

Bibliography

- [1] G. Roepstorff, *Path Integral Approach to Quantum Physics*, Springer, 1996.
- [2] L.S. Schulman, *Techniques and Applications of Path Integration*, John Wiley & Sons, Inc., 1981.
- [3] R.P. Feynman, *Space-time approach to non-relativistic quantum mechanics*, Rev. Mod. Phys. **20** (1948) 367.
- [4] R.P. Feynman and A.R. Hibbs, *Quantum Mechanics and Path Integrals*, McGraw-Hill, New York 1965.
- [5] I.M Gel'fand and A.M. Yaglom, *Integration in functional spaces and its applications in quantum physics*, J. Math. Phys. **1** (1960) 48.
- [6] E. Nelson, *Feynman integrals and the Schrödinger equation*, J. Math. Phys. **5** (1964) 332.
- [7] S.G. Brush, *Functional Integrals and Statistical Physics*, Rev. Mod. Phys. **33** (1961) 79.
- [8] H. Kleinert, *Path Integrals in Quantum Mechanics, Statistics and Polymer Physics, and Financial Markets*, 4 nd edition 2006, World Scientific, Singapore
- [9] J. Glimm and A. Jaffe, *Quantum Physics, A Functional Integral Point of View*, Springer, 1981
- [10] H. Groenewold, *On the principles of elementary quantum mechanics*, Physica **12** (1946) 405.
- [11] L. van Hove, *Sur certaines représentations unitaires d'un groupe infini de transformations*, Proc. Roy. Acad. Sci. Belgium **26** (1951) 1.
- [12] R.P. Feynman, *The Principle of Least Action in Quantum Mechanics*, Ph.D.Thesis, Princeton University, May 1942.
- [13] M. Kac, (1949). *On Distributions of Certain Wiener Functionals*, Transactions of the AMS **65** (1) (1949) 1.

- [14] J. Schwinger, *Selected Papers on Quantum Electrodynamics*, Dover, New York, 1958.
- [15] H. Bauer, *Wahrscheinlichkeitstheorie und Maßtheorie*, De Gruyter, Berlin, 1978.
- [16] Y. Aharonov and D. Bohm, *Significance of Electromagnetic Potentials in the Quantum Theory*, Phys. Rev. **115** (1955) 485.
- [17] M. Peshkin, *The Aharonov-Bohm Effect: Why it cannot be eliminated from Quantum Mechanics*, Phys. Rep. **80** (1981) 375.
- [18] L. O’Raifeartaigh, N. Straumann and A. Wipf, *On The Origin Of The Aharonov-Bohm Effect*, Comments Nucl. Part. Phys. **20** (1991) 15; *Aharonov-Bohm Effect In Presence Of Superconductors*, Found. Phys. **23** (1992) 703.
- [19] K. Kirsten and A. McKane, *Functional determinants for general Sturm-Liouville problems*, J. Phys. **A37** (2004) 4649.
- [20] M.L. Glasser, *Summation over Feynman histories: charged particle in a uniform magnetic field*, Phys. Rev. **B 113** (1964) 831.
- [21] P.R. Chernoff, *Note on product formulas for operator semigroups*, J. Funct. Anal. **2** (1968) 238.
- [22] M. Reed and B. Simon, *Methods of Modern Mathematical Physics I*, Academic Press, 1972.
- [23] H. Weyl, *Das asymptotische Verteilungsgesetz der Eigenwerte lineare partieller Differentialgleichungen*, Math. Ann. **71** (1912) 441.
- [24] M. Reed and B. Simon, *Methods of Modern Mathematical Physics IV*, chap. XIII.17, Academic Press, New York, (1978).
- [25] A. Fick, *Über Diffusion*, Poggendorff’s Annalen der Physik **94** (1855) 59.
- [26] A. Einstein, *Investigations on the Theory of the Brownian Movement* Dover, New York, 1956; S. Chandrasekhar, *Stochastic Problems in Physics and Astronomy*, Rev. Mod. Phys. **15** (1943) 1.
- [27] E.P. Wigner, *On the quantum correction for thermodynamic equilibrium*, Phys. Rev. **40** (1932) 749; J.G. Kirkwood, *Quantum Statistics of Almost Classical Assemblies*, Phys. Rev. **44** (1933) 31.
- [28] D. Fliegner, P. Haberl, M. Schmidt and C. Schubert, *An improved heat kernel expansion from worldline path integrals*, Discourses Math. Appl. **4** (1995) 87.

- [29] N. Metropolis, A.W. Rosenbluth, M.N. Rosenbluth, A.H. Teller and E. Teller, *Equations of state calculations by fast computing machines*, J. Chem. Phys. **21** (1953) 1087.
- [30] M. Creutz and B. Freedman, *A statistical approach to quantum mechanics*, Ann. Phys. **132** (1981) 421.
- [31] M.E.J. Newman und G.G. Barkenna, *Monte Carlo Methods in Statistical Physics*, Clarendon Press, Oxford, 1999.
- [32] *Markov Chain, Monte Carlo Simulations and Their Statistical Analysis*, World Scientific, Singapore, 2006.
- [33] A. Berezin, *The Method of Second Quantization*, Academic Press, New York, 1966.
- [34] J. Reinhardt and W. Greiner, *Feldquantisierung*, Harry Deutsch, Frankfurt, 1993.
- [35] H. Nicolai, *Supersymmetry and Spin Systems*, J. Phys. **A9** (1976) 1497
E. Witten, *Dynamical Breaking of Supersymmetry*, Nucl. Phys. **B188** (1981) 513.
- [36] E. Witten, *Supersymmetry and Morse Theory*, J. Diff. Geom. **17** (1982) 661.
- [37] F. Cooper, A. Khare and U. Sukhatme, *Supersymmetry Quantum Mechanics*, Phys. Rep. **251** (1995) 267 and World Scientific, Singapore, 2001.
- [38] G. Junker, *Supersymmetric Methods in Quantum Mechanics and Statistical Physics*, texts and monographs in physics, Springer, Berlin 1996.
- [39] H. Kalka and G. Soff, *Supersymmetry*, Teuber, 1997.
- [40] H. Nicolai, *On a New Characterization of Scalar Supersymmetric Theories*, Phys. Lett. **89 B** (1980) 341.
- [41] H. Ezawa and J.R. Klauder, *Fermion Without Fermions: The Nicolai Map Revisited*, Prog. Theor. Phys. **74** (1985) 904.
- [42] J. Schwinger, *Phys. Rev.* **128** (1962) 2425.
- [43] S. Coleman, R. Jackiw and L. Susskind, *Ann. Phys.* **93** (1975) 267; L.S. Brown, *Nuovo Cimento* **29** (1963) 617.
- [44] J.H. Loewenstein and J.A. Swieca, *Ann. Phys.* **68** (1971) 172; A.K. Raina and G. Wanders, *Ann. Phys.* **132** (1981) 404; A.Z. Capri and R. Ferrari, *Nuovo Cimento* **A62** (1981) 273. P. Becher, *Ann. Phys.* **146** (1983) 223

- [45] N.K. Nielsen and B. Schroer, *Nucl. Phys.* **B 120** (1977) 62; K.D. Rothe and J.A. Swieca, *Ann. Phys.* **117** (1979) 382; M. Hortascu, K.D. Rothe and B. Schroer, *Phys. Rev.* **D 20** (1979) 3203; N.V. Krasnikov et.al, *Phys. Lett Phys. Lett.* **B97** (1980) 103; R. Roskies and F. Schaposnik, *Phys. Rev.* **D 23** (1981) 558.
- [46] C. Jayewardena, *Helv. Phys. Acta* **61** (1988) 636.
- [47] I. Sachs and A. Wipf, *Finite Temperature Schwinger Model*, *Helv. Phys. Acta* **65** (1992) 652.
- [48] C. Bernard *Phys. Rev.* **D9** (3312) 1974; Itzykson Zuber (QFT) or Birrell and Davies (QFT in curved space time)
- [49] R. Musto, L. O’Raifeartaigh and A. Wipf, *The U(1)-Anomaly, the Non-Compact Index Theorem, and the (Supersymmetric) BA-Effect*, *Phys. Lett* **175 B** (1986) 433; P. Forgacs, L. O’Raifeartaigh and A. Wipf, *Scattering Theory, U(1)-Anomaly and Index Theorems for Compact and Non-Compact Manifolds*, *Nucl.Phys.* **B 293** (1987) 559
- [50] L. Faddeev, *Theor.Math.Phys.* **1** (1979) 1
- [51] J.D. Jackson, *Classical Electrodynamics*, J. Wiley and Sons, Inc., 1975
- [52] N.K. Nielsen and B. Schroer, *Nucl. Phys.* **B120** (1977) 62
- [53] G. Glashow, S. Weinberg and A. Salam in *Rev. Mod. Phys.* **52** (1980) 515 and *ibid*, **53** (1980) 539
- [54] K. Huang, *Quarks, Leptons and Gauge Fields*, World Scientific (1982)
- [55] L. O’Raifeartaigh, A. Wipf and H. Yoneyama, *The Constraint Effective Potential*, *Nucl. Phys.* **B271** (1986) 653
- [56] Y. Fujimoto, A. Wipf and H. Yoneyama, *Symmetry Restoration of Scalar Models at Finite Temperature*, *Phys. Rev.* **D38** (1988) 2625

Index

- γ -matrices, 83
- Aharonov-Bohm effect, 36
- asymptotic series, 49
- Berezin integral, 97
- Borel-measurable function, 67
- Brownian motion, 45, 60
- Chapman-Kolmogorov equation, 64
- characteristic function
 - of random variable, 70
- conditional expectation, 65
- connected 2-point function, 74
- correlation function, 15
- covariant derivative, 36, 82
- detailed balance, 92
- determinant
 - product rule, 55
 - zeta-function, 59
- diffusion, 60
- diffusion constant, 61, 63
- diffusion equation, 44
- diffusion flux, 61
- diffusion limit, 63
- Dirac Hamiltonian, 82
- Dirichlet boundary conditions, 58
- Dirichlet boundary conditions, 24
- Euclidean action, 47
- Euclidean path integral, 43
- euclidean path integral, 46
- evolution kernel
 - free particle, 11
 - expectation value, 68
 - external source, 22
- Feynman-Kac formula, 11, 12
- Ficks law, 60
- fluctuation operator, 26
- Fock space, 95
- free energy, 72
 - with source, 76
- Gaussian integral, 19
- Gelfand-Yaglom
 - generalized, 58
 - initial value problem, 20
- generating function
 - for Berezin integral, 98
- generating functional, 17
- Grassmann algebra, 96
- Grassmann integral, 97
- Greenfunction, 15
- harmonic oscillator, 18
 - constant frequency, 21
- heat kernel, 81
 - for Dirac-Hamiltonian, 82
- Heisenberg equation, 9
- Heisenberg picture, 9
- high temperature expansion
 - of $Z(\beta)$, 81
- Hilbert space, 9
- holomorphic function, 95
- imaginary time, 43

-
- important sampling, 87
 - Ito-calculus, 35
 - joint distribution, 68
 - left-derivative, 97
 - Lorentz equation, 34
 - Lorentz force, 34
 - master equation, 45
 - Mehler formula, 44
 - Metropolis algorithm, 87, 92
 - midpoint rule, 35
 - Monte-Carlo simulations, 87
 - Monte-Carlo sweep, 93
 - Moyal bracket, 9
 - Neumann boundary conditions, 58
 - Nicolai map, 102, 103
 - normal ordering, 96
 - observable, 9
 - operator, 9
 - oscillator
 - with external source, 22
 - particle
 - in electromagnetic field, 34
 - partition function, 47, 72
 - path
 - of stochastic process, 69
 - path integral
 - euclidean, 46
 - path integral
 - for fermions, 104
 - Pauli Hamiltonian, 38
 - phase space, 8
 - Poisson brackets, 8
 - probability space, 66
 - propagator
 - free particle, 11
 - quantum mechanics
 - supersymmetric, 101
 - random variable, 67
 - Gaussian, 68
 - random variables
 - independent, 68
 - random walk, 62
 - discrete, 62
 - right-derivative, 97
 - Robin boundary conditions, 58
 - saddle point approximation, 47
 - sample space, 67
 - scalar particle, 34
 - scalar potential, 34
 - scalar product
 - of analytic functions, 97
 - scaling limit
 - Brownian motion, 63
 - Schrödinger equation, 10
 - Schrödinger picture, 9
 - Schwinger function, 46
 - Schwinger functional, 24
 - thermal, 76
 - semi-group, 44
 - simple event, 67
 - spinning particle, 38, 40
 - statistical mechanics, 72
 - stochastic matrix, 88
 - attractive, 90
 - stochastic process, 68
 - homogeneous, 62
 - isotropic, 62
 - stochastic vector, 88
 - Stokes-Einstein relation, 61
 - supersymmetry, 101
 - susy Hamiltonian, 101
 - susy harmonic oscillator, 101

Theorem

- of Bochner, 71
- of Kolmogorov, 70
- of Kolmogorov-Prehorov, 71
- thermal correlation functions, 73
- thermal de Broglie wavelength, 79
- time evolution kernel, 10
- time ordering, 15
- trace class, 54
- Trotter product formula, 11

- variance, 68
- vector potential, 34

- Wick rotation, 43
- Wick theorem, 31
- Wiener measure, 43
- Wiener process, 65
- Wightman function, 45
- Wightman functions, 45
- Wigner-Kirkwood expansion, 79
- winding number, 37
- Wronskian, 56

- zeta-function, 59