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C. R. Zwanzig. Lectures in Theoretical Physics (Boulder), <u>III</u> , 106 (1960), [Interscience Publishers, N. Y. (1961)], "Statistical Mechanics of Irreversibility".	189
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B. H. C. Andersen, I. Oppenheim, K. E. Shuler and G. H. Weiss, J. Math. Phys. <u>5</u> , 522 (1964). "Exact Conditions for the Preservation of a Canonical Distribution in Markovian Relaxation Processes".	258
C. D. Bedeaux, K. E. Shuler and I. Oppenheim, J. Stat. Phys. <u>3</u> , 365 (1971). "Decay of Correla- tions IV. Necessary and Sufficient Conditions for a Rapid Decay of Correlations".	273
D. D. Bedeaux, K. Lakatos Lindenberg and K. E. Shuler, J. Math. Phys. <u>12</u> , 2116 (1971). "On the Relation between Master Equations and Random Walks and Their Solutions".	288
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A. J. Keilson and J. E. Storer, Quart. Appl. Math. <u>10</u> , 243 (1952). "On Brownian Motion, Boltzmann's Equation and the Fokker-Planck Equation".	298
B. N. G. van Kampen, Can. J. Phys. <u>39</u> , 551 (1961). "Power Series Expansion of the Master Equation".	315
C. R. F. Pawula, Phys. Rev. <u>162</u> , 186 (1967). "Approximation of the Linear Boltzmann Equation by the Fokker-Planck Equation".	332
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B. G. H. Weiss, Adv. Chem. Phys. <u>13</u> , 1 (1966). "First Passage Time Problems in Chemical Physics"	361

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B. E. W. Montroll and K. E. Shuler, J. Chem. Phys. <u>26</u> , 454 (1957). "Studies in Non-Equilibrium Rate Processes. I. The Relaxation of a System of Harmonic Oscillators".	390
C. C. Rankin and J. C. Light. J. Chem. Phys. <u>46</u> , 1305 (1967). "Relaxation of a Gas of Harmonic Oscillators".	401
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C. I. Oppenheim, K. E. Shuler and G. H. Weiss, J. Chem. Phys. <u>50</u> , 460 (1969). "Stochastic and Deterministic Formulation of Chemical Rate Equations".	483
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B. R. A. Orwoll and W. H. Stockmayer, Adv. in Chem. Phys. <u>15</u> , 305 (1969). "Stochastic Models for Chain Dynamics".	535
C. W. H. Stockmayer, W. Gobush and R. Norvice, Pure and Applied Chemistry <u>26</u> , 537 (1971). "Local Jump Models for Chain Dynamics".	555