

Publications of Irving Segal

Papers

- [1] *Fiducial distribution of several parameters with application to a normal system*, Proc. Camb. Philos. Soc. , **34** (1938), 41–47. Zbl 018.15703
- [2] *The automorphisms of the symmetric group*, Bull. Amer. Math. Soc. **46** (1940), 565. MR **2** #1c Zbl 061.03301
- [3] *The group ring of a locally compact group. I*, Proc. Nat. Acad. Sci. U. S. A. **27** (1941), 348–352. MR **3** #36b Zbl 063.06858
- [4] *The span of the translations of a function in a Lebesgue space*, Proc. Nat. Acad. Sci. U. S. A. **30** (1944), 165–169. MR **6** #49c Zbl 063.06859
- [5] *Topological groups in which multiplication of one side is differentiable*, Bull. Amer. Math. Soc. **52** (1946), 481–487. MR **8** #132d Zbl 061.04411
- [6] *Semi-groups of operators and the Weierstrass theorem*, Bull. Amer. Math. Soc. **52** (1946), 911–914. (with Nelson Dunford) MR **8** #386e Zbl 061.25307
- [7] *The group algebra of a locally compact group*, Trans. Amer. Math. Soc. **61** (1947), 69–105. MR **8** #438c Zbl 032.02901
- [8] *Irreducible representations of operator algebras*, Bull. Amer. Math. Soc. **53** (1947), 73–88. MR **8** #520b Zbl 031.36001
- [9] *The non-existence of a relation which is valid for all finite groups*, Bol. Soc. Mat. São Paulo **2** (1947), no. 2, 3–5 (1949). MR **13** #316b
- [10] *Postulates for general quantum mechanics*, Ann. of Math. (2) **48** (1947), 930–948. MR **9** #241b Zbl 034.06602
- [11] *Invariant measures on locally compact spaces*, J. Indian Math. Soc. (N.S.) **13** (1949), 105–130. MR **11** #425b Zbl 034.37101
- [12] *Two-sided ideals in operator algebras*, Ann. of Math. (2) **50** (1949), 856–865. MR **11** #187a Zbl 034.37102

- [13] *The class of functions which are absolutely convergent Fourier transforms*, Acta Sci. Math. Szeged **12** (1950), Leopoldo Fejer et Frederico Riesz LXX annos natis dedicatus, Pars B, 157–161. MR **12** #188d Zbl 036.20501
- [14] *An extension of Plancherel's formula to separable unimodular groups*, Ann. of Math. (2) **52** (1950), 272–292. MR **12** #157f Zbl 041.36312
- [15] *The two-sided regular representation of a unimodular locally compact group*, Ann. of Math. (2) **51** (1950), 293–298. MR **12** #157e Zbl 039.02103
- [16] *A theorem on unitary representations of semisimple Lie groups*, Ann. of Math. (2) **52** (1950), 509–517. (with John von Neumann) MR **12** #242a Zbl 041.36313
- [17] *A class of operator algebras which are determined by groups*, Duke Math. J. **18** (1951), 221–265. MR **13** #534b Zbl 045.38601
- [18] *Decompositions of operator algebras. I*, Mem. Amer. Math. Soc., **1951** (1951), no. 9, 67 pp. MR **13** #472a Zbl 043.11505
- [19] *Decompositions of operator algebras. II. Multiplicity theory*, Mem. Amer. Math. Soc., **1951** (1951), no. 9, 66 pp. MR **13** #472b Zbl 043.11601
- [20] *Equivalences of measure spaces*, Amer. J. Math. **73** (1951), 275–313. MR **12** #809f Zbl 042.35502
- [21] *Hypermaximality of certain operators on Lie groups*, Proc. Amer. Math. Soc. **3** (1952), 13–15. MR **14** #448b Zbl 049.35704
- [22] *A non-commutative extension of abstract integration*, Ann. of Math. (2) **57** (1953), 401–457. MR **14** #991f Zbl 051.34201
- [23] *Correction to "A non-commutative extension of abstract integration"*, Ann. of Math. (2) **58** (1953), 595–596. MR **15** #204h Zbl 051.34202
- [24] *Abstract probability spaces and a theorem of Kolmogoroff*, Amer. J. Math. **76** (1954), 721–732. MR **16** #149d Zbl 056.12301

- [25] *A mathematical approach to elementary particles and their fields*, Notes on Lectures given in 1955, Department of Mathematics, University of Chicago.
- [26] *Causality and analyticity*, Trans. Amer. Math. Soc. **78** (1955), 385–405. (with Y. Fourès - Bruhat) MR **16** #1032d Zbl 064.36805
- [27] *Uniqueness of the fine-structure constant*, Proc. Nat. Acad. Sci. U.S.A. **41** (1955), 1103–1107. MR **17** #925d
- [28] *Tensor algebras over Hilbert spaces. I*, Trans. Amer. Math. Soc. **81** (1956), 106–134. MR **17** #880d Zbl 070.34003
- [29] *Tensor algebras over Hilbert spaces. II*, Ann. of Math. (2) **63** (1956), 160–175. MR **17** #1114f Zbl 073.09403
- [30] *Convergent approach to the theory of elementary particle interactions*, Proc. Nat. Acad. Sci. U.S.A. **42** (1956), 670–676.
- [31] *Ergodic subgroups of the orthogonal group on a real Hilbert space*, Ann. of Math. (2) **66** (1957), 297–303. MR **19** #666d Zbl 083.10603
- [32] *The structure of a class of representations of the unitary group on a Hilbert space*, Proc. Amer. Math. Soc. **8** (1957), 197–203. MR **18** #812f Zbl 078.29301
- [33] *Direct formulation of causality requirements on the S operator*, Phys. Rev. (2) **109** (1958), 2191–2198. MR **23** #B897 Zbl 083.43702
- [34] *Caractérisation mathématique des observables en théorie quantique des champs et ses conséquences pour la structure des particules libres.*, Colloques Int. Centre Nat. Rech. Sci. **75** (1959), 57–103. Zbl 090.19503
- [35] *Distributions in Hilbert space and canonical systems of operators*, Trans. Amer. Math. Soc. **88** (1958), 12–41. MR **21** #1545 Zbl 099.12104
- [36] *Correction to previous paper*, Trans. Amer. Math. Soc. **96** (1960), 546

- [37] *Foundations of the theory of dynamical systems of infinitely many degrees of freedom. I*, Mat.-Fys. Medd. Danske Vid. Selsk. **31** (1959), no. 12, 39 pp. (1959). MR **22** #3477 Zbl 085.21806
- [38] *The mathematical meaning of operationalism in quantum mechanics*, in “The axiomatic method. With special reference to geometry and physics.” Proceedings of an International Symposium held at the Univ. of Calif., Berkeley, Dec. 26, 1957-Jan. 4, 1958 (edited by L. Henkin, P. Suppes and A. Tarski) (Amsterdam), North-Holland Publishing Co., 1959, Studies in Logic and the Foundations of Mathematics, pp. 341–352. MR **23** #B1380 Zbl 087.42801
- [39] *A theorem on the measurability of group-invariant operators*, Duke Math. J **26** (1959), 549–552. MR **22** #1823 Zbl 092.32104
- [40] *A note on the concept of entropy*, J. Math. Mech. **9** (1960), 623–629. MR **22** #12411 Zbl 223.94001
- [41] *Quantization of nonlinear systems*, J. Mathematical Phys. **1** (1960), 468–488. MR **24** #B1144 Zbl 099.22402
- [42] *Quasi-finiteness of the interaction hamiltonian of certain quantum fields*, Ann. of Math. (2) **72** (1960), 594–602. MR **22** #6504 Zbl 128.22103
- [43] *Foundations of the theory of dynamical systems of infinitely many degrees of freedom. II*, Canad. J. Math. **13** (1961), 1–18. MR **23** #B1877 Zbl 098.22104
- [44] *Mathematical characterization of the physical vacuum for a linear Bose-Einstein field. (Foundations of the dynamics of infinite systems. III)*, Illinois J. Math. **6** (1962), 500–523. MR **26** #1075 Zbl 106.42804
- [45] *Transforms for operators and symplectic automorphisms over a locally compact abelian group*, Math. Scand. **13** (1963), 31–43. MR **29** #486 Zbl 208.39002
- [46] *Non-linear semi-groups*, Ann. of Math. (2) **78** (1963), 339–364. MR **27** #2879 Zbl 204.16004

- [47] *The global Cauchy problem for a relativistic scalar field with power interaction*, Bull. Soc. Math. France **91** (1963), 129–135. MR **27** #3928 Zbl 178.45403
- [48] *Review of book*, “The quantum mechanics of many body problems” by D.J. Thouless, Amer. Math. Monthly **70** (1963), 908–909.
- [49] *Interprétation et solution d'équations non linéaires quantifiées*, C. R. Acad. Sci. Paris **259** (1964), 301–303. MR **29** #4453 Zbl 145.46703
- [50] *Quantum fields and analysis in the solution manifolds of differential equations*, Proc. Conf. on Theory and Appl. of Analysis in Function Space (Dedham, Mass., 1963), The M.I.T. Press, Cambridge, Mass., 1964, pp. 129–153. MR **29** #4427 and MR **35** #2579
- [51] *Explicit formal construction of nonlinear quantum fields*, J. Mathematical Phys. **5** (1964), 269–282. MR **31** #1932 Zbl 136.47103
- [52] *Infinite-dimensional irreducible representations of compact semi-simple groups*, Bull. Amer. Math. Soc. **70** (1964), 155–160. MR **28** #1256 Zbl 128.35602
- [53] *La variété des solutions d'une équation hyperbolique nonlinéaire d'ordre 2*, Equazioni differenziali non-lineari, C.I.M.E., Courses at Varenna, Summer 1964, 299–357.
- [54] *Remark on operational formulations of relativistic causality*, Nuovo Cimento (10) **31** (1964), 427–428. MR **29** #6839 Zbl 118.22404
- [55] *Anti-locality of certain Lorentz-invariant operators*, J. Math. Mech. **14** (1965), 629–638. (with R. W. Goodman) MR **31** #4411 Zbl 151.44201
- [56] *Algebraic integration theory*, Bull. Amer. Math. Soc. **71** (1965), 419–489. MR **31** #2642 Zbl 135.17402
- [57] *Differential operators in the manifold of solutions of a non-linear differential equation*, J. Math. Pures Appl. (9) **44** (1965) 71–105; *ibid.* (9) **44** (1965), 107–132. MR **33** #594 Zbl 139.09202
- [58] *La dispersion pour les équations non linéaires relativistes aux dérivées partielles*, C. R. Acad. Sci. Paris **261** (1965), 5323–5326. MR **32** #6977

- [59] *Séminaire sur les Équations aux Dérivées Partielles (1964–1965). III et Séminaire de Physique Mathématique (1964–1965)*, Collège de France, Paris, 1965. MR **52** #11265
- [60] *Quantization and dispersion for nonlinear relativistic equations*, Mathematical Theory of Elementary Particles (Proc. Conf., Dedham, Mass., 1965), M.I.T. Press, Cambridge, Mass., 1966, pp. 79–108. (R. Goodman and I.E. Segal, eds.) MR **36** #542
- [61] *Nonlinear partial differential equations in quantum field theory*, Proc. Sympos. Appl. Math., Vol. XVII, Amer. Math. Soc., Providence, R.I., 1965, pp. 210–226. MR **34** #2277 Zbl 152.23902
- [62] *Errata: “A theorem on the measurability of group-invariant operators”*, Duke Math. J. **33** (1966), 821. MR **33** #6429
- [63] *Representations of the canonical commutation relations*, Cargèse Lectures in Theoretical Physics: Application of Mathematics to Problems in Theoretical Physics (Cargèse, 1965), Gordon and Breach Science Publ., New York, 1967, pp. 107–170. MR **40** #3850
- [64] *An extension of a theorem of L. O’Raifeartaigh*, J. Funct. Anal. **1** (1967), 1–21. MR **37** #6079 Zbl 168.23601
- [65] *Notes toward the construction of nonlinear relativistic quantum fields. I. The Hamiltonian in two space-time dimensions as the generator of a C^* -automorphism group*, Proc. Nat. Acad. Sci. U.S.A. **57** (1967), 1178–1183. MR **35** #5195 Zbl 162.57801
- [66] *Positive-energy particle models with mass splitting*, Proc. Nat. Acad. Sci. U.S.A. **57** (1967), 194–197. MR **34** #5449
- [67] *Non-linear relativistic partial differential equations*, Proc. Internat. Congr. Math. (Moscow, 1966), Izdat. “Mir”, Moscow, 1968, pp. 681–690. MR **38** #5444 Zbl 204.41701
- [68] *Remark on the parametrization of the states of complex systems*, Theoretical Physics and Biology, ed. M. Marois, Proc. of a Conference at Versailles, June, 1967, North-Holland (Amsterdam), (1969), 418–422.

- [69] *Dispersion for non-linear relativistic equations. II*, Ann. Sci. École Norm. Sup. (4) **1** (1968), 459–497. MR **39** #5109 Zbl 179.42302
- [70] *Quantized differential forms*, Topology **7** (1968), 147–172. MR **38** #1113 Zbl 162.40602
- [71] *Nonlinear functions of weak processes. I*, J. Funct. Anal. **4** (1969), 404–456. MR **40** #2309 Zbl 187.39201
- [72] *Notes towards the construction of non-linear relativistic quantum fields. II. The basic nonlinear functions in general space-times*, Bull. Amer. Math. Soc. **75** (1969), 1383–1389. MR **40** #5216 Zbl 196.28005
- [73] *Notes towards the construction of nonlinear relativistic quantum fields. III. Properties of the C^* -dynamics for a certain class of interactions*, Bull. Amer. Math. Soc. **75** (1969), 1390–1395. MR **40** #5217 Zbl 196.28005
- [74] *Quantization of the de Rham complex*, Global Analysis (Proc. Sympos. Pure Math., Vol. XVI, Berkeley, Calif., 1968), Amer. Math. Soc., Providence, R.I., 1970, pp. 205–210. MR **42** #1157 Zbl 214.49001
- [75] *The mathematical theory of quantum fields*, Lectures in Modern Analysis and Applications, II, ed. C. T. Taam, Springer, Berlin, 1970, Lecture Notes in Mathematics, Vol. 140, pp. 30–57 (loose erratum). MR **42** #2762 Zbl 201.58101
- [76] *Construction of non-linear local quantum processes. I*, Ann. of Math. (2) **92** (1970), 462–481. MR **42** #7187 Zbl 213.40904
- [77] *Local non-linear functions of quantum fields*, in “Functional Analysis and Related Fields” (Proc. Conf. for M. Stone, Univ. Chicago, Chicago, Ill., 1968), ed. F. E. Browder, Springer, New York, 1970, pp. 188–210. MR **43** #1520 Zbl 245.46105
- [78] *Scattering theory as the analysis of elliptic fixed points*, Global Analysis (Proc. Sympos. Pure Math., Vol. XVI, Berkeley, Calif., 1968), Amer. Math. Soc., Providence, R.I., 1970, pp. 95–100. MR **44** #1358 Zbl 223.47006

- [79] *Local noncommutative analysis*, in “Problems in analysis” (Lectures at the Sympos. in honor of Salomon Bochner, ed. R. C. Gunning, Princeton Univ., Princeton, N.J., 1969), pp. 111–130. Princeton Univ. Press, Princeton, N.J., 1970. MR **49** #10298 Zbl 215.20001
- [80] *Nonlinear functions of weak processes. II*, J. Funct. Anal. **6** (1970), 29–75. MR **41** #7974 Zbl 202.42201
- [81] *Transformations in Wiener space and squares of quantum fields*, Advances in Math. **4** (1970), 91–108. MR **42** #8826 Zbl 206.26603
- [82] *Causally oriented manifolds and groups*, Bull. Amer. Math. Soc. **77** (1971), 958–959. MR **48** #12432 Zbl 242.53009
- [83] *Construction of non-linear local quantum processes. II*, Invent. Math. **14** (1971), 211–241. MR **45** #4761 Zbl 221.47023
- [84] *Erratum to “Construction of non-linear local quantum processes. I”.*, Ann. of Math. (2) **93** (1971), 597. MR **43** #8301
- [85] *Non-linear quantum processes and automorphism groups of C^* -algebras*, Actes du Congr?s International des Math?maticiens (Nice, 1970), Tome 2, pp. 419–426. Gauthier-Villars, Paris, 1971. MR **54** #14620 Zbl 233.46077
- [86] *Singular perturbations of semi-group generators*, 54–61. Internat. Ser. Numer. Math., Vol. 20, eds. P. L. Butzer and B. Sz. Nagy, Birkhauser Verlag, 1972. MR **52** #1370 Zbl 257.47026
- [87] *New and unsolved problems*, (1972), 493–503. Internat. Ser. Numer. Math., Vol. 20. MR **51** #6219
- [88] *Covariant Chronogeometry and Extreme Distances, I*, Astron. and Astrophys. **18** (1972), 143–148.
- [89] In S. Deser, *Gravitation and particle physics*, Fields and Quanta **2** (1971/72), no. 3, 255–292, With discussion by F. C. Michel, A. Salam, I. Segal and the author. MR **56** #10712

- [90] *Symplectic structures and the quantization problem for wave equations*, Symposia Mathematica, Vol. XIV (Convegno di Geometria Simplettica e Fisica Matematica, INDAM, Rome, 1973), pp. 99–117. Academic Press, London, 1974. MR **52** #15571 Zbl 328.53028
- [91] *A variant of special relativity and extragalactic astronomy* In “Quantum theory and the structures of time and space”, eds. L. Castell, M. Drieschner and C. F. von Weiszacker. Carl Hanser Verlag, Munich-Vienna, 1975. 163–212. Papers presented at a Conference held in Feldafing, July 1974. MR **58** #25455
- [92] *A variant of special relativity and long-distance astronomy*, Proc. Nat. Acad. Sci. U.S.A. **71** (1974), 765–768. MR **49** #8598
- [93] *Observational validation of chronometric cosmology, 1. Preliminaries and redshift-magnitude relation*, Proc. Nat. Acad. Sci. U.S.A. **72** no. 7 (1975), 2473–2477.
- [94] *Phenomenological analysis of observed relations for low-redshift galaxies*, Proc. Nat. Acad. Sci. U.S.A. **72** no. 12 (1975), 4691–4695. (with J. F. Nicoll)
- [95] *The constructive approach to nonlinear quantum field theory*, in “Mathematical physics and physical mathematics,” (Symposium on recent progress in mathematical physics, Warsaw, 1974), eds. K. Maurin and R. Raczka, Warsaw (1976), 175-185.
- [96] *Functional integration and interacting quantum fields*, in “Functional integration and its applications” (Proc. Internat. Conf., London, 1974), ed. A. M. Arthurs, pp. 157–168. Clarendon Press, Oxford, 1975. MR **58** #19987
- [97] *Interacting quantum fields and the chronometric principle*, Proc. Nat. Acad. Sci. U.S.A. **73** (1976), no. 10, 3355–3359. MR **54** #4442
- [98] *Space-time decay for solutions of wave equations*, Advances in Math. **22** (1976), no. 3, 305–311. MR **58** #11945 Zbl 344.35058
- [99] *Theoretical foundations of the chronometric cosmology*, Proc. Nat. Acad. Sci. U. S. A. **73** (1976), no. 3, 669–673. MR **53** #10112

- [100] *Causality and symmetry in cosmology and the conformal group*, Group theoretical methods in physics (Proc. Fifth Internat. Colloq., Univ. Montréal, Montreal, Que., 1976), Academic Press, New York, (1977), 433–447. MR **58** #9038
- [101] *Spinors, cosmology, elementary particles*, in “Quantum theory and the structures of time and space,” Vol. 2 (Second Conf., Tutzing, 1976), eds. L. Castell et al., Hanser, Munich, 1977, pp. 113–129.
- [102] *The complex-wave representation of the free boson field*, in “Topics in functional analysis (essays dedicated to M. G. Kreĭn on the occasion of his 70th birthday)”, eds. I. Gohberg and M. Kac, Academic Press, New York, 1978, pp. 321–343. MR **82d**:81069 Zbl 471.22024
- [103] *Observational validation of chronometric cosmology: The redshift-magnitude relation for quasi-stellar objects, 2*, Proc. Nat. Acad. Sci. U.S.A. **75** no. 2 (1978), 535–539. (with J. F. Nicoll)
- [104] *Symmetry and causality properties of physical fields*, Proc. Nat. Acad. Sci. U.S.A. **75** no. 4 (1978), 1609–1611. (with H. P. Jakobsen, B. Orsted, B. Speh and M. Vergne)
- [105] *Statistical scrutiny of phenomenological redshift distance square law*, Ann. Phys. **113** no. 1 (1978), 1–28. (with J. F. Nicoll)
- [106] *Statistical analysis of medium-redshift galaxy data, 1. Markarian list of Seyfert-like galaxies*, Astron. Astrophys. **68** no. 3 (1978), 353–359.
- [107] *Correction of erroneous presentation of chronometric redshift theory*, Astron. Astrophys. **68** no. 3 (1978), 343–344.
- [108] *General properties of the Yang-Mills equations in physical space*, Proc. Nat. Acad. Sci. U.S.A. **75** (1978), no. 10, 4638–4639. MR **80a**:58011 Zbl 394.35095
- [109] *Apparent super-relativistic velocities and the chronometric cosmology*, Astrophys. J. **227** no. 1 (1979), 15–17.
- [110] *Angular momentum of the cosmic background radiation* Phys. Rev. Lett. **42** no. 26 (1979), 1788–1791. (with H.P. Jakobsen and Mark Kon)

- [111] *The Cauchy problem for the Yang-Mills equations*, J. Funct. Anal. **33** (1979), no. 2, 175–194. MR **84a**:58025 Zbl 416.58027
- [112] *Some general principles of symmetry breaking and the nature of the weak interactions*, in “Quantum theory and the structures of time and space”, Vol. 3 (Third Conf., Tutzing, 1978), eds. L. Castell et al., Hanser, Munich, 1979, pp. 121–137. MR **84m**:81084
- [113] *Time, Energy, Relativity, and Cosmology*, in ”Symmetries in Science”, eds. Bruno Gruber and Richard S. Millman, ”Proceedings of the Einstein centennial celebration science symposium on symmetries in science, held February 23-March 2, 1979.”, Plenum Press 1980, 385–396.
- [114] *Decay processes and the quantization of non-unitarizable representations of causal groups*, Proc. Conf. Group-theoretical methods in physics, Israel, Spring 1979, eds. L. P. Horowitz and Y. Ne’eman, 326–329.
- [115] *The redshift-magnitude relation for bright galaxies at low redshifts*, Monthly Notices Roy. Astronom. Soc. **192** (1980), no. 3, 755–767. MR **81i**:85002
- [116] *Statistical invalidation of the Hubble law*, Proc. Nat. Acad. Sci. U.S.A. **77** (1980), no. 11, part 1, 6275–6279. (with J. F. Nicoll, D. Johnson and W. Segal) MR **81m**:85008
- [117] *Quantization of wave equations and Hermitian structures in partial differential varieties*, Proc. Nat. Acad. Sci. U.S.A. **77** (1980), no. 12, part 1, 6943–6947. (with S. M. Paneitz) MR **82g**:81040 Zbl 469.35065
- [118] *Nonparametric elimination of the observational magnitude cutoff bias*, Astron. Astrophys. **82** no. 3 (1980), L3–L6. (with J. F. Nicoll)
- [119] *Some recent tests of the chronometric cosmology*, Proc. Nat. Acad. Sci. U.S.A. **77** (1980), no. 1, part 1, 10–13. MR **80m**:85006
- [120] *The X-ray luminosity-redshift relationship of quasars*, Proc. Nat. Acad. Sci. U.S.A. **77** no. 6 (1980), 3080–3084. (with William Segal)

- [121] *Uniformity of the radial distribution of quasars in the chronometric cosmology and the X-ray background*, *Astrophys. J.* **239** no. 1 (1980), 38–41. (with J. Loncaric and William Segal)
- [122] *Singular perturbations in the interaction representation*, *J. Funct. Anal.* **38** (1980), no. 1, 71–98. (with Rhonda J. Hughes) MR **81m**:47065 Zbl 454.47014
- [123] *Stability theory and quantization*, in “Differential geometrical methods in mathematical physics”, (Proc. Conf., Aix-en-Provence/ Salamanca, 1979), eds. P. L. Garcia et al., Springer, Berlin, 1980, pp. 375–382. MR **83d**:81070 Zbl 467.58011
- [124] *Field quantization*, *Phys. Scripta* **24** (1981), no. 5, 827–831. MR **83a**:81039
- [125] *Quantum implications of global space-time structure*, in “Quantum theory and the structures of time and space” Vol 4. , eds. L. Castell et al., Carl Hanser Press, Munich, **4** (1981), 43–63.
- [126] *The phase space for the Yang-Mills equations*, *Differential geometric methods in mathematical physics* (Proc. Internat. Conf., Tech. Univ. Clausthal, Clausthal-Zellerfeld, 1978), Springer, Berlin, 1981, pp. 101–109. MR **82k**:81060
- [127] *Banach algebras and nonlinear semigroups*, *Integral Equations Operator Theory* **4** (1981), no. 3, 435–455. MR **83d**:35027 Zbl 471.35055
- [128] *Quantization of symplectic transformations*, in “Mathematical analysis and applications”, Part B, ed. L. Nachbin, Academic Press, New York, 1981, pp. 749–758. MR **83d**:81071 Zbl 471.46052
- [129] *Quantization, stability, and scattering*, 18th Scandinavian Congress of Mathematicians (Aarhus, 1980), Birkhäuser Boston, Mass., 1981, pp. 125–150. MR **84m**:81081 Zbl 467.46058
- [130] *Maxwell’s influence on geometry*, J. C. Maxwell, the sesquicentennial symposium (Amherst, Mass., 1981), North-Holland, Amsterdam, 1984, pp. 245–262. (Berger, M.S. ed.) MR **86h**:83075 Zbl 541.00019

- [131] *Covariant chronogeometry and extreme distances: elementary particles*, Proc. Nat. Acad. Sci. U.S.A. **78** (1981), no. 9, part 1, 5261–5265. (with H. P. Jakobsen, B. Ørsted, S. M. Paneitz, and B. Speh) MR **82i**:81150
- [132] *Spatial homogeneity and redshift-distance laws*, Proc. Nat. Acad. Sci. U.S.A. **79** (1982), no. 12, 3913–3917. (with J. F. Nicoll) MR **83e**:85006
- [133] *Chronometric cosmology and fundamental fermions*, Proc. Nat. Acad. Sci. U.S.A. **79** (1982), no. 24, 7961–7962. MR **84b**:85010
- [134] *Quantization as analysis in partial-differential varieties*, Czech J. Phys. **32** no. 5 (1982), 549–555.
- [135] *Null influence of possible local extra-galactic perturbations on tests of redshift distance laws*, Astron. Astrophys. **115** no. 2 (1982), 398–403. (with J. F. Nicoll)
- [136] *The dependence on redshift of the steepness of quasar counts*, Publ. Astron. Soc. Jpn. **34** (1982), 507–513.
- [137] *A correction: the quadratic redshift-distance law and the observational magnitude cutoff bias*, Astrophys. J. **252** (1982), no. 1, 37–38. MR **84j**:85011
- [138] *Correction of a criticism of the phenomenological quadratic redshift-distance law*, Astrophys. J. **258** no. 2 (1982), 457–466. (with J. F. Nicoll)
- [139] *Analysis in space-time bundles. I. General considerations and the scalar bundle*, J. Funct. Anal. **47** (1982), no. 1, 78–142. (with Stephen M. Paneitz) MR **83k**:22042 Zbl 535.58019
- [140] *Analysis in space-time bundles. II. The spinor and form bundles*, J. Funct. Anal. **49** (1982), no. 3, 335–414. (with Stephen M. Paneitz) MR **84h**:81039 Zbl 535.58020
- [141] *Covariant chronogeometry and extreme distances. III. Macro-micro relations*, Internat. J. Theoret. Phys. **21** (1982), no. 10-11, 851–869, Dirac Symposium, New Orleans, 1981. MR **84k**:81144

- [142] *Particle theory and global geometry*, in “Differential geometric methods in mathematical physics” (Clausthal, 1980), eds. H. D. Doebner et al., Lect. Notes in Math. No. 905, Springer, Berlin, 1982, pp. 151–164. MR **84m**:81185 Zbl 538.53070
- [143] *Nonlinear wave equations*, in “Nonlinear partial differential operators and quantization procedures” (Clausthal, 1981), Lect. Notes in Math. 1037, Springer, Berlin, 1983, pp. 115–141. Zbl 559.35050
- [144] *Solution globale des équations de Yang-Mills sur l’univers d’Einstein*, C. R. Acad. Sci. Paris Sér. I Math. **294** (1982), no. 6, 225–230. (with Yvonne Choquet-Bruhat) MR **83i**:58098 Zbl 501.58023
- [145] *Elementary particles in universal space-time*, Differential geometric methods in theoretical physics, Conf. Trieste 1981, 127–139 (1983) Zbl 533.53038
- [146] *The Yang-Mills equations on the universal cosmos*, J. Funct. Anal. **53** (1983), no. 2, 112–150. (with Y. Choquet-Bruhat and S. M. Paneitz) MR **85i**:58111 Zbl 535.58022
- [147] *Angular momentum of the cosmic background radiation - reply*, Phys. Rev. D **27** no. 4. (1983), 992–993.
- [148] *An optimal procedure for non-parametric elimination of observational cutoff bias in complete samples*, Astron. Astrophys. **118** no. 1 (1983), 180–188. (with J. F. Nicoll)
- [149] *Tests of alternative cosmologies based on the Palomar Bright Quasar Survey*, Quasars and Gravitational Lenses, 24th Liege Astrophysics Coll., June 1983, 293–300.
- [150] *Self and cross tests of astronomical hypotheses and optimal cutoff bias-free nonparametric estimation*, Proc. Stat. Methods in Astron. Symp., Strassbourg, Sept. 1983, Publ. Euro space Agency, ESA SP-201, 215–224.
- [151] *Distance and model dependence of observational galaxy cluster concepts*, Astron. Astrophys. **123** no. 1 (1983), 151–158.

- [152] *Radiation in the Einstein universe and the cosmic background*, Phys. Rev. D (3) **28** (1983), no. 10, 2393–2401. MR **85d**:83089
- [153] *Selfadjointness of the Fourier expansion of quantized interaction field Lagrangians*, Proc. Nat. Acad. Sci. U.S.A. **80** (1983), no. 14 Phys. Sci., 4595–4598. (with S. M. Paneitz) MR **85f**:81042 Zbl 516.46053
- [154] *Alternative space-times and the physics of extreme distances*, XIIIth international colloquium on group theoretical methods in physics (College Park, Md., 1984), World Sci. Publishing, Singapore, 1984, pp. 143–154. Zbl 561.53070
- [155] *Concerning: “A critique of Segal’s chronometric theory” [Gen. Relativity Gravitation **16** (1984), no. 4, 393–401; MR 86h:83048a] by L. I. Wormald*, Gen. Relativity Gravitation **16** (1984), no. 4, 403–409. MR **86h**:83048b
- [156] *Evolution of the inertial frame of the Universe*, Nuovo Cimento B (11) **79** (1984), no. 2, 187–192. MR **85e**:83080
- [157] *Reduction of scattering to an invariant finite displacement in an ambient space-time*, Proc. Nat. Acad. Sci. U.S.A. **81** (1984), no. 22, Phys. Sci., 7266–7268. MR **86b**:81090 Zbl 571.58026
- [158] *Stephen Paneitz: a brief appreciation*, Group theoretical methods in physics (Trieste, 1983), Lect. Notes in Phys. 201, Springer, Berlin, 1984, pp. 79–83.
- [159] *Regularity aspects of the quantized perturbative S-matrix in 4-dimensional space-time*, Differential geometric methods in mathematical physics (Clausthal, 1983), eds. H. D. Doebner and J.D. Hennig, Lect. Notes in Math. 1139, Springer, Berlin, 1985, pp. 136–149. MR **87e**:81099 Zbl 577.46066
- [160] *The work of Steven M. Paneitz*, Differential geometric methods in mathematical physics (Clausthal, 1983), eds. H. D. Doebner and J.D. Hennig, Lect. Notes in Math. 1139, Springer, Berlin, 1985, pp. 1–5. (with H.D. Doebner and J.D. Hennig.) MR **87f**:01039

- [161] *Classical and quantized invariant wave equations—progress and problems*, Nonlinear functional analysis and its applications, Part 2 (Berkeley, Calif., 1983), Amer. Math. Soc., Providence, R.I., 1986, pp. 341–358. MR **87i**:58167 Zbl 617.35056
- [162] *Global theory of nonlinear wave equations*, Semigroups, theory and applications, Vol. I (Trieste, 1984), Longman Sci. Tech., Harlow, 1986, pp. 214–226. MR **88a**:81087 Zbl 632.35043
- [163] *Uniformity of quasars in the chronometric cosmology*, Astron. Astrophys. **144** no. 2. (1985), L23–L26. (with J. F. Nicoll)
- [164] *Quasar redshifts*, Phys. Today **38** no. 7. (1985), 13–13.
- [165] *Poincaré-invariant structures in the solution manifold of a nonlinear wave equation*, Rev. Mat. Iberoamericana **2** (1986), no. 1-2, 99–104. MR **88b**:58151 Zbl 599.58007
- [166] *Induced bundles and nonlinear wave equations*, Group representations, ergodic theory, operator algebras, and mathematical physics (Berkeley, Calif., 1984), Springer, New York, 1987, pp. 199–224. MR **88f**:58143 Zbl 617.58033
- [167] *Hilbert-Schmidt cohomology of Weyl systems*, Aspects of mathematics and its applications, North-Holland, Amsterdam, 1986, pp. 727–734. MR **88h**:47073 Zbl 596.46068
- [168] *The morphology luminosity relation of galaxies as a function of cosmology*, Publ. Astron. Soc. Jpn. **37** (1985), 499–506.
- [169] *The cosmic background radiation and the chronometric cosmology*, Conference Proc., The cosmic background radiation and fundamental physics., Publ. Societa Italiana di Fisica, **1** (1985), 209–223.
- [170] *Complete quasar samples and comparative cosmology*, Proc. IAU Symposium No. 119, Quasars, ed. G. Swarup, Bangalore, 1985, 493–494.
- [171] *Comparative statistical study of the chronometric and Friedman cosmologies based on the Palomar bright quasar and other complete quasar surveys*, Astrophys. J. **300** no. 1. (1986), 224–241. (with J. F. Nicoll)

- [172] *Quasar luminosity evolution – fact or artifact?* Publ. Astron. Soc. Jpn. **38** (1986), 611-617. (with J. F. Nicoll)
- [173] *Directly observed relations in complete galaxy samples and the predictions of redshift distance power laws*, Proc. Nat. Acad. Sci. U.S.A. **83** no. 19 (1986), 7129–7131.
- [174] *The physics of extreme distances and the universal cosmos*, Quantum theory and the structure of time and space, **6**, eds. L. Castell and C.F. von Weizsäcker, Carl Hanser Verlag, Munich, (1986), 120–137.
- [175] *Resolution of the discrepancy between the X-ray background spectrum and that of discrete sources*, Astrophys. J. **313** no. 2 (1987), 543–546.
- [176] *The paucity of high-redshift quasars and comparative cosmology*, Astrophys. J. **316** (1987), no. 1, part 2, L5–L6. MR **88b**:83002
- [177] *Correction of a study of source counts in the chronometric cosmology*, Astrophys. J. **320** no. 1 (1987), 135–138
- [178] *The local redshift distance relation and spatial uniformity*, Proc. Nat. Acad. Sci. U.S.A. **84** no. 18 (1987), 6326–6326.
- [179] *Analysis in space-time bundles. IV. Natural bundles deforming into and composed of the same invariant factors as the spin and form bundles*, J. Funct. Anal. **75** (1987), no. 1, 1–57. (with S. M. Paneitz and D. A. Vogan, Jr.) MR **90a**:22013 Zbl 682.58022
- [180] *Explanation of parity nonconservation*, Proc. Nat. Acad. Sci. U.S.A. **84** (1987), no. 2, 319–323. (with B. Ørsted, S. M. Paneitz and D. A. Vogan, Jr.) MR **88c**:81038
- [181] *Causal symmetries and the physics of extreme distances*, Infinite-dimensional Lie algebras and quantum field theory (Varna, 1987), World Sci. Publishing, Teaneck, NJ, 1988, pp. 78–96. Zbl 765.53071
- [182] *Algebraic quantization of induced bundles*, Physique quantique et géométrie (Paris, 1986), Hermann, Paris, 1988, pp. 119–139. MR **90b**:58099 Zbl 651.58013

- [183] *The computer-intensive statistics to flux-limited samples*, Newsletter of Working Gp. for Mod. Astron. Method., Feb. (1988), 4-13.
- [184] *Direct comparison of observed magnitude-redshift relations in complete galaxy samples with systematic predictions of alternative redshift-distance laws*, Monthly Notices Roy. Astronom. Soc. **237** (1989), no. 1, 17–37.
- [185] *A pilot model in two dimensions for conformally invariant particle theory*, J. Funct. Anal. **83** (1989), no. 1, 150–184. (with B. Ørsted)
MR **90k**:81236 Zbl 704.55011
- [186] *Algebraic characterization of the vacuum for quantized fields transforming nonunitarily*, Pacific J. Math. **137** (1989), no. 2, 387–403.
MR **90h**:81069 Zbl 683.46050
- [187] *Apparent superluminal sources, comparative cosmology and the cosmic distance scale*, Monthly Notices Roy. Astronom. Soc. **242** no. 3 (1990), 423–427.
- [188] *The global Goursat problem and scattering for nonlinear wave equations*, J. Funct. Anal. **93** (1990), no. 2, 239–269. (with John C. Baez and Zhengfang Zhou) MR **91k**:58128 Zbl 724.35105
- [189] *Algebraic quantization and stability*, Operator theory: operator algebras and applications, Part 1 (Durham, NH, 1988), Amer. Math. Soc., Providence, RI, 1990, pp. 503–518. MR **91m**:81122 Zbl 727.47023
- [190] *The mathematical implications of fundamental physical principles*, The legacy of John von Neumann (Hempstead, NY, 1988), Amer. Math. Soc., Providence, RI, 1990, pp. 151–178. MR **92h**:81002
- [191] *The unscientific charm of the big bang*, The New York Times, Friday, May 4, (1990), p. A34.
- [192] *Singular operators on boson fields as forms on spaces of entire functions on Hilbert space*, J. Funct. Anal. **100** (1991), no. 1, 36–58. (with S. M. Paneitz, J. Pedersen and Zhengfang Zhou) MR **92k**:47142 Zbl 758.47053

- [193] *Is the cygnet the quintessential baryon?* Proc. Nat. Acad. Sci. U.S.A. **88** no. 3 (1991), 994–998.
- [194] *The nature of the redshift and directly observed quasar statistics*, Naturwissenschaften **78** (1991), 289–296. (with J. F. Nicoll, P. Wu and Zhengfang Zhou)
- [195] *Is the physical vacuum really Lorentz-invariant?*, In “Differential geometry, group representations, and quantization”, eds. J. Hennig, W. Lucke and J. Tolar, Lect. Notes in Phys. 379, Springer-Verlag, Berlin, 1991, pp. 137–143. MR **93g**:81196
- [196] *Norbert Wiener*, Biographical Memoirs of the Nat. Acad. of Sci., USA **61** (1992), 389–436.
- [197] *Convergence of nonlinear massive quantum field theory in the Einstein universe*, Ann. Physics **218** (1992), no. 2, 279–292. (with Zhengfang Zhou) MR **93i**:81170 Zbl 875.53017
- [198] *Massless φ_d^4 quantum field theories and the nontriviality of φ_4^4* , Nuclear Phys. B **376** (1992), no. 1, 129–142. (with J. Pedersen and Zhengfang Zhou) MR **93m**:81100
- [199] *Apparent nonlinearity of the redshift distance relation in infrared astronomical satellite galaxy samples*, Proc. Nat. Acad. Sci. U.S.A. **89** no. 24 (1992), 11669–11672. (with J. F. Nicoll)
- [200] *The redshift distance relation*, Proc. Nat. Acad. Sci. U.S.A. **90** no. 11 (1993), 4798–4805.
- [201] *Statistically efficient testing of the Hubble and Lundmark laws on IRAS galaxy samples*, Astrophys. J. **411** no. 2, (1993), 465–484. (with J. F. Nicoll, P. Wu and Zhengfang Zhou)
- [202] *Nonlinear quantum fields in ≥ 4 dimensions and cohomology of the infinite Heisenberg group*, Trans. Amer. Math. Soc. **345** (1994), no. 1, 73–95. (with J. Pedersen and Zhengfang Zhou) MR **95a**:81158 Zbl 803.46086

- [203] *Geometric derivation of the chronometric redshift*, Proc. Nat. Acad. Sci. U.S.A. **90** (1993), no. 23, 11114–11116. MR **94h**:83120
- [204] *Convergence of quantum electrodynamics in a curved modification of Minkowski space*, Proc. Nat. Acad. Sci. U.S.A. **91** (1994), no. 3, 962–963. (with Zhengfang Zhou) MR **94j**:81300
- [205] *Convergence of quantum electrodynamics in a curved deformation of Minkowski space*, Ann. Physics **232** (1994), no. 1, 61–87. (with Zhengfang Zhou) MR **95c**:81174 Zbl 801.53069
- [206] *C*-algebras and quantization*, C*-algebras: 1943–1993 (San Antonio, TX, 1993), Amer. Math. Soc., Providence, RI, 1994, pp. 54–65. (Doran, Robert S. ed.) MR **95e**:81113 Zbl 853.46069
- [207] *Fundamental physics in universal space-time*, Proc. of a Conf. “Physics on manifolds” (Paris, 1992), eds. M. Flato et al, Kluwer Acad. Publ., Dordrecht, 1994, pp. 253–264. MR **95e**:81229 Zbl 832.53072
- [208] *Rigorous covariant form of the correspondence principle*, Quantization, nonlinear partial differential equations, and operator algebra (Cambridge, MA, 1994), Amer. Math. Soc., Providence, RI, 1996, pp. 175–202. MR **97d**:81118 Zbl 855.47049
- [209] *Complex noncommutative infinite-dimensional analysis and fermion-boson interactions*, The Legacy of Norbert Wiener: A Centennial Symposium (Cambridge, MA, 1994), Amer. Math. Soc., Providence, RI, 1997, pp. 329–353. MR **98h**:81072 Zbl 884.47047
- [210] *Wiener space and nonlinear quantum field theory*, Proceedings of the Norbert Wiener Centenary Congress, 1994 (East Lansing, MI, 1994) (Providence, RI), Amer. Math. Soc., 1997, pp. 151–162. MR **98m**:28028 Zbl 899.60095
- [211] *Statistically efficient parallel testing of the Friedmann and chronometric flux-redshift predictions in the radio band*, Astrophys. J. **430** (1994), 63–73. (with J. F. Nicoll and E. Blackman)

- [212] *Statistically efficient parallel testing of the Hubble and Lundmark laws in the preevolutionary X-ray band*, *Astrophysics J.* **431** (1994), 52-68. (with J. F. Nicoll and P. Wu)
- [213] *Maxwell's equations in the Einstein universe and chronometric cosmology*, *Astrophys. J. Suppl.* **S 100** no. 2 (1995), 307-324. (with Zhengfang Zhou)
- [214] *Constructive non-linear quantum field theory in four space-time dimensions*, *Perspectives on quantization* (South Hadley, MA, 1996), eds. L. A. Coburn and M. Rieffel, *Contemporary Math.*, 214, Amer. Math. Soc., Providence, RI, 1998, pp. 145-156. MR **98j**:81200 Zbl 896.46052
- [215] *Statistics of a complete high-redshift quasar survey and predictions of nonevolutionary cosmologies*, *Astrophys. J.* **459** (1996), 496-503. (with J. F. Nicoll)
- [216] *Tests of local redshift-distance laws on the basis of a complete optical sample*, *Astrophys. J.* **465** (1996), 578-594. (with J. F. Nicoll)
- [217] *Cosmic time dilation*, *Astrophys. J.* **482** (1997), L115-L117.
- [218] *Phenomenology of the local angular diameter to redshift relation*, *Astrophys. J.* **488** (1997), L87-L90. (with J. F. Nicoll)
- [219] *Modern statistical methods for cosmological testing*, *Statistical challenges in modern astronomy II. Proceedings of the 2nd conference, SCMA II, University Park, PA, USA, June 2-5, 1996.* (Babu, G. Jogesh et al, eds.), New York, NY: Springer. 67-81 (1997). Zbl 900.85017
- [220] *The Black-Scholes pricing formula in the quantum context*, *Proc. Natl. Acad. Sci. USA*, **95**, No. 7 (1998), 4072-4075. (with William Segal) Zbl 903.90009
- [221] *Real spinor fields and the electroweak interaction*, *J. Funct. Anal.* **154** (1998), no. 2, 542-558. MR **99g**:81075 Zbl 912.53059
- [222] *Spinor currents as vector particles*, *J. Funct. Anal.* **156** (1998), no. 1, 252-262. (with David A. Vogan, Jr. and Zhengfang Zhou) MR **99h**:81066 Zbl 912.53060

- [223] *Conformal extension of massive wave functions*, J. Funct. Anal. **155** (1998), no. 2, 550–570. (with Zhengfang Zhou) MR **99e**:81083 Zbl 915.58100
- [224] *Cosmological implications of a large complete quasar sample*, Proc. Natl. Acad. Sci. U. S. A. **95** (1998), no. 9, 4804–4807. (with J. F. Nicoll)
- [225] *Is redshift-dependent evolution of galaxies a theoretical artifact?*, Proc. Natl. Acad. Sci. U. S. A. **96** (1999), no. 24, 13615–13619.
- [226] *Phenomenological analysis of redshift-distance power laws*, Astrophys. Space Sci. **274** (2000), 503-512. (with J. F. Nicoll)
- [227] John C. Baez, Edwin F. Beschler, Leonard Gross, Bertram Kostant, Edward Nelson, Michèle Vergne, and Arthur S. Wightman, *Irving Ezra Segal (1918–1998)*, Notices Amer. Math. Soc. **46** (1999), no. 6, 659–668.

Books

- [1] *Mathematical problems of relativistic physics*, American Mathematical Society, Providence, R.I., 1963, With an appendix by George W. Mackey. Lectures in Applied Mathematics (proceedings of the Summer Seminar, Boulder, Colorado, 1960), Vol. II. MR **26** #1774 Zbl 112.45307
- [2] I. Sigal, *Matematicheskie problemy relyativistskoifiziki*, Izdat. “Mir”, Moscow, 1968, Translated from the English by V. S. Buslaev. Edited by L. D. Faddeev. MR **39** #5113
- [3] *Proceedings of a Conference on the Theory and Applications of Analysis in Function Space*, The M.I.T. Press, Cambridge, Mass., 1964, Dedham, Mass., June 9-13, 1963. Edited by William Ted Martin and Irving Segal. MR **29** #1518 and MR **31** #1903 Zbl 172.39101
- [4] *Mathematical Theory of Elementary Particles* (Proc. Conf., Dedham, Mass., 1965), M.I.T. Press, Cambridge, Mass., 1966, (R. Goodman and I.E. Segal, eds.) Zbl 171.24301

- [5] Irving E. Segal and Ray A. Kunze, *Integrals and operators*, McGraw-Hill Book Co., New York, 1968. MR **36** #335 Zbl 177.30302
- [6] ———, *Integrals and operators*, enlarged ed., Springer-Verlag, Berlin, 1978, Grundlehren der Mathematischen Wissenschaften, Band 228. MR **58** #6126 Zbl 373.28001
- [7] *Mathematical cosmology and extragalactic astronomy*, Academic Press [Harcourt Brace Jovanovich Publishers], New York, 1976, Pure and Applied Mathematics, Vol. 68. MR **58** #14894
- [8] *Studies in applied mathematics* A volume dedicated to Irving Segal. Edited by Victor Guillemin, with an introduction by Edward Nelson and list of publications of I.E. Segal, (xv-xxv). Advances in Mathematics, Supplementary Studies, 8. Academic Press, Inc. [Harcourt Brace Jovanovich, Publishers], New York, 1983. xxv+163 pp. MR **85f**:00008 Zbl 508.00010
- [9] *Introduction to algebraic and constructive quantum field theory*, Princeton University Press, Princeton, NJ, 1992. (with John C. Baez and Zhengfang Zhou) MR **93m**:81002 Zbl 760.46061
- [10] *Quantization, nonlinear partial differential equations, and operator algebra*, Proceedings of the 1994 John von Neumann Symposium on Quantization and Nonlinear Wave Equations held at the Massachusetts Institute of Technology, Cambridge, Massachusetts, June 7–11, 1994. Edited by William Arveson, Thomas Branson and Irving Segal. Proceedings of Symposia in Pure Mathematics, 59. American Mathematical Society, Providence, RI, 1996. x+224 pp. MR **96m**:00020 Zbl 840.00054