
References

Editors' note:

See also the updated lists of main book publications of C. F. von Weizsäcker and of books on Weizsäcker's philosophy of physics at pages XXXII and XXXIII.

Abbreviation:

QTS: Quantum Theory and the Structures of Time and Space, volumes I (1975), II (1977), III (1979), IV (1981), V (1983), edited by L. Castell, M. Drieschner and C. F. v. Weizsäcker; volume VI (1986), edited by L. Castell and C. F. v. Weizsäcker. Munich, Hanser

- Barut, A. O. (1984). Unification based on electrodynamics. In *Symposium on Unification, Caput*.
- Boerner, H. (1955). *Darstellungen von Gruppen*. Springer, Berlin.
- Bohm, D. (1951). *Quantum theory*. Prentice Hall, New York.
- Bohm, D. (1952). A suggested interpretation of the quantum theory in terms of "hidden" variables. *Physical Review*, 85:166–179, 180.
- Bohr, N. (1913a). On the constitution of atoms and molecules. *Phil. Mag.*, 26:1–25, 476–502, 857–875.
- Bohr, N. (1913b). Über das Wasserstoffspektrum. *Fysisk Tidskrift*, 12:97.
- Bohr, N. (1935). Can quantum-mechanical description of reality be considered complete? *Phys. Rev.*, 48:696–702.
- Bohr, N. (1949). Discussion with Einstein on epistemological problems in atomic physics. In *Schilpp (1949)*.
- Bohr, N., Kramers, H., and Slater, J. (1924). Über die Quantentheorie der Strahlung. *Z. Phys.*, 24:69–87.
- Bopp, F. (1954). Korpuskularstatistische Begründung der Quantenmechanik. *Z. Naturforschung*, 9a:579–600.
- Bopp, F. (1983). Quantenphysikalischer Ursprung der Eichidee. *Annalen d. Physik*, 40:317–333.

- Borges, J. L. (1970). *Sämtliche Erzählungen*. Hanser, Munich.
- Born, M. (1924). Über Quantenmechanik. *Z. Phys.*, 26:379–395.
- Born, M. (1925). *Vorlesungen über Atommechanik*. Springer, Berlin.
- Born, M. (1926). Quantenmechanik der Stoßvorgänge. *Z. Phys.*, 38:803–827.
- Born, M. and Jordan, P. (1930). *Elementare Quantenmechanik*. Springer, Berlin.
- Broglie, L. d. (1924). *Thèses*. Masson et Cie, Paris.
- Capra, F. (1975). *The Tao of Physics*. Berkely.
- Castell, L. (1975). Quantum theory of simple alternatives. In *QTS II*, 147–162.
- Courant, R. and Hilbert, D. (1937). *Methoden der mathematischen Physik*, volume II. Springer, Berlin.
- Dingler, H. (1943). *Aufbau der exakten Fundamentalwissenschaft*. Edited by P. Lorenzen, Eidos, Munich, 1964.
- Dirac, P. A. M. (1927). The quantum theory of the emission and absorption of radiation. *Proc. Roy. Soc.*, A(114):243–265.
- Dirac, P. A. M. (1933). The Lagrangian in quantum mechanics. *Phys. Z. Sowjetunion*, 3:64–72.
- Dirac, P. A. M. (1937). The cosmological constants. *Nature*, 139:323.
- Drieschner, M. (1967). *Quantum mechanics as a general theory of objective prediction*. PhD thesis, Univ. Hamburg.
- Drieschner, M. (1979). *Voraussage-Wahrscheinlichkeit-Objekt*. Springer, Berlin.
- Dürr, H.-P. (1977). Heisenberg's unified theory of elementary particles and the structure of space and time. In *QTS II*, 33–45.
- Eckert, M., Pricha, W., Schubert, H., and Torkar, G. (1984). Geheimrat Sommerfeld – Theoretischer Physiker: Eine Dokumentation aus seinem Nachlaß. Abhandlungen und Berichte des Deutschen Museums München, Sonderheft 1.
- Ehrenfest, P. and Ehrenfest, T. (1906). Über eine Aufgabe aus der Wahrscheinlichkeitsrechnung, die mit der kinetischen Deutung der Entropievermehrung zusammenhängt. *Math.-Naturwiss. Blätter*, 11:12.
- Eigen, M. (1971). Selforganization of matter and the evolution of biological macromolecules. *Natwiss.*, 58:465–523.
- Einstein, A. (1905). Über einen die Erzeugung und Verwandlung des Lichts betreffenden heuristischen Gesichtspunkt. *Ann. d. Physik*, 17:132–148.
- Einstein, A. (1917). Quantentheorie der Strahlung. *Phys. Zeitschrift*, 18:121–128.
- Einstein, A. (1949). Autobiographisches. In *Schilpp (1949)*, pages 2–95.
- Einstein, A., Podolsky, B., and Rosen, N. (1935). Can quantum-mechanical description of reality be considered complete? *Phys.Rev.*, 47:777–780.
- Everett, H. (1957). Relative state formulation of quantum mechanics. *Review of Modern Physics*, 29:454–462.
- Feynman, R. P. (1948). Space-time approach to non-relativistic quantum mechanics. *Rev. Mod. Phys.*, 20:367–387.
- Finetti, B. d. (1972). *Probability, induction and statistics*. J. Wiley, New York.
- Finkelstein, D. (1968). Space-time code. *Phys. Rev.*, 185:1261.
- Franz, H. (1949). Master's thesis, MPI Physik, Göttingen.
- Gadamer, H. G. (1960). *Wahrheit und Methode*. Mohr (Siebeck), Tübingen.
- Gibbs, H. W. (1902). *Elementary principles in statistical mechanics*. Yale University Press, New Haven.
- Glandsdorff, P. and Prigogine, I. (1971). *Thermodynamic theory of structure, stability and fluctuations*. J. Wiley, New York.

- Gödel, K. (1949). An example of a new type of cosmological solutions of Einstein's field equation of gravitation. *Rev. Mod. Phys.*, 21:447–450.
- Green, H. S. (1953). A generalized method of field quantization. *Phys. Rev.*, 90:270–273.
- Greenberg, O. W. and Messiah, A. M. L. (1965). High-order limit of para-Bose and para-Fermi fields. *J. Math. Phys.*, 6:500–504.
- Gupta, S. N. (1950). Theory of longitudinal photons in quantum electrodynamics. *Proc. Phys. Soc.*, A(63):681–691.
- Gupta, S. N. (1954). Gravitation and electromagnetism. *Phys. Rev.*, 96:1683–85.
- Haken, H. (1978). *Synergetics*. Springer, Berlin.
- Hawking, S. W. and Ellis, G. F. R. (1973). *The large scale structure of space-time*. Cambridge University Press, Cambridge.
- Heidenreich, W. (1981). *Die dynamischen Gruppen $SO(3,2)$ und $SO(4,2)$ als Raum-Zeit-Gruppen von Elementarteilchen*. PhD thesis, TU Munich, Munich.
- Heisenberg, W. (1925). Über die quantentheoretische Umdeutung kinematischer und mechanischer Beziehungen. *Z. Physik*, 33:879–893.
- Heisenberg, W. (1927). Über den anschaulichen Inhalt der quantentheoretischen Kinematik und Mechanik. *Z. Phys.*, 43:172–198.
- Heisenberg, W. (1930). *Die physikalischen Prinzipien der Quantentheorie*. Hirzel, Leipzig.
- Heisenberg, W. (1948). Der Begriff abgeschlossene Theorie in der modernen Naturwissenschaft. *Dialectica*, 2:331–336.
- Heisenberg, W. (1967). *Einführung in die einheitliche Feldtheorie der Elementarteilchen*. Hirzel, Leipzig.
- Heisenberg, W. (1969). *Der Teil und das Ganze*. Piper, Munich.
- Heisenberg, W., Dürr, H.-P., Mitter, H., Schlieder, S., and Yamasaki, K. (1959). *Z. Naturforschung*, 14a:441.
- Heisenberg, W. and Pauli, W. (1929). Zur Quantendynamik der Wellenfelder. *Z. Phys.*, 56:1; (1930) 59:168.
- Helmholtz, H. v. (1868). Über die Tatsachen, die der Geometrie zugrunde liegen. *Nachr. Königl. Ges. Wiss. Göttingen*, 9:193–221.
- Hilbert, D. (1915). Die Grundlagen der Physik. *Nachr. Königl. Ges. Wiss. Göttingen*, 395; (1917) 201.
- Hoffmann, B. and Dukas, H. (1972). *Albert Einstein*. Viking Press, New York.
- Jacob, P. (1979). *Konform invariante Theorie exklusiver Elementarteilchen-Streuungen bei großen Winkeln*. PhD thesis, MPI Starnberg.
- Jammer, M. (1974). *The philosophy of quantum mechanics*. J. Wiley, New York.
- Jauch, J. M. (1968). *Foundations of quantum mechanics*. Addison-Wesley, Reading, Mass.
- Kant, I. (1781). *Kritik der reinen Vernunft*. Riga.
- Kant, I. (1786). *Metaphysische Anfangsgründe der Naturwissenschaft*. Riga.
- Kuhn, T. S. (1962). *The Structure of Scientific Revolutions*. University of Chicago Press.
- Künemund, T. (1982). Dynamische Symmetrien in der Elementarteilchenphysik. Master's thesis, TU Munich.
- Künemund, T. (1985). *Die Darstellungen der symplektischen und konformen Superalgebren*. PhD thesis, TU Munich.
- Lorentz, K. (1973). *Die Rückseite des Spiegels*. Piper, Munich.

- Lorenz, K. (1942). Die angeborenen Formen möglicher Erfahrung. *Z. Tierpsychol.*, 5:235.
- Ludwig, G. (1954). *Die Grundlagen der Quantenmechanik*. Springer, Berlin.
- Mehra, J. (1973a). Einstein, Hilbert, and the theory of gravitation. In *Mehra (1973b)*.
- Mehra, J., editor (1973b). *The physicists's conception of nature*, Dordrecht. Reidel.
- Meyer-Abich, K. M. (1965). *Korrespondenz, Individualität und Komplementarität*. Steiner, Wiesbaden.
- Mittelstaedt, P. (1979). Der Dualismus von Feld und Materie in der Allgemeinen Relativitätstheorie. In Nelkowski, H., editor, *Einstein Symposium Berlin*, Berlin. Springer.
- Neumann, J. v. (1932). *Mathematische Grundlagen der Quantenmechanik*. Springer, Berlin.
- Neumann, J. v. and Morgenstern, O. (1944). *Theory of games and economic behavior*. Princeton University Press, Princeton.
- Pais, A. (1982). *Subtle is the Lord*. Oxford University Press, Oxford.
- Picht, G. (1958). Die Erfahrung der Geschichte. In *Picht (1969)*.
- Picht, G. (1960). Die Epiphanie der ewigen Gegenwart. In *Picht (1969)*.
- Picht, G. (1969). *Wahrheit, Vernunft, Verantwortung*. Klett, Stuttgart.
- Popper, K. R. (1934). Zur Kritik der Ungenauigkeitsrelationen. *Naturwiss.*, 22:807–808.
- Popper, K. R. (1975). The rationality of scientific revolutions. In Harré, R., editor, *Problems of scientific revolution*, Oxford. Clarendon.
- Rudolph, E. (1983). Zur Theologie des Aristoteles.
- Sartre, J. P. (1943). *L'être et le néant*. Gallimard, Paris.
- Savage, L. J. (1954). *The foundations of statistics*. J. Wiley, New York.
- Scheibe, E. (1964). *Die kontingenten Aussagen in der Physik*. Athenäum, Frankfurt.
- Scheibe, E. (1973). *The logical analysis of quantum mechanics*. Pergamon Press, Oxford.
- Schilpp, P., editor (1949). *Albert Einstein: Philosopher-scientist*, Evanston, Ill. The Library of living philosophers, volume VII.
- Schmutzger, E. (1983). Prospects for relativistic physics. In *Proc. of GR 9*, Berlin. Dt. Verlag d. Wissenschaften.
- Schrödinger, E. (1935). Die gegenwärtige Situation in der Quantenmechanik. *Naturwiss.*, 49:823–828.
- Segal, I. E. (1976). Theoretical foundations of the chronometric cosmology. *Proc. Nat. Acad. Sci USA*, 73:669–673.
- Sexl, R. U. and Urbantke, H. K. (1983). *Gravitation und Kosmologie*. Bibliographisches Institut, Mannheim.
- Shannon, C. F. and Weaver, W. (1949). *The mathematical theory of communication*. Urbana, Ill.
- Snyder, H. S. (1947). Quantized space-time. *Phys. Rev.*, 71:38–41.
- Strawson, P. F. (1959). *Individuals*. Methuen, London.
- Stükelberg, E. C. G. (1960). Quantum theory in real Hilbert space. *Helv. Phys. Acta*, 33:727–752.
- Thirring, W. E. (1961). An alternative approach to the theory of gravitation. *Ann. Phys. (N.Y.)*, 16:96–117.
- Vigier, H. P. (1954). Structure des micro-objets dans l'interprétation causale de la théorie des quantes. Paris.

- Weizsäcker, C. F. v. (1931). Ortsbestimmung eines Elektrons durch ein Mikroskop. *Z. Physik*, 70:114–130.
- Weizsäcker, C. F. v. (1934). Nachwort zu einer Arbeit von K. Popper (1934). *Naturwiss.*, 22:808.
- Weizsäcker, C. F. v. (1939). Der zweite Hauptsatz und der Unterschied von Vergangenheit und Zukunft. *Ann. Physik*, 36:275. Reprinted in Weizsäcker, 1971a.
- Weizsäcker, C. F. v. (1943). *Zum Weltbild der Physik*. Hirzel, Leipzig.
- Weizsäcker, C. F. v. (1948). *Die Geschichte der Natur*. Hirzel, Stuttgart.
- Weizsäcker, C. F. v. (1949). Eine Bemerkung über die Grundlagen der Mechanik. *Ann. Physik*, 6:67–68.
- Weizsäcker, C. F. v. (1955). Komplementarität und Logik I. *Naturwiss.*, 42:521–529 and 545–555. Reprinted in Weizsäcker (1957).
- Weizsäcker, C. F. v. (1957). *Zum Weltbild der Physik*. Hirzel, Stuttgart, 7th edition.
- Weizsäcker, C. F. v. (1958). Komplementarität und Logik II. *Z. Naturforschung*, 13a:245–253.
- Weizsäcker, C. F. v. (1971a). *Die Einheit der Natur*. Hanser, Munich.
- Weizsäcker, C. F. v. (1971b). Notizen über die philosophische Bedeutung der Heisenbergschen physik. In Dürr, H.-P., editor, *Quanten und Felder*, Braunschweig. Vieweg.
- Weizsäcker, C. F. v. (1971c). The Unity of Physics. In Bastin, T., editor, *Quantum Theory and Beyond*, Cambridge. Cambridge University Press.
- Weizsäcker, C. F. v. (1972). Evolution und Entropiewachstum. *Nova Acta Leopoldina*, 206:515–530. Reprinted in Weizsäcker (1974b).
- Weizsäcker, C. F. v. (1973a). Classical and quantum descriptions. In Mehra (1973b).
- Weizsäcker, C. F. v. (1973b). Comment on Dirac's paper. In Mehra (1973b).
- Weizsäcker, C. F. v. (1973c). Probability and quantum mechanics. *Brit. J. Phil. Sci.*, 24:321–337.
- Weizsäcker, C. F. v. (1974a). Der Zusammenhang der Quantentheorie elementarer Felder mit der Kosmogonie. *Nova Acta Leopoldina*, 212:61–80.
- Weizsäcker, C. F. v. (1974b). Geometrie und Physik. In Enz, C. P. and Mehra, J., editors, *Physical reality and mathematical description*, pages 48–90, Dordrecht. Reidel.
- Weizsäcker, C. F. v. (1975). The philosophy of alternatives. In *QTS I*, 213–230.
- Weizsäcker, C. F. v. (1977). *Der Garten des Menschlichen*. Hanser, Munich.
- Weizsäcker, C. F. v. (1979). Einstein. In *Weizsäcker (1983)*.
- Weizsäcker, C. F. v. (1982). Bohr und Heisenberg. In *Weizsäcker (1983)*.
- Weizsäcker, C. F. v. (1983). *Wahrnehmung der Neuzeit*. Hanser, Munich.
- Weizsäcker, C. F. v. (1985). Werner Heisenberg. In Gall, L., editor, *Die großen Deutschen unserer Epoche*, Berlin. Propyläen.
- Weizsäcker, C. F. v., Scheibe, E., and Süßmann, G. (1958). Mehrfache Quantelung, Komplementarität und Logik III. *Z. Naturforschung*, 13a:705–721.
- Weizsäcker, C. v. and Weizsäcker, E. v. (1984). Fehlerfreundlichkeit. In Kornwachs, K., editor, *Offenheit, Zeitlichkeit, Komplexität*, Frankfurt, New York. Campus.
- Weizsäcker, E. v. (1974a). Erstmaligkeit und Bestätigung als Komponenten der pragmatischen Information. In *Weizsäcker (1974b)*.
- Weizsäcker, E. v., editor (1974b). *Offene Systeme I*. Klett-Cotta, Stuttgart.
- Weizsäcker, E. v. (1985). Contagious knowledge. In Ganelius, T., editor, *Progress in Science and its Social Conditions—Proceedings of the 58th Nobel symposium, Stockholm 1983*, New York. Pergamon Press.

- Weizsäcker, E. v. and Weizsäcker, C. v. (1972). Wiederaufnahme der begrifflichen Frage: Was ist Information? *Nova acta Leopoldina*, 206:535–555.
- Weyl, H. (1918). *Raum-Zeit-Materie*. Springer, Berlin.
- Wheeler, J. A. (1978). The “past” and the “delayed choice” double-slit experiment. In Marlow, A. R., editor, *Mathematical Foundations of Quantum Theory*, pages 9–48. Academic Press, New York.
- Wigner, E. (1939). On unitary representations of the inhomogeneous Lorentz group. *Ann. Math.*, 40(1):39–94.
- Wigner, E. (1961). Remarks on the mind-body question. In Good, I. J., editor, *The scientist speculates*, London. Heinemann.
- Wigner, E. (1983). Realität und Quantenmechanik. In *QTS V*, 7–18.
- Wolff, M. (1971). *Fallgesetz und Massenbegriff. Zwei wissenschaftliche Untersuchungen zur Kosmologie des Johannes Philoponus*. de Gruyter, Berlin.
- Zucker, F. J. (1974). Information, Entropie, Komplementarität und Zeit. In *Weizsäcker (1974b)*.

Index

- Action at a distance, 5, 24, 35
Alternative, 7, 72, 85, 105, 107, 260, 337, 341
anti-de Sitter group, 97, 171
Apriorism, xxii, 82, 251, 256, 277, 334, 335
Aristarchus, 37, 38, 339
Aristotle, xv, xxx, 24, 26, 29, 32, 236, 287, 298, 307, 309, 334, 338–343
Ashtekar, A., xxvi
Atomism, xxi, 25, 34, 89, 103, 131, 133, 152
- Böhme, G., 184
Barut, A. O., 136
Becker, J., xvii
Being, 25, 287–289, 297, 298, 304, 310, 311, 315, 316, 342, 343
Bekenstein, J., xxix, 167, 169
Bellarmin, R., 38
Berdjis, F., xvii
Besso, M. A., 288
Biology, 211, 214, 215, 219, 229, 234, 274, 303, 338
Black hole, xxix, 167–169, 177
Bleuler, K., 259
Body, 5, 20–26
Bohm, D., 284, 291
Bohr, N., xiii, xiv, xvi, xix, xxxi, 8, 9, 15, 33, 43, 52, 53, 57, 83, 87, 137, 142, 145, 244–248, 250, 251, 253–261, 263–266, 269, 270, 274, 276, 277, 279, 284, 288–290, 314, 321, 322, 325, 326, 344
- Boltzmann, L., 4, 113, 187, 190, 201–204
Bolyai, J., 36, 141
Bopp, F., 79, 136, 255
Borges, J., 294
Born, M., xiv, 247–249, 251, 253, 259
Boscovich, R. J., 21
Bose statistics, 69, 91, 92, 112–114, 117
Brahe, T., 39
Broglie, L. V. de, xiv, 53, 70, 245–247, 249, 254, 260
Buddha, 341
Buffon, G. L. L., 29
- Cantor, G., 309
Capra, F., 344
Carnap, R., 66, 288
Carnot, S., 218
Castell, L., xvi, xxiv, xxv, 100, 112, 118–120, 123, 126, 127, 304, 347
Causality, 6, 27, 30, 86, 133, 181, 182, 206, 248, 249, 258, 266, 338, 341
Chemistry, 5, 15, 31–34, 52, 54, 55, 89, 106, 131, 137, 250, 299–301, 310, 338, 339
Chievitz, O., 255
Clarke, S., 40, 41
Classical physics, 5–9, 14–16, 20, 23–25, 27, 29, 40–44, 51, 55, 57, 81, 82, 84, 87, 105, 106, 141, 152, 182, 234, 243–246, 248, 258, 261, 264–266, 269, 276, 277, 287, 288, 290, 292, 295, 300, 308, 313, 316, 321, 335, 341, 345
Clausius, R., 218

- Clifford screw, 95, 99, 103
 Closed theory, 1, 2, 13, 14, 36, 41, 53,
 55, 72, 243, 245, 277, 278, 309,
 311, 312, 331, 335–337
 Cognition, xxii, 27, 72, 234–236, 238,
 307, 308, 333
 Columbus, C., 94
 Complementarity, xx, 78, 253, 255–257,
 274, 314, 344
 Compton, A. H., 138, 145, 246
 Condensation model, 223
 Conditional, 19, 20, 39, 40, 66, 73–75,
 87, 183, 184, 207, 285
 Configuration space, 69, 70, 73, 142,
 247, 254
 Confirmation, 229, 230, 232, 233
 Connes, A., xxvi
 Conservation law, 15, 34, 154, 158, 283,
 303
 Copenhagen interpretation, 244, 246,
 249, 253, 259, 268, 269, 276, 284,
 321, 322
 Copernicus, N., 37, 38, 50
 Correspondence principle, 55, 70, 71,
 83, 245, 253–255, 258, 276
 Correspondence principle, 84
 Cosmology, 37, 49–51, 57, 95, 108, 109,
 122, 143, 146, 147, 149–151, 154,
 155, 159, 169, 177, 201, 313
 Courant, R., 28
 Covariance, 45, 47
 Croesus, 318, 319
 Cusanus, 38, 47

 Dürr, H. P., xvi, 134
 Dalton, J., 32
 Dark matter, 167
 Darwin, C., 212, 215, 219, 234, 341
 Delayed choice, 280, 282, 290
 Delbrück, M., 274
 Democritus, 25
 Density matrix, 267, 268, 271
 Descartes, R., xv, 29, 44, 299
 Determinism, 87, 90, 183, 269, 292, 305
 Dingler, H., 41
 Dirac, P., xiii, 6, 30, 147, 156, 259, 284
 Distinguishability, xxiii
 Drühl, K., xvii, 111

 Drieschner, M., xvi, xxii, 75, 77–79,
 123, 347
 Dukas, H., 288
 Dynamics, xxi, xxviii, 5, 6, 31, 35, 39
 73, 76, 78, 83–85, 90, 94, 99

 Ebert, R., xvi
 Eddington number, xxviii, xxix
 Ehlers, J., 143
 Ehrenfest, P., 187, 190, 191
 Ehrenfest, T., 187, 190, 191
 Eidos, 5, 236, 298–300, 303, 306–309
 Eigen, M., 221
 Einstein space, 95, 108, 118, 120–122,
 126, 127, 138, 140, 142, 144, 145,
 169
 Einstein, A., xiii, xiv, 6, 8, 9, 30, 33–35,
 38–53, 55, 72, 84, 102, 120, 132,
 133, 137, 140–146, 156, 170, 206,
 207, 244–246, 248, 250–252, 256,
 257, 259, 260, 262, 264, 266, 277,
 280–284, 286–291, 315, 316, 326,
 336
 Electrodynamics, 25, 35, 45, 51–53, 129,
 132, 135, 137, 144, 265
 Elementary particle, xxx, 8, 52, 54,
 55, 89, 90, 108, 111, 131, 138, 145,
 152, 156, 167, 169–171, 178, 217,
 278, 301, 312
 Ellis, G. F. R., 209
 Empiricism, 82, 149, 150, 334, 335
 Energy, 34, 300
 Energy condition, 159
 Entropy, xxix, 4, 34, 167, 169, 187,
 190, 192–194, 200–206, 211, 212,
 214–217, 219–223, 225, 227, 228,
 268, 300, 305, 322
 EPR thought experiment, 280, 282, 284,
 286, 289–292, 322
 Euclid, 36
 Event, 2–5, 9, 60, 63, 64, 66, 74–76, 87,
 138, 181, 193, 198, 199, 206, 213,
 216–218, 268, 270, 274, 279, 304,
 324, 326–329, 338
 Event horizon, xxix
 Everett, H., 249, 286, 293–295, 322, 323
 Evolution, xvii, 4, 86, 190, 211, 212,
 214, 215, 218–221, 229, 230, 234,

- 235, 237, 267, 268, 303, 306, 308,
309, 311–314, 333, 336, 340, 341
- Expectation value, 4, 60, 62, 64–66, 68,
70, 71, 103, 216, 217
- Experience, 1–3, 54, 60, 61, 71, 72, 195,
251, 255, 289, 334, 335, 337
- Extremum principle, 3, 6, 28, 185
- Facticity, 4, 9, 57, 88, 193, 194, 200,
209, 276, 289, 292, 293, 295, 310,
311, 316, 320, 321, 323, 324, 327,
329, 340
- Falsification, 43, 46
- Faraday, M., 35
- Fermat, P. de, 29
- Fermi, E., xiii, 142, 284
- Feynman, R. P., 6, 30
- Field theory, 46, 48, 55, 70, 116, 129,
132, 133, 137, 142, 143, 146, 169,
206, 245, 254, 259, 260, 278, 283,
288
- Finitism, 7, 75, 78, 84, 86–88, 133, 138,
146, 147
- Finkelstein, D., xvi, xxv, xxvi, 126,
143, 146, 290
- Form, xxx, xxxi, 4, 77, 82, 83, 213,
214, 218, 220–222, 227, 235, 238,
239, 298, 299, 306, 308–310, 331,
338, 340, 341
- Franck, J., 52
- Franz, H. R., 31
- Frege, G., XV, 17
- Frequency, 3, 4, 51, 60, 61, 64–68, 98,
186, 188, 191, 192, 213, 214, 218,
245, 246, 255, 263, 269, 270
- Friedmann, A. A., 145
- Future, 3, 9, 192, 262, 263, 278, 289,
304, 313, 316, 335
- Gödel, K., 208
- Görnitz, T., xvii, xxiv, 120, 141, 145
- Gadamer, H.-G., 314
- Galilean transformation, 26, 43
- Galilei, G., 23, 26, 38, 40, 47, 265
- Gauge group, 8, 113, 129, 135, 136, 145
- Gauge theory, xxviii, 136
- Gauss, C. F., 36, 46, 141
- Geometry, Euclidean, 14, 15, 41, 83
- Geometry, non-Euclidean, 6, 15, 36, 83
- Gestalt, 213–215, 298, 341
- Gibbs, H. W., 34, 187, 191, 204, 205
- Glansdorff, P., 218, 220, 221, 223, 227
- Goethe, J. W. v., 341
- Golden Copenhagen rule, 322, 326
- Graudenz, D., xxiv
- Gravitation, 15, 22, 131, 145, 156, 245,
291
- Green, H. S., 112–114
- Gregor-Dellin, M., 93
- Grosse, R., xvii
- Gupta, S. N., 48, 108, 146, 259
- H-theorem, 190–193, 201
- Hügel, K., xvii
- Habicht, C., 51
- Haken, H., xvii, 215
- Hamilton, W., 6, 29, 30
- Hawking, S. W., xxix, 167, 169, 209
- Hegel, G. W. F., 237, 328
- Heidegger, M., xv, 287, 304
- Heidenreich, W., xvii, 112, 135
- Heisenberg, M., 238
- Heisenberg, W., xiii–xv, xix, xxxi,
1, 2, 13, 30, 31, 36, 43, 48, 53, 54,
70, 72, 83, 84, 132–135, 137, 244,
246–248, 250–256, 259, 264, 265,
269, 282–284, 288, 293, 311–313,
325, 335, 336
- Helmholtz, H. v., 34, 41
- Heraclitus, 309
- Hertz, G., 51, 52
- Heyn, E., xvii
- Hidden variable, 253, 291–293, 316
- Hoffmann, B., 288
- Holographic principle, xxix
- Hooft, G. 't, xxix
- Hume, D., 2, 67, 86, 207, 335
- Husserl, E., 323
- Hypothesis, 2, 8, 21, 23, 24, 33, 38, 51,
89, 94, 122, 125–127, 130, 146,
152, 201, 202, 204–206, 219, 244,
245, 248, 249, 274, 275, 316, 318,
339
- Idealization, 18, 20, 37, 41, 83, 86
- Identity, 6, 21, 42, 77, 90, 124, 125, 133,
134, 137, 212, 254, 299, 300, 327,
328

- Indeterminism, 7, 9, 55, 72, 77, 78, 247, 249, 305, 313, 316
 Inertia, 6, 23, 38, 44, 45, 84, 96, 141, 182, 339, 341
 Infinity, 151, 154, 263, 309
 Information, xi, xvi, xxi, xxv, xxviii–xxx, 4, 5, 177, 197, 211–239, 260, 262, 300–306
 Information theory, 230, 262
 Initial condition, 19–23, 29, 50, 185, 186, 218, 248
 Interaction, xxviii, 85, 90, 266, 272, 324, 329
 Interpretation of physics, xi, xv, xxxi, 2, 4, 5, 8–10, 15, 17, 18, 32, 34, 38, 42–44, 48, 55–57, 59, 60, 114, 133, 203, 204, 211, 212, 241, 243, 244, 247–249, 253, 255, 259–262, 264, 265, 268, 269, 275–278, 283, 284, 291–294, 297, 313–315, 321–323
 Invariance, xxv, 31, 42, 47–49, 84, 98, 107, 121, 126, 136, 144, 145, 206
 Irreversibility, xvi, 4, 9, 15, 28, 34, 50, 86, 182, 185–187, 190, 191, 197, 201, 208, 211, 215, 218, 266–268, 278, 279, 294, 304, 310, 313, 316, 320–323, 327, 328

 Jacob, P., xvii, 112, 310
 James, W., 234, 325
 Jammer, M., 244, 247–249, 256, 259, 260, 282, 283, 286, 291–293
 Joos, H., 135
 Jordan, P., xiv, 147, 156, 254, 259, 344
 Jung, C. G., 32

 Künemund, T., xvii, 112
 Küppers, B. O., xvii, 220
 Kaluza, T., 146, 151
 Kant, I., xv, xxi, 2, 3, 27, 29, 33, 41, 42, 50, 72, 82, 86, 93, 108, 212, 228, 237, 256, 258, 271, 300, 304, 307, 308, 334–337
 Kepler, J., 29, 30, 38, 39
 Kinematics, 55, 79, 83, 84, 251, 330
 Kirchhoff, G. R., 51
 Klein, F., 30, 83, 141, 146, 151
 Kornwachs, K., xvii

 Kramers, H. A., 245, 246, 248, 263
 Kreisgang, xxii, 5, 10, 71, 82, 94, 212, 234, 235, 308, 331, 333, 346
 Kuhn, T. S., 1, 13, 313, 335, 336
 Kunsemüller, H., xvi

 Lakatos, I., 59
 Lambert, J. H., 36
 Landau, L., 203
 Lange, L., 41, 42
 Laplace, P. S. de, 50, 66, 67, 212, 228
 Lattice, xxii, 3, 6, 7, 64, 65, 67, 73–75, 78
 Law of inertia, 29, 43, 44, 95, 96, 182, 184
 Laws of nature, form of, 3, 14, 28, 29, 37, 50, 54, 300, 340
 Lehmeier, T., xvii
 Leibniz, G. W., 26, 38–42, 44–46, 143, 146, 339
 Lenard, P., 51
 Lepton, 123, 125, 126, 128–132, 135, 136
 Leucippus, 25
 Lie, S., 30, 141
 Life, 1, 211, 215, 219, 232, 234, 236, 299, 303, 308, 310, 333, 339–341
 Lindemann, F. v., 132
 Lobachevsky, N. I., 141
 Logic, xiii, xiv, xvi, xx, xxii, 3, 4, 6, 10, 16, 17, 39, 55, 63, 212, 234, 236, 239, 308, 311, 314, 327, 331, 333, 334, 345
 Lorentz group, xxiii, 42, 82, 98, 102, 126, 127, 171
 Lorentz invariance, 6, 42, 43, 49, 120, 121, 126, 132, 206
 Lorentz, H. A., 206
 Lorenz, K., 82, 234, 335, 336
 Ludwig, G., 41, 156, 265

 Mach's principle, 45, 48
 Mach, E., 26, 30, 38, 39, 41, 42, 44–46, 48, 143, 251
 Macrostate, 189, 190, 198–200, 202, 204, 205, 214, 216, 217, 222, 224, 268, 322
 Magellan, 94
 Maxwell field, 127–129, 131, 136, 247

- Maxwell, J. C., 35, 45, 51, 52, 132, 265, 287
- McTaggart, J. M. E., xxiii
- Measurement, xxiii, xxviii, 6, 22, 24, 43, 49, 51, 61, 62, 69, 83, 86, 95, 102, 104, 138, 139, 146, 164, 249, 252, 257, 258, 260–268, 270–276, 281, 282, 284–286, 289, 291, 292, 294, 304–306, 314, 317, 321, 322, 324, 326, 336
- Mehra, J., 46
- Meré, A. G. de, 59
- Metaphysics, 10, 243, 287–289, 315, 330, 331, 334, 340–346
- Metric field, 6, 45, 48, 141, 143, 145
- Meyer-Abich, K. M., xvi, 245, 256
- Microstate, 189, 190, 199, 200, 203–205, 214, 216, 217, 222, 224, 227, 268, 322
- Mind, 5, 213, 275, 299, 306, 307, 331
- Mind–body problem, 269, 299
- Minkowski space, xxiv, 8, 43, 48, 81, 82, 101, 103, 108, 109, 118–122, 125–127, 137, 141, 142, 145, 146, 154, 169, 171, 173, 175, 207
- Minkowski, H., 44, 206
- Mittelstaedt, P., 39, 48, 207
- Modality, 3, 63, 212, 316, 320, 322, 327, 328, 331
- Myth, 265, 314, 339
- Napoleon, 39
- Negentropy, 216, 217
- Neumann, J. v., 6, 244, 258, 259, 266
- Newton, I., 25–27, 29, 35, 38–41, 43–45, 50, 141, 145, 221, 265, 287
- Nietzsche, F., 237
- Nostradamus, 317–319
- Novelty, 229, 230, 232, 233
- Object, 7, 18, 19, 74–75, 269, 289, 328
- Observer, 43, 66, 67, 86, 87, 102, 103, 120, 181, 202, 227, 232, 233, 238, 260–265, 267–271, 274, 275, 279, 281, 283–286, 290, 294, 299, 304, 307, 309, 310, 314, 322, 326
- Ontology, xxx, xxxi, 44, 280, 325, 333
- Ousia, 298
- Pais, A., 259
- Para-Bose operator, 116, 172
- Paradoxes, 276–278
- Parmenides, 25, 287, 288, 315, 342, 343
- Pascal, B., 306, 310
- Past, 2, 9, 192, 262, 263, 289, 311, 316, 317
- Pauli, W., xiii, 135, 247, 248, 252, 259, 282, 284, 344
- Penrose, R., xxv, xxvi
- Perception, xxii, 4, 27, 39, 48, 72, 82, 83, 90, 93, 238, 248, 250, 256, 271, 280, 299, 303, 308, 314, 318, 319, 321, 327, 331, 335, 341, 344, 345
- Petersen, A., 257
- Phase space, 18, 20, 29, 47, 183, 305
- Phenomenon, 256, 269, 290, 299, 309, 312, 339
- Philosophy, xi, xii, xv, xix, xx, xxii, 1, 5, 25, 30–33, 39, 46, 71, 106, 149, 213, 234, 255, 257, 277, 286, 287, 298, 299, 306–309, 311, 315, 325, 331, 333–336, 338–342, 344, 345
- Philosophy of science, xxx, xxxi, 219, 334
- Picht, G., 25, 88, 288, 300, 304, 315, 343
- Planck length, xxix, 157, 158
- Planck, M., xiii, 51, 52
- Plato, XV, 26, 30, 236, 237, 250, 287, 288, 298, 299, 307, 309, 335, 342, 343
- Podolsky, B., xiv, 142, 244, 256, 277, 282, 283, 286, 289, 326
- Poincaré group, xxiv, 8, 83, 85, 101, 102, 107, 108, 114, 127, 132, 134, 169–171, 173, 174
- Poincaré, H., 205
- Point mass, 6, 16, 18–22, 24, 25, 27, 36, 40, 73, 85, 131, 132, 141, 187, 254, 288, 289, 299–301, 305
- Popper, K. R., 46, 234, 235, 289, 293, 335
- Position space, xxi, xxvii, 6, 8, 9, 81, 84, 95, 98, 141, 151–153, 156, 160, 171, 305
- Positivism, 251, 256, 277, 284
- Possibility, 4, 19, 26, 28, 41, 54, 57, 67, 85, 194, 196, 200, 237, 262, 289,

- 292–294, 316, 320–322, 324, 327, 329, 330, 337, 340, 343, 346
- Present, 3, 85–87, 182, 191, 193, 194, 202, 206, 207, 279, 309, 311, 315, 317, 327, 329, 343
- Prigogine, I., 218, 220, 221, 223, 227
- Probability, xiii, 2–4, 6, 34, 54, 56, 57, 59, 79, 213, 215–218, 246–248, 261
- Property, xxx, 5, 19, 74, 77, 89, 172, 184, 213, 214, 238, 272, 301, 328
- Proposition, xiii, 3, 6, 7, 16, 28, 40, 46, 55, 63, 64, 73–78, 85, 86, 207, 257, 275, 314, 327, 337
- Prout, W., 33
- Psyche, 299, 344
- Quantization, xxvii, 6, 30, 46, 55, 70, 71, 92, 98, 116, 123–125, 127, 128, 142, 143, 171, 253–255
- multiple, xx, xxvii, xxviii, 6, 116, 132, 170
- Quantum electrodynamics, xxvi, 8, 108, 123, 129, 130, 140, 282
- Quantum field theory, xxiv, xxvii, 84, 153, 156, 171
- Quantum gravity, xxvi, xxxi, 145
- Quantum information, xxv, 163, 167, 176, 177
- Quantum information theory, xxi, xxiii, xxiv
- Quantum logic, xxii, xxiii, 7
- Quantum theory, 1, 2, 4–8, 14, 51–53, 78, 243–295
- Quark, 132, 133, 135, 136, 152
- Quasiparticle, 116, 117, 122, 129, 134, 144
- Qubit, xxi, xxiii, xxviii, 153, 176
- Ray representation, 113
- Realism, 82, 251, 256, 277, 284, 287, 289, 293, 334, 335
- structural, xxxi
- Reality, 248, 260, 277, 286–289, 295, 334
- Reconstruction, 4, 54, 71, 78, 254, 259
- Reduction of wave packet, 249, 252, 261, 267, 268, 275, 281, 293, 295, 321–323
- Refutation, 22
- Reichenbach, H., 187
- Relativity, general, xvii, 6, 8, 15, 27, 39, 40, 42–47, 50, 54, 55, 57, 82, 84, 95, 102, 106–108, 120–122, 141–145, 149–151, 159, 168, 201, 207, 208, 246, 260, 288, 289, 291
- Relativity, special, xiii, xxiv, 2, 6, 8, 14, 15, 24, 28, 34, 35, 40–45, 47–49, 52, 54, 55, 57, 75, 81, 83, 84, 86, 94, 96, 98, 99, 101–103, 105, 107, 126, 133, 134, 141, 146, 154, 155, 206, 207, 252, 266, 278, 288, 300, 304, 305
- Religion, xix, 315, 342
- Rest mass, 8, 102, 108, 116, 118, 122, 127, 133–135, 137, 138, 140, 144, 145, 147, 167, 172, 176, 177, 303
- Retrodiction, 263, 281, 317
- Reversal of arguments, 55, 83, 84, 106, 121, 142, 144, 150
- Reversibility, 182, 184, 185, 194, 205
- Riemann, B., 46, 141
- Roman, P., xvii
- Rosen, N., xiv, 142, 244, 256, 277, 282, 283, 286, 289, 326
- Rovelli, C., xxvi
- Rubens, H., 51
- Rudolph, E., 342
- Russell, B., 39, 40
- Rutherford, E., xiii, 52, 137
- Süßmann, G., xvi, xx, xxvii, 123, 324
- Saccheri, G. G., 36
- Sartre, J.-P., 325
- Scheibe, E., xvi, xx, xxvii, 123, 256
- Schiller, F., 297
- Schmutzer, E., 146
- Scholem, G., 237
- Schopenhauer, A., 93
- Schrödinger's cat, 278, 279
- Schrödinger, E., xiv, 53, 142, 246, 247, 254, 278, 279
- Schwarzschild radius, 168, 169
- Scientific revolution, 1, 13, 33, 35, 106, 313, 331, 335, 336, 339
- Segal, J. E., 119
- Semantic consistency, 14, 18, 35–37, 41–43, 107, 234, 258, 260–262,

- 264, 268, 269, 276, 284, 294, 312, 313, 337, 346
- Semantics, 16, 18, 20, 22, 36, 37, 200, 229, 230, 252, 302, 312
- Separability, 2, 3, 7, 10, 83, 87, 129, 130, 266, 308, 309, 321, 322, 328, 330, 341
- Shannon, C. E., 4, 212, 214, 216, 222, 230, 232, 233
- Simplicity, 34, 47, 48, 312, 336
- Slater, J. G., 245, 246, 248, 263
- Smolin, L., xxvi
- Snyder, H. S., 146
- Socrates, xiv, 346
- Solar eclipse, 196, 317, 318
- Sommerfeld, A., xiv, 132, 250
- Spacetime continuum, xvii, xxviii, 8, 43–45, 47–49, 55, 79, 81, 82, 94, 95, 109, 117, 122, 133, 134, 141, 146, 201, 207, 288, 289
- Spatiality, 81–83
- Spencer, H., 219, 228
- Spinorism, xxi, xxv, xxvi
- Spinoza, B., 288, 315
- Strawson, P. F., 238
- Subject, 27, 39, 143, 261, 269, 271, 289, 307, 308
- Substance, xxx, 5, 31–33, 39, 40, 42, 45, 46, 48, 52, 90, 143, 172, 297–301, 303, 304, 306–308, 338, 340
- Supernova Ia, 164
- Superposition, 77, 102, 103, 107, 153, 247, 282, 294, 304
- Supersymmetry, 92, 111, 132
- Symmetry, xi, xxi, xxiii–xxv, xxviii, 3, 8, 10, 28, 48, 67, 69, 81, 83, 84, 91, 93–95, 98, 113–115, 117, 118, 129, 133, 134, 142, 143, 151, 152, 154, 191, 202, 239, 247, 250, 266, 290, 291, 300, 304, 328, 340
- Tataru-Mihaj, P., xvii
- Teller, E., 257, 265, 266
- Temporality, xxiii
- Tensor space of urs, 91, 92, 97, 100, 104, 108, 109, 111, 113–116, 121, 127, 133, 136, 139, 142, 143, 145, 146
- Tetrad, xxvii
- Thales, 196, 317, 318
- Thermodynamics, xiv, xxix, xxxi, 4, 5, 14, 15, 33, 34, 51, 54–56, 106, 158, 184, 186, 188, 193, 204, 211, 218–220, 266, 268, 291, 300, 301, 317, 326
- second law, xiv, 4, 15, 34, 186, 193–195, 197–206, 208, 209, 212, 218–223, 228, 300
- Thirring, W., 48, 108, 146
- Thought experiment, xiv, 142, 256, 260, 264, 274, 277–282, 315, 326
- Time, xi, xxiii, xxxi, 3, 4, 13, 24, 27, 28, 34, 56, 57, 86, 88, 93, 96, 99, 102, 121, 141, 147, 158, 193–195, 200, 201, 204, 206, 208, 221, 222, 266, 279, 288, 289, 297, 298, 304, 306, 309, 312, 315, 316, 329, 334, 337, 339, 343
- direction of, 190, 194, 201, 202, 204, 206
- modes of, xxiii, 6, 134, 194, 289
- Trieste theory, 323, 326
- Truth, 1–3, 10, 38, 63, 195, 214, 234–239, 289, 298, 310, 315, 323, 342
- Uncertainty relation, xiv, 9, 43, 78, 79, 248, 251–253, 265, 292, 322, 328, 330, *see* Uncertainty relation
- Unity of Nature, xxxii
- Unity of nature, xvi, 2, 236, 338, 341
- Unity of physics, xi, xiii, xv, 2, 6, 11, 13, 27, 105, 243
- Universe, 106
- Ur hypothesis, 91
- Ur theory, xi, xxiii, 98, 140
- Ur alternative, xxiii
- Ur hypothesis, xxiii, 8, 9, 56, 91, 93, 94, 98, 99, 103, 108, 111, 130, 133, 136, 144, 151, 177, 255, 259, 266, 278, 290
- Ur theory, xi, xvii, xix–xxi, xxiii–xxx, 30, 101, 108, 112, 120, 121, 133–137, 140, 144, 146, 150–152, 161, 171

- Vacuum, xxiv, 26, 48, 49, 92, 96,
112–115, 161, 168, 170, 173–176,
305
- Void, 25, 26, 342
- Waerden, B. L. v. d., 37, 251
- Wagner, C., 93
- Wagner, R., 93
- Wave mechanics, 6, 15, 30, 31, 254, 258
- Wave picture, 54, 253, 254
- Wave–particle duality, 254, 255
- Weizsäcker, C. v., xvi, 212, 229, 230,
232
- Weizsäcker, E. v., xvi, 212, 229, 230,
232
- Weizsäcker, V. v., 325
- Wesendonck, M., 93
- Weyl equation, 123, 125
- Weyl, H., 45, 46
- Wheeler, J. A., xxv, 281, 290
- Wigner’s friend, 279
- Wigner, E. P., 29, 75, 127, 132, 254,
267, 279
- WMAP, 166
- Wolff, M., 341
- World, 49–51
- Zucker, F. J., xvi

CARL FRIEDRICH VON WEIZSÄCKER FOUNDATION

Preamble

In Carl Friedrich von Weizsäcker the nowadays more than ever necessary intercultural and interdisciplinary dialog has found one of its most important proponents. He is one of the few great thinkers who combine the perspectives of science, philosophy, religion, and politics with a view toward the challenges but also the responsibilities of our times.

Two quotes characterize the intention and manner of his endeavor:

“I am ready to criticize a position if I could equally defend it” — “Our ethics must not stay behind the development of our technology, our observing reason not behind our analytical intellect, our love not behind our power.”

What will we do? What do we need to know? What do we know already?

To develop effective longterm strategies which contribute to recognizing, planning, and implementing the necessary approaches in the tension of challenge and responsibility—this is the aim of the Carl Friedrich von Weizsäcker-Foundation along the lines of the concerns of Carl Friedrich von Weizsäcker.

If you want to know more about the Carl Friedrich von Weizsäcker Society “Wissen und Verantwortung e.V.” and the Carl Friedrich von Weizsäcker-Foundation, please write to:

Carl Friedrich von Weizsäcker-Stiftung
Bielefelder Straße 8
D-32130 Enger
fax: 05224/977 898
e-mail: stiftung@cfvw.de

Executive Directors
Dr. Bruno Redeker
Bernhard Winzinger

Board
Dr. Walter Kroy
Prof. Dr. Thomas Görnitz
Bishop Dr. Reinhard Marx

Fundamental Theories of Physics

Series Editor: Alwyn van der Merwe, University of Denver, USA

1. M. Sachs: *General Relativity and Matter*. A Spinor Field Theory from Fermis to Light-Years. With a Foreword by C. Kilmister. 1982 ISBN 90-277-1381-2
2. G.H. Duffey: *A Development of Quantum Mechanics*. Based on Symmetry Considerations. 1985 ISBN 90-277-1587-4
3. S. Diner, D. Fargue, G. Lochak and F. Selleri (eds.): *The Wave-Particle Dualism*. A Tribute to Louis de Broglie on his 90th Birthday. 1984 ISBN 90-277-1664-1
4. E. Prugovečki: *Stochastic Quantum Mechanics and Quantum Spacetime*. A Consistent Unification of Relativity and Quantum Theory based on Stochastic Spaces. 1984; 2nd printing 1986 ISBN 90-277-1617-X
5. D. Hestenes and G. Sobczyk: *Clifford Algebra to Geometric Calculus*. A Unified Language for Mathematics and Physics. 1984 ISBN 90-277-1673-0; Pb (1987) 90-277-2561-6
6. P. Exner: *Open Quantum Systems and Feynman Integrals*. 1985 ISBN 90-277-1678-1
7. L. Mayants: *The Enigma of Probability and Physics*. 1984 ISBN 90-277-1674-9
8. E. Tocaci: *Relativistic Mechanics, Time and Inertia*. Translated from Romanian. Edited and with a Foreword by C.W. Kilmister. 1985 ISBN 90-277-1769-9
9. B. Bertotti, F. de Felice and A. Pascolini (eds.): *General Relativity and Gravitation*. Proceedings of the 10th International Conference (Padova, Italy, 1983). 1984 ISBN 90-277-1819-9
10. G. Tarozzi and A. van der Merwe (eds.): *Open Questions in Quantum Physics*. 1985 ISBN 90-277-1853-9
11. J.V. Narlikar and T. Padmanabhan: *Gravity, Gauge Theories and Quantum Cosmology*. 1986 ISBN 90-277-1948-9
12. G.S. Asanov: *Finsler Geometry, Relativity and Gauge Theories*. 1985 ISBN 90-277-1960-8
13. K. Namsrai: *Nonlocal Quantum Field Theory and Stochastic Quantum Mechanics*. 1986 ISBN 90-277-2001-0
14. C. Ray Smith and W.T. Grandy, Jr. (eds.): *Maximum-Entropy and Bayesian Methods in Inverse Problems*. Proceedings of the 1st and 2nd International Workshop (Laramie, Wyoming, USA). 1985 ISBN 90-277-2074-6
15. D. Hestenes: *New Foundations for Classical Mechanics*. 1986 ISBN 90-277-2090-8; Pb (1987) 90-277-2526-8
16. S.J. Prokhorov: *Light in Einstein's Universe*. The Role of Energy in Cosmology and Relativity. 1985 ISBN 90-277-2093-2
17. Y.S. Kim and M.E. Noz: *Theory and Applications of the Poincaré Group*. 1986 ISBN 90-277-2141-6
18. M. Sachs: *Quantum Mechanics from General Relativity*. An Approximation for a Theory of Inertia. 1986 ISBN 90-277-2247-1
19. W.T. Grandy, Jr.: *Foundations of Statistical Mechanics*. Vol. I: *Equilibrium Theory*. 1987 ISBN 90-277-2489-X
20. H.-H von Borzeszkowski and H.-J. Treder: *The Meaning of Quantum Gravity*. 1988 ISBN 90-277-2518-7
21. C. Ray Smith and G.J. Erickson (eds.): *Maximum-Entropy and Bayesian Spectral Analysis and Estimation Problems*. Proceedings of the 3rd International Workshop (Laramie, Wyoming, USA, 1983). 1987 ISBN 90-277-2579-9
22. A.O. Barut and A. van der Merwe (eds.): *Selected Scientific Papers of Alfred Landé*. [1888-1975]. 1988 ISBN 90-277-2594-2

Fundamental Theories of Physics

23. W.T. Grandy, Jr.: *Foundations of Statistical Mechanics*. Vol. II: *Nonequilibrium Phenomena*. 1988 ISBN 90-277-2649-3
24. E.I. Bitsakis and C.A. Nicolaides (eds.): *The Concept of Probability*. Proceedings of the Delphi Conference (Delphi, Greece, 1987). 1989 ISBN 90-277-2679-5
25. A. van der Merwe, F. Selleri and G. Tarozzi (eds.): *Microphysical Reality and Quantum Formalism, Vol. 1*. Proceedings of the International Conference (Urbino, Italy, 1985). 1988 ISBN 90-277-2683-3
26. A. van der Merwe, F. Selleri and G. Tarozzi (eds.): *Microphysical Reality and Quantum Formalism, Vol. 2*. Proceedings of the International Conference (Urbino, Italy, 1985). 1988 ISBN 90-277-2684-1
27. I.D. Novikov and V.P. Frolov: *Physics of Black Holes*. 1989 ISBN 90-277-2685-X
28. G. Tarozzi and A. van der Merwe (eds.): *The Nature of Quantum Paradoxes*. Italian Studies in the Foundations and Philosophy of Modern Physics. 1988 ISBN 90-277-2703-1
29. B.R. Iyer, N. Mukunda and C.V. Vishveshwara (eds.): *Gravitation, Gauge Theories and the Early Universe*. 1989 ISBN 90-277-2710-4
30. H. Mark and L. Wood (eds.): *Energy in Physics, War and Peace*. A Festschrift celebrating Edward Teller's 80th Birthday. 1988 ISBN 90-277-2775-9
31. G.J. Erickson and C.R. Smith (eds.): *Maximum-Entropy and Bayesian Methods in Science and Engineering*. Vol. I: *Foundations*. 1988 ISBN 90-277-2793-7
32. G.J. Erickson and C.R. Smith (eds.): *Maximum-Entropy and Bayesian Methods in Science and Engineering*. Vol. II: *Applications*. 1988 ISBN 90-277-2794-5
33. M.E. Noz and Y.S. Kim (eds.): *Special Relativity and Quantum Theory*. A Collection of Papers on the Poincaré Group. 1988 ISBN 90-277-2799-6
34. I.Yu. Kobzarev and Yu.I. Manin: *Elementary Particles. Mathematics, Physics and Philosophy*. 1989 ISBN 0-7923-0098-X
35. F. Selleri: *Quantum Paradoxes and Physical Reality*. 1990 ISBN 0-7923-0253-2
36. J. Skilling (ed.): *Maximum-Entropy and Bayesian Methods*. Proceedings of the 8th International Workshop (Cambridge, UK, 1988). 1989 ISBN 0-7923-0224-9
37. M. Kafatos (ed.): *Bell's Theorem, Quantum Theory and Conceptions of the Universe*. 1989 ISBN 0-7923-0496-9
38. Yu.A. Izyumov and V.N. Syromyatnikov: *Phase Transitions and Crystal Symmetry*. 1990 ISBN 0-7923-0542-6
39. P.F. Fougère (ed.): *Maximum-Entropy and Bayesian Methods*. Proceedings of the 9th International Workshop (Dartmouth, Massachusetts, USA, 1989). 1990 ISBN 0-7923-0928-6
40. L. de Broglie: *Heisenberg's Uncertainties and the Probabilistic Interpretation of Wave Mechanics*. With Critical Notes of the Author. 1990 ISBN 0-7923-0929-4
41. W.T. Grandy, Jr.: *Relativistic Quantum Mechanics of Leptons and Fields*. 1991 ISBN 0-7923-1049-7
42. Yu.L. Klimontovich: *Turbulent Motion and the Structure of Chaos*. A New Approach to the Statistical Theory of Open Systems. 1991 ISBN 0-7923-1114-0
43. W.T. Grandy, Jr. and L.H. Schick (eds.): *Maximum-Entropy and Bayesian Methods*. Proceedings of the 10th International Workshop (Laramie, Wyoming, USA, 1990). 1991 ISBN 0-7923-1140-X
44. P. Pták and S. Pulmannová: *Orthomodular Structures as Quantum Logics*. Intrinsic Properties, State Space and Probabilistic Topics. 1991 ISBN 0-7923-1207-4
45. D. Hestenes and A. Weingartshofer (eds.): *The Electron*. New Theory and Experiment. 1991 ISBN 0-7923-1356-9

Fundamental Theories of Physics

-
46. P.P.J.M. Schram: *Kinetic Theory of Gases and Plasmas*. 1991 ISBN 0-7923-1392-5
47. A. Micali, R. Boudet and J. Helmstetter (eds.): *Clifford Algebras and their Applications in Mathematical Physics*. 1992 ISBN 0-7923-1623-1
48. E. Prugovečki: *Quantum Geometry*. A Framework for Quantum General Relativity. 1992 ISBN 0-7923-1640-1
49. M.H. Mac Gregor: *The Enigmatic Electron*. 1992 ISBN 0-7923-1982-6
50. C.R. Smith, G.J. Erickson and P.O. Neudorfer (eds.): *Maximum Entropy and Bayesian Methods*. Proceedings of the 11th International Workshop (Seattle, 1991). 1993 ISBN 0-7923-2031-X
51. D.J. Hoekzema: *The Quantum Labyrinth*. 1993 ISBN 0-7923-2066-2
52. Z. Oziewicz, B. Jancewicz and A. Borowiec (eds.): *Spinors, Twistors, Clifford Algebras and Quantum Deformations*. Proceedings of the Second Max Born Symposium (Wrocław, Poland, 1992). 1993 ISBN 0-7923-2251-7
53. A. Mohammad-Djafari and G. Demoment (eds.): *Maximum Entropy and Bayesian Methods*. Proceedings of the 12th International Workshop (Paris, France, 1992). 1993 ISBN 0-7923-2280-0
54. M. Riesz: *Clifford Numbers and Spinors* with Riesz' Private Lectures to E. Folke Bolinder and a Historical Review by Pertti Lounesto. E.F. Bolinder and P. Lounesto (eds.). 1993 ISBN 0-7923-2299-1
55. F. Brackx, R. Delanghe and H. Serras (eds.): *Clifford Algebras and their Applications in Mathematical Physics*. Proceedings of the Third Conference (Deinze, 1993) 1993 ISBN 0-7923-2347-5
56. J.R. Fanchi: *Parametrized Relativistic Quantum Theory*. 1993 ISBN 0-7923-2376-9
57. A. Peres: *Quantum Theory: Concepts and Methods*. 1993 ISBN 0-7923-2549-4
58. P.L. Antonelli, R.S. Ingarden and M. Matsumoto: *The Theory of Sprays and Finsler Spaces with Applications in Physics and Biology*. 1993 ISBN 0-7923-2577-X
59. R. Miron and M. Anastasiei: *The Geometry of Lagrange Spaces: Theory and Applications*. 1994 ISBN 0-7923-2591-5
60. G. Adomian: *Solving Frontier Problems of Physics: The Decomposition Method*. 1994 ISBN 0-7923-2644-X
61. B.S. Kerner and V.V. Osipov: *Autosolitons*. A New Approach to Problems of Self-Organization and Turbulence. 1994 ISBN 0-7923-2816-7
62. G.R. Heidbreder (ed.): *Maximum Entropy and Bayesian Methods*. Proceedings of the 13th International Workshop (Santa Barbara, USA, 1993) 1996 ISBN 0-7923-2851-5
63. J. Peřina, Z. Hradil and B. Jurčo: *Quantum Optics and Fundamentals of Physics*. 1994 ISBN 0-7923-3000-5
64. M. Evans and J.-P. Vigić: *The Enigmatic Photon*. Volume 1: The Field $\mathbf{B}^{(3)}$. 1994 ISBN 0-7923-3049-8
65. C.K. Raju: *Time: Towards a Consistent Theory*. 1994 ISBN 0-7923-3103-6
66. A.K.T. Assis: *Weber's Electrodynamics*. 1994 ISBN 0-7923-3137-0
67. Yu. L. Klimontovich: *Statistical Theory of Open Systems*. Volume 1: A Unified Approach to Kinetic Description of Processes in Active Systems. 1995 ISBN 0-7923-3199-0; Pb: ISBN 0-7923-3242-3
68. M. Evans and J.-P. Vigić: *The Enigmatic Photon*. Volume 2: Non-Abelian Electrodynamics. 1995 ISBN 0-7923-3288-1
69. G. Esposito: *Complex General Relativity*. 1995 ISBN 0-7923-3340-3

Fundamental Theories of Physics

70. J. Skilling and S. Sibisi (eds.): *Maximum Entropy and Bayesian Methods*. Proceedings of the Fourteenth International Workshop on Maximum Entropy and Bayesian Methods. 1996
ISBN 0-7923-3452-3
71. C. Garola and A. Rossi (eds.): *The Foundations of Quantum Mechanics Historical Analysis and Open Questions*. 1995
ISBN 0-7923-3480-9
72. A. Peres: *Quantum Theory: Concepts and Methods*. 1995 (see for hardback edition, Vol. 57)
ISBN Pb 0-7923-3632-1
73. M. Ferrero and A. van der Merwe (eds.): *Fundamental Problems in Quantum Physics*. 1995
ISBN 0-7923-3670-4
74. F.E. Schroeck, Jr.: *Quantum Mechanics on Phase Space*. 1996
ISBN 0-7923-3794-8
75. L. de la Peña and A.M. Cetto: *The Quantum Dice*. An Introduction to Stochastic Electrodynamics. 1996
ISBN 0-7923-3818-9
76. P.L. Antonelli and R. Miron (eds.): *Lagrange and Finsler Geometry*. Applications to Physics and Biology. 1996
ISBN 0-7923-3873-1
77. M.W. Evans, J.-P. Vigiér, S. Roy and S. Jeffers: *The Enigmatic Photon*. Volume 3: Theory and Practice of the $B^{(3)}$ Field. 1996
ISBN 0-7923-4044-2
78. W.G.V. Rosser: *Interpretation of Classical Electromagnetism*. 1996
ISBN 0-7923-4187-2
79. K.M. Hanson and R.N. Silver (eds.): *Maximum Entropy and Bayesian Methods*. 1996
ISBN 0-7923-4311-5
80. S. Jeffers, S. Roy, J.-P. Vigiér and G. Hunter (eds.): *The Present Status of the Quantum Theory of Light*. Proceedings of a Symposium in Honour of Jean-Pierre Vigiér. 1997
ISBN 0-7923-4337-9
81. M. Ferrero and A. van der Merwe (eds.): *New Developments on Fundamental Problems in Quantum Physics*. 1997
ISBN 0-7923-4374-3
82. R. Miron: *The Geometry of Higher-Order Lagrange Spaces*. Applications to Mechanics and Physics. 1997
ISBN 0-7923-4393-X
83. T. Hakioglu and A.S. Shumovsky (eds.): *Quantum Optics and the Spectroscopy of Solids*. Concepts and Advances. 1997
ISBN 0-7923-4414-6
84. A. Sitenko and V. Tartakovskii: *Theory of Nucleus*. Nuclear Structure and Nuclear Interaction. 1997
ISBN 0-7923-4423-5
85. G. Esposito, A.Yu. Kamenshchik and G. Pollifrone: *Euclidean Quantum Gravity on Manifolds with Boundary*. 1997
ISBN 0-7923-4472-3
86. R.S. Ingarden, A. Kossakowski and M. Ohya: *Information Dynamics and Open Systems*. Classical and Quantum Approach. 1997
ISBN 0-7923-4473-1
87. K. Nakamura: *Quantum versus Chaos*. Questions Emerging from Mesoscopic Cosmos. 1997
ISBN 0-7923-4557-6
88. B.R. Iyer and C.V. Vishveshwara (eds.): *Geometry, Fields and Cosmology*. Techniques and Applications. 1997
ISBN 0-7923-4725-0
89. G.A. Martynov: *Classical Statistical Mechanics*. 1997
ISBN 0-7923-4774-9
90. M.W. Evans, J.-P. Vigiér, S. Roy and G. Hunter (eds.): *The Enigmatic Photon*. Volume 4: New Directions. 1998
ISBN 0-7923-4826-5
91. M. Rédei: *Quantum Logic in Algebraic Approach*. 1998
ISBN 0-7923-4903-2
92. S. Roy: *Statistical Geometry and Applications to Microphysics and Cosmology*. 1998
ISBN 0-7923-4907-5
93. B.C. Eu: *Nonequilibrium Statistical Mechanics*. Ensembled Method. 1998
ISBN 0-7923-4980-6

Fundamental Theories of Physics

94. V. Dietrich, K. Habetha and G. Jank (eds.): *Clifford Algebras and Their Application in Mathematical Physics*. Aachen 1996. 1998 ISBN 0-7923-5037-5
95. J.P. Blaizot, X. Campi and M. Ploszajczak (eds.): *Nuclear Matter in Different Phases and Transitions*. 1999 ISBN 0-7923-5660-8
96. V.P. Frolov and I.D. Novikov: *Black Hole Physics*. Basic Concepts and New Developments. 1998 ISBN 0-7923-5145-2; Pb 0-7923-5146
97. G. Hunter, S. Jeffers and J-P. Vigiér (eds.): *Causality and Locality in Modern Physics*. 1998 ISBN 0-7923-5227-0
98. G.J. Erickson, J.T. Rychert and C.R. Smith (eds.): *Maximum Entropy and Bayesian Methods*. 1998 ISBN 0-7923-5047-2
99. D. Hestenes: *New Foundations for Classical Mechanics (Second Edition)*. 1999 ISBN 0-7923-5302-1; Pb ISBN 0-7923-5514-8
100. B.R. Iyer and B. Bhawal (eds.): *Black Holes, Gravitational Radiation and the Universe*. Essays in Honor of C. V. Vishveshwara. 1999 ISBN 0-7923-5308-0
101. P.L. Antonelli and T.J. Zastawniak: *Finslerian Diffusion with Applications*. 1998 ISBN 0-7923-5511-3
102. H. Atmanspacher, A. Amann and U. Müller-Herold: *On Quanta, Mind and Matter Hans Primas in Context*. 1999 ISBN 0-7923-5696-9
103. M.A. Trump and W.C. Schieve: *Classical Relativistic Many-Body Dynamics*. 1999 ISBN 0-7923-5737-X
104. A.I. Maimistov and A.M. Basharov: *Nonlinear Optical Waves*. 1999 ISBN 0-7923-5752-3
105. W. von der Linden, V. Dose, R. Fischer and R. Preuss (eds.): *Maximum Entropy and Bayesian Methods Garching, Germany 1998*. 1999 ISBN 0-7923-5766-3
106. M.W. Evans: *The Enigmatic Photon Volume 5: O(3) Electrodynamics*. 1999 ISBN 0-7923-5792-2
107. G.N. Afanasiev: *Topological Effects in Quantum Mecvhanics*. 1999 ISBN 0-7923-5800-7
108. V. Devanathan: *Angular Momentum Techniques in Quantum Mechanics*. 1999 ISBN 0-7923-5866-X
109. P.L. Antonelli (ed.): *Finslerian Geometries A Meeting of Minds*. 1999 ISBN 0-7923-6115-6
110. M.B. Mensky: *Quantum Measurements and Decoherence Models and Phenomenology*. 2000 ISBN 0-7923-6227-6
111. B. Coecke, D. Moore and A. Wilce (eds.): *Current Research in Operation Quantum Logic*. Algebras, Categories, Languages. 2000 ISBN 0-7923-6258-6
112. G. Jumarie: *Maximum Entropy, Information Without Probability and Complex Fractals*. Classical and Quantum Approach. 2000 ISBN 0-7923-6330-2
113. B. Fain: *Irreversibilities in Quantum Mechanics*. 2000 ISBN 0-7923-6581-X
114. T. Borne, G. Lochak and H. Stumpf: *Nonperturbative Quantum Field Theory and the Structure of Matter*. 2001 ISBN 0-7923-6803-7
115. J. Keller: *Theory of the Electron*. A Theory of Matter from START. 2001 ISBN 0-7923-6819-3
116. M. Rivas: *Kinematical Theory of Spinning Particles*. Classical and Quantum Mechanical Formalism of Elementary Particles. 2001 ISBN 0-7923-6824-X
117. A.A. Ungar: *Beyond the Einstein Addition Law and its Gyroscopic Thomas Precession*. The Theory of Gyrogroups and Gyrovector Spaces. 2001 ISBN 0-7923-6909-2
118. R. Miron, D. Hrimiuc, H. Shimada and S.V. Sabau: *The Geometry of Hamilton and Lagrange Spaces*. 2001 ISBN 0-7923-6926-2

Fundamental Theories of Physics

119. M. Pavšič: *The Landscape of Theoretical Physics: A Global View*. From Point Particles to the Brane World and Beyond in Search of a Unifying Principle. 2001 ISBN 0-7923-7006-6
120. R.M. Santilli: *Foundations of Hadronic Chemistry*. With Applications to New Clean Energies and Fuels. 2001 ISBN 1-4020-0087-1
121. S. Fujita and S. Godoy: *Theory of High Temperature Superconductivity*. 2001 ISBN 1-4020-0149-5
122. R. Luzzi, A.R. Vasconcellos and J. Galvão Ramos: *Predictive Statistical Mechanics*. A Nonequilibrium Ensemble Formalism. 2002 ISBN 1-4020-0482-6
123. V.V. Kulish: *Hierarchical Methods*. Hierarchy and Hierarchical Asymptotic Methods in Electrodynamics, Volume 1. 2002 ISBN 1-4020-0757-4; Set: 1-4020-0758-2
124. B.C. Eu: *Generalized Thermodynamics*. Thermodynamics of Irreversible Processes and Generalized Hydrodynamics. 2002 ISBN 1-4020-0788-4
125. A. Mourachkine: *High-Temperature Superconductivity in Cuprates*. The Nonlinear Mechanism and Tunneling Measurements. 2002 ISBN 1-4020-0810-4
126. R.L. Amoroso, G. Hunter, M. Kafatos and J.-P. Vigiér (eds.): *Gravitation and Cosmology: From the Hubble Radius to the Planck Scale*. Proceedings of a Symposium in Honour of the 80th Birthday of Jean-Pierre Vigiér. 2002 ISBN 1-4020-0885-6
127. W.M. de Muynck: *Foundations of Quantum Mechanics, an Empiricist Approach*. 2002 ISBN 1-4020-0932-1
128. V.V. Kulish: *Hierarchical Methods*. Undulative Electrodynamical Systems, Volume 2. 2002 ISBN 1-4020-0968-2; Set: 1-4020-0758-2
129. M. Mugur-Schächter and A. van der Merwe (eds.): *Quantum Mechanics, Mathematics, Cognition and Action*. Proposals for a Formalized Epistemology. 2002 ISBN 1-4020-1120-2
130. P. Bandyopadhyay: *Geometry, Topology and Quantum Field Theory*. 2003 ISBN 1-4020-1414-7
131. V. Garzó and A. Santos: *Kinetic Theory of Gases in Shear Flows*. Nonlinear Transport. 2003 ISBN 1-4020-1436-8
132. R. Miron: *The Geometry of Higher-Order Hamilton Spaces*. Applications to Hamiltonian Mechanics. 2003 ISBN 1-4020-1574-7
133. S. Esposito, E. Majorana Jr., A. van der Merwe and E. Recami (eds.): *Ettore Majorana: Notes on Theoretical Physics*. 2003 ISBN 1-4020-1649-2
134. J. Hamhalter: *Quantum Measure Theory*. 2003 ISBN 1-4020-1714-6
135. G. Rizzi and M.L. Ruggiero: *Relativity in Rotating Frames*. Relativistic Physics in Rotating Reference Frames. 2004 ISBN 1-4020-1805-3
136. L. Kantorovich: *Quantum Theory of the Solid State: an Introduction*. 2004 ISBN 1-4020-1821-5
137. A. Ghatak and S. Lokanathan: *Quantum Mechanics: Theory and Applications*. 2004 ISBN 1-4020-1850-9
138. A. Khrennikov: *Information Dynamics in Cognitive, Psychological, Social, and Anomalous Phenomena*. 2004 ISBN 1-4020-1868-1
139. V. Faraoni: *Cosmology in Scalar-Tensor Gravity*. 2004 ISBN 1-4020-1988-2
140. P.P. Teodorescu and N.-A. P. Nicorovici: *Applications of the Theory of Groups in Mechanics and Physics*. 2004 ISBN 1-4020-2046-5
141. G. Munteanu: *Complex Spaces in Finsler, Lagrange and Hamilton Geometries*. 2004 ISBN 1-4020-2205-0

Fundamental Theories of Physics

142. G.N. Afanasiev: *Vavilov-Cherenkov and Synchrotron Radiation*. Foundations and Applications. 2004 ISBN 1-4020-2410-X
143. L. Munteanu and S. Donescu: *Introduction to Soliton Theory: Applications to Mechanics*. 2004 ISBN 1-4020-2576-9
144. M.Yu. Khlopov and S.G. Rubin: *Cosmological Pattern of Microphysics in the Inflationary Universe*. 2004 ISBN 1-4020-2649-8
145. J. Vanderlinde: *Classical Electromagnetic Theory*. 2004 ISBN 1-4020-2699-4
146. V. Čápek and D.P. Sheehan: *Challenges to the Second Law of Thermodynamics*. Theory and Experiment. 2005 ISBN 1-4020-3015-0
147. B.G. Sidharth: *The Universe of Fluctuations*. The Architecture of Spacetime and the Universe. 2005 ISBN 1-4020-3785-6
148. R.W. Carroll: *Fluctuations, Information, Gravity and the Quantum Potential*. 2005 ISBN 1-4020-4003-2
149. B.G. Sidharth: *A Century of Ideas*. Personal Perspectives from a Selection of the Greatest Minds of the Twentieth Century. Planned 2006. ISBN 1-4020-4359-7
150. S.H. Dong: *Factorization Method in Quantum Mechanics*. Planned 2006. ISBN to be announced
151. R.M. Santilli: *Isodual Theory of Antimatter with applications to Antigravity, Grand Unification and Cosmology*. 2006 ISBN 1-4020-4517-4
152. A. Plotnitsky: *Reading Bohr: Physics and Philosophy*. Planned 2006 ISBN 1-4020-5253-7
153. V. Petkov: *Relativity and the Dimensionality of the World*. Planned 2007. ISBN to be announced
154. C.F. von Weizsäcker, H. Lyre and Th. Görnitz: *The Structure of Physics*. Edited, revised and enlarged by Thomas Görnitz and Holger Lyre. 2006 ISBN 1-4020-5234-0