

# Contents

<b>Acknowledgment</b>	<b>v</b>
<b>Preface</b>	<b>vii</b>
<b>1. Model-Free Statistical Reduction of Single-Molecule Time Series</b>	<b>1</b>
<i>Haw Yang</i>	
1 Introduction . . . . .	1
2 General theoretical background: Statistical likelihood . . . . .	3
3 The transition between molecular states occurs much faster than the experimental time resolution — Intermittency . . . . .	12
4 Experimental time resolution is sufficient to follow the transition between molecular states . . . . .	15
5 Distributions . . . . .	17
6 Bursts . . . . .	21
7 Conclusion . . . . .	24
Acknowledgments . . . . .	24
References . . . . .	25
<b>2. Testing Hypothesis with Single Molecules: Bayesian Approach</b>	<b>31</b>
<i>Taras Plakhotnik</i>	
1 Introduction to the Bayesian approach . . . . .	31
2 Hidden parameters . . . . .	39
3 Finding quasi-stationary states . . . . .	41
4 Finding distances between molecules . . . . .	49
References . . . . .	59

<b>3.</b>	<b>Generating Functions for Single-Molecule Statistics</b>	<b>61</b>
	<i>Frank L. H. Brown</i>	
1	Introduction . . . . .	61
2	The Poisson process and introduction of generating functions . . . . .	64
3	Generating functions for photon emission: More complex kinetic models . . . . .	73
4	Generating functions for photon emission: Quantum treatment . . . . .	79
5	Quantum dynamics examples . . . . .	81
6	Conclusion . . . . .	90
	Acknowledgments . . . . .	91
	References . . . . .	91
<b>4.</b>	<b>Multipoint Correlation Functions for Photon Statistics in Single-Molecule Spectroscopy: Stochastic Dynamics in Liouville Space</b>	<b>93</b>
	<i>František Šanda and Shaul Mukamel</i>	
1	Photon statistics: Factorial moments vs. correlation functions . . . . .	93
2	Photon statistics in weakly driven systems: Analogy with four wave mixing . . . . .	99
3	Multipoint correlation functions for slow fluctuations . . . . .	108
4	Summary . . . . .	134
	Acknowledgments . . . . .	134
	References . . . . .	135
<b>5.</b>	<b>Thermodynamics and Kinetics from Single-Molecule Force Spectroscopy</b>	<b>139</b>
	<i>Gerhard Hummer and Attila Szabo</i>	
1	Introduction . . . . .	139
2	Thermodynamics from single-molecule pulling experiments . . . . .	141
3	Kinetics from single-molecule pulling experiments . . . . .	155
4	Concluding remarks . . . . .	175

Acknowledgments . . . . .	176
References . . . . .	176
<b>6. Theory of Photon Counting in Single-Molecule Spectroscopy</b>	<b>181</b>
<i>Irina V. Gopich and Attila Szabo</i>	
1 Introduction . . . . .	181
2 General formalism . . . . .	186
3 Fluorescence quenching and conformational dynamics . . . . .	203
4 Influence of translational diffusion . . . . .	225
5 Concluding remarks . . . . .	238
Acknowledgments . . . . .	239
References . . . . .	239
<b>7. Memory Effects in Single-Molecule Time Series</b>	<b>245</b>
<i>Jianshu Cao</i>	
1 Introduction . . . . .	245
2 Modulated reaction model: General formalism . . . . .	247
3 On–off blinking time series . . . . .	257
4 Photon emission time series . . . . .	269
5 Data analysis . . . . .	278
6 Concluding remarks . . . . .	280
Acknowledgments . . . . .	281
References . . . . .	281
<b>8. Analysis of Experimental Observables and Oscillations in Single-Molecule Kinetics</b>	<b>287</b>
<i>Marcel O. Vlad and John Ross</i>	
1 Introduction . . . . .	287
2 Correlation functions and oscillations . . . . .	290
3 On–off time distributions and oscillations . . . . .	304
4 Reaction event statistics and oscillations . . . . .	307
5 Conclusions . . . . .	310
Acknowledgments . . . . .	311
References . . . . .	311

<b>9. Discrete Stochastic Models of Single-Molecule Motor Proteins Dynamics</b>	<b>313</b>
<i>Anatoly B. Kolomeisky</i>	
1 Introduction . . . . .	313
2 Single-molecule experiments . . . . .	315
3 Theoretical models . . . . .	316
4 Conclusions . . . . .	329
References . . . . .	330
<b>10. Unique Mechanisms From Finite Two-State Trajectories</b>	<b>337</b>
<i>Ophir Flomenbom and Robert J. Silbey</i>	
1 Introduction . . . . .	337
2 Mathematical formulations . . . . .	340
3 RD forms . . . . .	344
4 Constructing the RD form from the data . . . . .	348
5 Concluding remarks . . . . .	352
Appendix A . . . . .	353
Appendix B . . . . .	354
References . . . . .	360
<b>11. Weak Ergodicity Breaking in Single-Particle Dynamics</b>	<b>365</b>
<i>E. Barkai</i>	
1 Introduction . . . . .	365
2 Blinking nanocrystals . . . . .	369
3 Continuous time random walk . . . . .	380
4 The quenched trap model . . . . .	383
5 Discussion . . . . .	387
Acknowledgment . . . . .	389
References . . . . .	389
<b>About the Editors</b>	<b>393</b>
<b>Index</b>	<b>395</b>