson's IPM	58
4.3.2. Multipole potentials	62
4.4. The Pairing Force and Superconductivity	64
4.5. Collective Dynamics	71
4.5.1. Constraints as dynamical variables	71
4.5.2. Cranking model formula for the mass parameters	72
4.5.3. Mass parameter for $\beta$ -motion	75
4.6. Experimental Consequences	77
4.6.1. Special role of the saddle point	77
4.6.2. Spontaneous fission lifetimes	78
4.6.3. Angular distribution of fission fragments	81
4.6.4. Mass yield	85

## CONTENTS

<b>5. NON-ADIABATICITY AND VISCOSITY</b>	
5.1. Real and Virtual Transitions	89
5.2. Simple Systems: Slippage	90
5.2.1. Single crossing formula	90
5.2.2. Multiple crossings	91
5.2.3. Criteria for applicability	93
5.3. Excitation as a Diffusion Process	94
5.3.1. The diffusion equation	94
5.3.2. Estimation of the diffusion coefficient	96
5.3.3. Some limitations	98
5.4. Correspondence with Viscosity	99
<b>6. STATISTICAL MODELS</b>	
6.1. The Basic Assumptions	101
6.2. Fundamental Formula	102
6.2.1. According to Fong	102
6.2.2. According to Newton	103
6.3. Ingredients of the Formula	105
6.3.1. Fragment masses	105
6.3.2. Fragment deformation energy	106
6.3.3. Level density	107
6.3.4. Scission radius	108
6.4. Comparison with Experiment	108
6.5. Discussion	114
<b>7. SLOW NEUTRON FISSION WIDTHS</b>	
7.1. Concept of a Channel	114
7.2. $2\pi \langle \Gamma_f \rangle / D$ as a Measure of Channel Number	116
7.3. Fluctuation in $\Gamma_f$ , as a Measure of Channel Number	117
7.4. Comparison with Experiment	120
<b>APPENDIX</b>	123
<b>BIBLIOGRAPHY AND AUTHOR INDEX</b>	125
<b>SUBJECT INDEX</b>	131