

JOSEPH SUCHER

Professor Emeritus of Physics

University of Maryland, College Park, MD

I. Education:

B.S., Brooklyn College, 1952 (summa cum laude)

Ph.D., Columbia University, 1957

II. Experience in Higher Education:

1953 (Summer) Brooklyn College, Lecturer

1952-57 Columbia University, Research Assistant and Fellow

1957-61 University of Maryland, Assistant Professor

1961-64 University of Maryland, Associate Professor

1964-98 University of Maryland, Professor

1998-present University of Maryland, Professor Emeritus

III. Experience Other than Higher Education:

1960 (Summer) Brookhaven National Laboratory, Visiting Scientist

1963-1964 CERN, Geneva, Switzerland, Visiting Scientist

1973 (Summer) Brookhaven National Laboratory, Visiting Scientist

1993 (Spring) Lawrence Berkeley Laboratory, Visiting Scientist

IV. Publications:

See Attached List

V. Professional Activities:

Associate Editor, *Surveys in High-Energy Physics* (to 1985)

Co-director, Program on *Relativistic Effects, Quantum Electrodynamics and Weak Interaction Effects in Atoms*, Institute for Theoretical Physics, UCSB, Santa Barbara, 1988

Member, Executive Committee of the APS Topical Group on Few-Body Systems and Multi-Particle Dynamics (1993-1996)

VI. Honors, Awards, and Visiting Positions

Phi Beta Kappa, Junior year	(Brooklyn College, 1951)
B.S. Summa Cum Laude	(Brooklyn College, 1952)
Higgins Fellow	(Columbia University, 1953)
NSF Pre-doctoral Fellow	(Columbia University, 1954)
Quincy W. Boese Fellow	(Columbia University, 1955)

Faculty Research Award, General Research Board of the
University of Maryland, 1962

NSF Senior Post-doctoral Fellow, 1963-64

Fellow of the American Physical Society

Guggenheim Fellowship, 1968-69

Visiting Scholar, University of Washington, 1970

NATO Fellowship, Cambridge University, England, 1971

Fellow of Clare Hall, Cambridge University, 1971

Visiting Professor, University of Paris, 1971-72

National Research Council Senior Associateship, 1978-79

Faculty Research Award, General Research Board of the
University of Maryland, 1984

Ernest Kempton Adams Fellow and Visiting Professor,
Columbia University, Fall 1984

Visiting Professor, Columbia University, 1985-1986

Visiting Professor, New York University, Spring 1986

Member, Institute for Theoretical Physics,
UCSB, Santa Barbara, Spring 1988

Distinguished Scholar Teacher, University of Maryland, 1989-1990

International Symposium: "From Atoms to Quarks", October 1990;
in honor of 60th birthday

Summary speaker: Nobel Symposium No. 85, Saltsjobaden, July 1992

Visiting Scholar, Chalmers and Uppsala Universities, Summer 1992

Visiting Scientist, U.C. Berkeley, Spring, 1993

Washington Academy of Sciences Award for Outstanding Achievement in
Physical Sciences, 1996

Other Scholarly Activities:

Public lecture: *The Joys of Physics: Romancing the Photon*, (April 1990)

Public lecture: *My Romance with Physics*, (December, 2001)

Bibliography

A. Papers published in refereed journals

1. RELATIVISTIC AND MAGNETIC SPIN INTERACTIONS IN HELIUM-LIKE ATOMS, with H.M. Foley; *Phys. Rev.* 95, 966 (1954).
2. REDUCTION OF THE DIRAC EQUATION, *Phys. Rev.* 103, 468 (1956).
3. S-MATRIX FORMULATION FOR LEVEL-SHIFT CALCULATIONS, *Phys. Rev.* 107, 1448 (1957).
4. ENERGY LEVELS OF THE TWO-ELECTRON ATOM TO ORDER α^3 Rydberg, IONIZATION ENERGY OF HELIUM, *Phys. Rev.* 109, 1010 (1958).
5. ON THE RADIATIVE CORRECTIONS TO THE SCATTERING OF MESONS IN AN EXTERNAL ELECTROMAGNETIC FIELD, with A.K. Bhatia; *Progr. Theoret. Phys.* (Kyoto) 20, 397 (1958).
6. K⁻p RELATIVE PARITY FROM THE K⁻d CHARGE EXCHANGE REACTION, with T.B. Day and G.A. Snow; *Nuovo Cimento* 13, 614 (1959).
7. Σ and Λ PRODUCTION FROM THE (K⁻,p) SYSTEM, with T.B. Day and G.A. Snow; *Phys. Rev. Letters* 2, 529 (1959).
8. ON THE SUPPRESSION OF p-STATE CAPTURE IN (K⁻,p) ATOMS, with T.B. Day and G.A. Snow; *Phys. Rev. Letters* 3, 61 (1959).
9. ON A RELATION BETWEEN SCATTERING AND PRODUCTION AMPLITUDES, with T.B. Day; *Nuovo Cimento* 13, 1111 (1959).
10. K-NUCLEON SCATTERING LENGTHS AND THE K⁻d ELASTIC SCATTERING REACTION, with T.B. Day and G.A. Snow, *Nuovo Cimento* 14, 637 (1959).
11. AN ASYMPTOTIC CAUSALITY REQUIREMENT FOR SYSTEMS WITH CONSTRAINED INPUTS, *Nucl. Phys.* 14, 263a (1959).
12. HIGH ORBITAL S-STATE CAPTURE OF π MESONS BY PROTONS, with T.B. Day and G.A. Snow; *Phys. Rev.* 118, 864 (1960).

13. DETERMINATION OF K^+ -n P-WAVE PHASE SHIFTS FROM K^+ -d REACTIONS, with T.B. Day, L.S. Rodberg and G.A. Snow; *Nuovo Cimento* 16, 770 (1960).

14. K-DEUTERON SCATTERING AND THE K-NUCLEON SCATTERING LENGTHS, with T.B. Day and G.A. Snow; *Phys. Rev.* 119, 1100 (1960).
- 14a. THE POSSIBILITY OF A SPIN WAVE MAGNETIC MOMENT DETECTOR, with T.B. Day; *J. Appl. Phys.* 32, 1788 (1961).
15. Σ - Λ RELATIVE PARITY AND THE DALITZ DECAY OF THE Σ HYPERON, with G.A. Snow; *Nuovo Cimento* 18, 195 (1960).
16. CUSP PHENOMENA IN THE REGION OF TWO NEIGHBORING THRESHOLDS, with G.A. Snow and T.B. Day; *Phys. Rev.* 122, 5 (1961).
17. ANALYTICITY IN THE COUPLING CONSTANT AND BOUND STATES IN POTENTIAL THEORY, with B. Bosco; *Nuovo Cimento* 19, 1183 (1961).
18. NOTE ON REARRANGEMENT COLLISIONS, with T.B. Day, L.S. Rodberg and C.A. Snow; *Phys. Rev.* 123, 1051 (1961).
19. RELATIVISTIC INVARIANCE AND THE SQUARE-ROOT KLEIN-GORDON EQUATION; *J. Math. Phys.* 4, 17 (1963).
20. ROTATIONAL INVARIANCE AND THE S-MATRIX IN NONRELATIVISTIC QUANTUM MECHANICS, with R. Fong; *Phys. Rev.* 129, 2824 (1963).
21. DISPERSION THEORY METHODS FOR PION-DEUTERON ELASTIC SCATTERING, with J.J. Brehm; *Ann. Phys.* 25, 1 (1963).
22. LOW ENERGY K-d SCATTERING, with A.K. Bhatia; *Phys. Rev.* 132, 855 (1963).
23. RELATIVISTIC PARTICLE DYNAMICS AND THE S-MATRIX, with R. Fong; *J. Math. Phys.* 5, 456 (1964).
24. POLARIZATION OF A FINAL PARTICLE IN A TWO STEP PROCESS: APPLICATION TO $K^- + p \rightarrow \pi + \Lambda$, with M.H. Cha; *Phys. Rev.* 140, B668 (1965).
25. BROKEN SYMMETRIES AND MASS FORMULAE FOR VECTOR MESONS, with G. Segre; *Nuovo Cimento* 38, 428 (1965).
26. LONG-RANGE ELECTROMAGNETIC INTERACTIONS OF NEUTRAL PARTICLES, with

G. Feinberg, *Phys. Rev.* 139, B1619 (1965).

27. K_{e3} DECAY AND UNIVERSALITY IN CABIBBO'S THEORY OF LEPTONIC DECAYS, with S. Oneda, *Phys. Rev. Letters* 15, 927 (1965).

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28. FICTITIOUS NATURE OF CORE TERM IN EXCHANGE AMPLITUDE FOR ELECTRON-ATOM COLLISIONS, with I.K. Kang; *Phys. Letters* 20, 22 (1966).
29. BOUND STATES OF A RELATIVISTIC TWO-BODY HAMILTONIAN; COMPARISON WITH THE BETHE-SALPETER EQUATION, with N.D. Son; *Phys. Rev.* 153, 1496 (1967).
30. RESONANCE SATURATION OF AXIAL CHARGE COMMUTATORS, SU(3) SYMMETRY AND SCALAR MESONS, with S. Matsuda and S. Oneda; *Phys. Rev.* 159, 1247 (1967).
31. EXTRAPOLATION PROBLEM IN CURRENT ALGEBRA CALCULATIONS OF THE π - π SCATTERING LENGTHS, with C.H. Woo; *Phys. Rev. Letters* 18, 723 (1967).
32. VANDER WAALS FORCE, DISPERSION THEORY AND SINGULARITIES ON SECOND RIEMANN SHEETS, with J. Soffer; *Phys. Rev.* 161, 1664 (1967).
33. INEQUIVALENCE OF $\Phi = \Phi_C$ AND $Z_3 = 0$, with R.A. Brandt and C.H. Woo; *Phys. Rev. Letters* 19, 801 (1967).
34. LONG-RANGE FORCES FROM NEUTRINO-PAIR EXCHANGE, with G. Feinberg; *Phys. Rev.* 166, 1638 (1968).
35. ELECTROMAGNETIC MASS SHIFTS, COMMUTATOR AMBIGUITIES, AND EXPONENTIALLY FALLING FORM FACTORS, with R.A. Brandt; *Phys. Rev. Letters* 20, 1131 (1968).
36. EXACT COMPUTATION OF THE VAN DER WAALS CONSTANT FOR TWO HYDROGEN ATOMS, with M. O'Carroll; *Phys. Rev. Letters* 21, 1143 (1968).
37. ELECTROMAGNETIC MASS SHIFTS, EQUAL-TIME COMMUTATORS AND OSCILLATING SPECTRAL FUNCTIONS, with R.A. Brandt; *Phys. Rev.* 177, 2218 (1969).
38. LOCAL TENSOR FIELDS AND THE ENERGY-MOMENTUM OPERATOR, with C. Orzalesi and C.H. Woo; *Phys. Rev. Letters* 21, 1550 (1968).

39. THE GENERAL FORM OF THE RETARDED VAN DER WAALS POTENTIAL, with G. Feinberg; *J. Chem. Phys.* 48, 3333 (1968).
40. THE EIKONAL APPROXIMATION IN QUANTUM FIELD THEORY, with M. Levy; *Phys. Rev.* 186, 1656 (1969).
41. ARC TANGENT APPROXIMATION TO THE INTERMOLECULAR POTENTIAL, with M. O'Carroll; *Phys. Rev.* 187, 85 (1969).

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42. SINGULARITY STRUCTURE OF CAUSAL DISTRIBUTIONS AND RESTRICTED EQUAL-TIME LIMITS, with P. Otterson; *J. Math. Phys.* 11, 3307 (1970).
43. ASYMPTOTIC BEHAVIOR OF SCATTERING AMPLITUDES IN RELATIVISTIC EIKONAL APPROXIMATION, with M. Levy; *Phys. Rev. D* 2, 1716 (1970).
44. GENERAL THEORY OF THE VAN DER WAALS INTERACTIONS: A MODEL INDEPENDENT APPROACH, with G. Feinberg; *Phys. Rev. A* 2, 2375 (1970).
45. CALCULATION OF THE DECAY RATE FOR $2^3S_1 \rightarrow 1^1S_0 + \gamma$ IN HELIUM, with G. Feinberg; *Phys. Rev. Letters* 26, 681 (1971).
46. DOES THE LIGHT CONE DOMINATE THE ASYMPTOTIC BEHAVIOR OF VERTEX FUNCTIONS AND SCATTERING AMPLITUDES?, with C.H. Woo, *Phys. Rev. Letters* 27, 696 (1971).
47. RETARDATION EFFECTS IN VERY LOW-ENERGY HELIUM-HELIUM SCATTERING, with John Konrady; *Phys. Rev. Letters* 28, 2 (1972).
48. THE SIGN OF THE ELECTRIC POLARIZABILITY IN RELATIVISTIC QUANTUM THEORY, *Phys. Rev. D* 6, 1798 (1972).
49. OFF-SHELL FORM FACTORS FOR COMPOSITE HADRONS AND EXCLUSIVE PROCESSES IN ELECTRO-PRODUCTION, with C.H. Woo, *Phys. Rev. D* 1, 3372 (1973).
50. IS THERE SPONTANEOUS SYMMETRY BREAKING IN GAUGE THEORIES WITH THE HIGGS-KIBBLE MECHANISM?, with C.H. Woo; *Phys. Rev. D* 8, 2721 (1973).
51. ARBITRARINESS OF COUPLING CONSTANTS IN ASYMPTOTICALLY FREE THEORIES, with C.H. Woo; *Il Nuovo Cimento* 10, 111 (1974).

52. SCATTERING OF GAUGE BOSONS IN SIXTH ORDER AND NON-RENORMALIZABILITY OF MASSIVE YANG-MILLS THEORIES, with R. Mohapatra and S. Sakakibara; *Phys. Rev. D* 10, 1844-1854 (1974).
53. 2^3S_1 1^1S_0 + ONE PHOTON TRANSITION IN HELIUM-LIKE IONS: EXACT RESULT FOR THE LOWEST-ORDER EFFECT OF THE ELECTRON-ELECTRON INTERACTION, with E. Kelsey; *Phys. Rev. A* 11, 1829 (1975).
54. EVIDENCE FOR ALMOST POINT-LIKE BEHAVIOR OF OFF-SHELL PARTICLES IN FIELD THEORY, with C.A. Orzalesi and C.H. Woo; *Physics Letters* 58B, 328 (1975).

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55. RELATIVISTIC CALCULATION OF RADIATIVE M1 TRANSITIONS IN CHARMONIUM, with G. Feinberg, *Phys. Rev. Letters* 35, 1740 (1975).
56. HOW LIGHT CAN OBSERVABLE COLOR-GLUONS BE?, with J.C. Pati and C.H. Woo; *Phys. Rev. D* 15, 147 (1977).
57. CAN LEPTONS GIVE FLAVOR TO HADRONS?, with E. Nowak and C.H. Woo; *Phys. Rev. D* 16, 2874 (1977).
58. QUARK MODEL RELATION FOR KAON CHARGE RADII, with O.W. Greenberg and S. Nussinov; *Physics Letters* 70B, 465 (1977).
59. GROUND STATE ENERGY OF ANY ATOM, *J. Phys. B, Atom. Molec. Phys.* 11, 1515-1520 (1978).
60. THEORY OF RADIATIVE CORRECTIONS TO ATOMIC DECAY RATES, with R. Barbieri; *Nuclear Physics* B134, 155-168 (1978).
61. RADIATIVE M1 TRANSITIONS OF THE NARROW RESONANCES, with J.S. Kang; *Phys. Rev. D* 18, 2698-2703 (1978).
62. MAGNETIC DIPOLE TRANSITIONS IN ATOMIC AND PARTICLE PHYSICS: IONS AND PSIONS, *Rep. Progr. Phys.* 41, 1781-1838 (1978).
63. NEW TECHNIQUES FOR EVALUATING PARITY-CONSERVING AND PARITY-VIOLATING CONTACT INTERACTIONS, with J. Hiller and G. Feinberg; *Phys. Rev. A* 18,

2399-2411 (1978).

64. AXIAL GLUONS AND THE FINE-STRUCTURE OF HEAVY Q-Q SYSTEMS, with B. Lynn and G. Feinberg; *Phys. Rev. D* 19, 2231 (1979).
65. GLOBAL OPERATORS FOR DELTA-FUNCTIONS: EXTENSION TO SCATTERING STATES AND THE INCLUSION OF SPIN, with R. Drachman; *Phys. Rev. A* 20, 424 (1979).
66. ANNIHILATION IN POSITRON-ATOM COLLISIONS: A NEW APPROACH, with R.J. Drachman; *Phys. Rev. A* 20, 442 (1979).
67. IS THERE A STRONG VAN DER WAALS FORCE BETWEEN HADRONS?, with G. Feinberg; *Phys. Rev. D* 20, 1717 (1979).
68. PARITY-VIOLATING E1 TRANSITIONS IN HELIUM, with J. Hiller, A.K. Bhatia and G. Feinberg; *Phys. Rev. A* 21, 1082 (1980).

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69. RELATIVISTIC THEORY OF PARITY VIOLATION IN MANY-ELECTRON ATOMS, with J. Hiller, G. Feinberg and B. Lynn, *Annals of Physics* 127, 149-178 (1980).
70. GAUGE INVARIANCE AND THE CHOICE OF GAUGE FOR ONE-GLUON- EXCHANGE CORRECTIONS TO QUARKONIUM MASS SPECTRA, with G. Feldman and T. Fulton; *Phys. Rev. D* 21, 845-849 (1980).
71. BOUND-STATE RELATIVISTIC EFFECTIVE-RANGE APPROXIMATION AND THE CHARGE RADII OF THE K MESONS, with E.J. Nowak; *Nucl. Phys.* B169, 88-102 (1980).
72. NEW APPROACH TO HYPERFINE STRUCTURE: APPLICATION TO THE Li GROUND STATE, with A.K. Bhatia; *J. Phys.* B13, L409-L413 (1980).
73. FOUNDATIONS OF THE RELATIVISTIC THEORY OF MANY-ELECTRON ATOMS, *Phys. Rev. A* 22, 348-362 (1980).
74. A QUANTUM STRUCTURE-DYNAMIC MODEL OF QUARKS, LEPTONS, WEAK VECTOR BOSONS, AND HIGGS MESONS, with O.W. Greenberg; *Physics Letters* 99B, 339-343 (1981).
75. CAN WE SEE COLOR VAN DER WAALS FORCES BETWEEN LEPTONS MADE OF

- COLORED CONSTITUENTS?, with A.D. Kennedy; *Phys. Rev. D* 25, 880-884 (1982).
76. RELATIVISTIC CORRECTIONS TO DIPOLE DECAY AMPLITUDES IN QUARKONIUM, with G. Hardekopf; *Phys. Rev. D* 25, 2938 (1982).
77. LONG-RANGE FORCES BETWEEN A CHARGED AND NEUTRAL SYSTEM, with G. Feinberg; *Phys. Rev.* 27, 1958 (1983).
78. GLUONIC CONTRIBUTIONS TO EXCLUSIVE TWO-PHOTON PROCESSES, with G. Atkinson and K. Tsokos; *Physics Letters* 137B, 407-410 (1984).
79. FOUNDATIONS OF THE RELATIVISTIC THEORY OF MANY-ELECTRON BOUND STATES, *Int. J. Quant. Chem* XXV, 3-21, (1984).
80. RELATIVISTIC WAVE EQUATIONS IN MOMENTUM SPACE, with G. Hardekopf; *Phys. Rev.* 30, 703-711, (1984).
81. RETARDED VANDER WAALS INTERACTION IN He RYDBERG STATES, with C.K. Au and G. Feinberg, *Phys. Rev. Letters* 53, 1145 (1984).

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82. CRITICAL COUPLING CONSTANTS FOR RELATIVISTIC WAVE EQUATIONS AND VACUUM BREAKDOWN IN QED, with G. Hardekopf, *Phys. Rev. A* 31, 2020-2029 (1985).
83. CONTINUUM DISSOLUTION AND THE RELATIVISTIC MANY-BODY PROBLEM: A SOLVABLE MODEL, *Phys. Rev. Letters* 55, 1033 (1985).
84. LOW-ENERGY ELECTRON-ATOM SCATTERING: THE CASE OF NEAR DEGENERACY, with G. Feinberg and R. Amado, *Phys. Rev. Letters* 52, 416-419 (1986).
85. PROTON DECAY IN A LINEAR POTENTIAL MODEL, with A. Mohanty, *Annals of Physics*, 174, 1-25 (1987).
86. A QUANTUM-FIELD THEORY APPROACH TO THE CALCULATION OF ENERGY LEVELS IN HELIUM-LIKE RYDBERG ATOMS, with C. K. Au and G. Feinberg, *Annals of Physics* 174, 355-410 (1987).

87. ROLE OF NEAR DEGENERACY IN THE SCATTERING OF COMPOSITE NEUTRAL SYSTEMS, with G. Feinberg, *Phys. Rev. A* 36, 40-44 (1987).
88. THE TWO-PHOTON EXCHANGE FORCE BETWEEN CHARGED SYSTEMS: SPINLESS PARTICLES, with G. Feinberg, *Phys. Rev. D* 38, 3763-3798 (1988).
89. ON THE CHOICE OF ELECTRON-ELECTRON INTERACTION IN RELATIVISTIC ATOMIC PHYSICS, *J. Phys. B. (Letters): At. Mol. Opt. Phys.* 21, L585-L591 (1988).
90. THE DISPERSION THEORY OF DISPERSION FORCES, with G. Feinberg and C.-K Au, *Physics Reports* 180 (2), 83-157 (1989).
91. THE QUADRATIC ZEEMAN EFFECT IN POSITRONIUM, with G. Feinberg and A. Rich; *Phys. Rev. A* 41, 3478-3480 (1990).
92. RECOIL CORRECTIONS TO RYDBERG ENERGY LEVELS IN HELIUM, with C.K. Au and G. Feinberg; *Phys. Rev. A* 43, 561 (1991).
93. THE TWO-COULOMB EXCHANGE POTENTIAL IN THE PRESENCE OF OPEN CHANNELS, with G. Feinberg and C.K. Au; *Phys. Rev. A* 43, 3419-3426 (1991).
94. SPIN-DEPENDENT TWO-PHOTON EXCHANGE FORCES: SPIN-0 PARTICLE AND A CHARGED SPIN-1/2 PARTICLE, with G. Feinberg; *Phys. Rev. D*, 45, 2493 (1992).
95. QED IN THE ION AGE; *Physica Scripta* 46, (1993).

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96. TWO-PHOTON EXCHANGE IN SCALAR ELECTRODYNAMICS: THE ASYMPTOTIC STORY; *Phys. Rev. D* 49, 4284 (1994)
97. CONFINEMENT IN RELATIVISTIC POTENTIAL MODELS; *Phys. Rev. D* 15, 5965(1995)
98. WHAT IS THE FORCE BETWEEN ELECTRONS? *Adv. Quant. Chem.*, 30, 433 (1998)
99. HIGHER-ORDER POLES AND MASS-SHELL SINGULARITIES IN ELECTRON HYDROGEN SCATTERING. *Phys. Rev. A* 66 042706 (2002)

B. Invited papers

LONG RANGE ELECTROMAGNETIC INTERACTIONS OF NEUTRAL PARTICLES.
Meeting of the American Physical Society, Washington, D.C., April, 1965.

ELECTROMAGNETIC MASS SHIFTS, EQUAL-TIME COMMUTATORS, AND
OSCILLATING SPECTRAL FUNCTIONS. International Symposium on Hadron
Spectroscopy, Keszethely, Hungary, June, 1969; published in *Acta Physica Hungarica*, 1969.

SCATTERING OF GAUGE BOSONS AND NON-RENORMALIZABILITY OF
YANG-MILLS THEORIES. Symposium on High Energy Hadron Interactions, Balatonfured,
Hungary, June, 1974; published in *Proceedings of the Symposium*.

IS THE HIGGS-KIBBLE MECHANISM NECESSARY FOR UNIFIED GAUGE THEORIES?
Meeting of the Division of Particles and Fields of the APS, Williamsburg, Ga., September,
1974; published in *AIP Conference Proceedings No. 23*.

RELATIVISTIC MAGNETIC DIPOLE TRANSITION: FROM KRYPTON XXXV TO
CHARMONIUM. Meeting of the American Physical Society, New York City, New York,
February, 1976.

RELATIVISTIC MAGNETIC DIPOLE TRANSITIONS IN ATOMS, IONS AND POSITRONS.
Vth International Conference on Atomic Physics, Berkeley, July, 1976; published in *Atoms*
V, ed. R. Marrus, (Plenum Press, New York, 1977).

QUANTUM ELECTRODYNAMICS AND THE INTERFACE BETWEEN ATOMIC AND
PARTICLE PHYSICS. Meeting of the Association of Canadian Physicists, Montreal,
Canada, November 1978.

RELATIVISTIC THEORY OF PARITY VIOLATION: FOUNDATIONS.
Gordon Conference on Atomic Physics, July, 1979.

ELEMENTARY PARTICLE FORCES: THE LONG AND THE SHORT OF IT.
Colloquium on Fundamental Interactions, Marseilles, France, July, 1979; published in
Regards sur la physique contemporaine, Editions du CNRS, Paris, 1980.

QUANTUM ELECTRODYNAMICS AND THE RELATIVISTIC THEORY OF MANY-
ELECTRON ATOMS. Workshop on Foundations of the Relativistic Theory of Atomic

Structure, Argonne, Ill. Dec. 4-5, 1980; *Proceedings published as ANL 80-126*, ed. by H.G. Berry et al.

COMPOSITE MODEL OF QUARKS AND LEPTONS WITH STRONG AND WEAK INTERACTIONS ON PARALLEL FOOTING, with O.W. Greenberg, *Proceedings of VPI Workshop on Weak Interactions as Probes of Unification*, ed. G. Collins and L.N. Chan (Baltimore, 1980).

FOUNDATIONS OF THE RELATIVISTIC THEORY OF ATOMIC STRUCTURE. San Francisco Meeting of the American Physical Society, January, 1982.

FOUNDATIONS OF THE RELATIVISTIC THEORY OF MANY-ELECTRON BOUND STATES. Symposium on Relativistic Effects in Quantum Chemistry, Turku, Finland, June, 1982; published in *International Journal of Quantum Chemistry XXV*, 3-21 (1984).

GLUON EFFECTS IN TWO-PHOTON PROCESSES. With G. Atkinson and K. Tsokos, VI International Symposium on Two-Photon Physics (Lake Tahoe, September 1984); appeared in *Proceedings*.

HEALTHY HAMILTONIANS FOR RELATIVISTIC ATOMIC PHYSICS. Atomic Theory Workshop on Relativistic and QED Effects in Heavy Atoms, National Bureau of Standards, Gaithersburg, Md. May 13-24, 1985, (H. P. Kelly and Y.-K. Kim, eds. AIP, New York, 1986).

RELATIVISTIC MANY-ELECTRON HAMILTONIANS. Symposium on Relativistic Many Body Problems, ICTP, Trieste, June 30-July 4, 1986; *Physica Scripta*, 1987.

BOUND-STATE QED. In *Proceedings of the Program on Relativistic, Quantum Electrodynamical and Weak Interaction Efforts in Atoms* (Institute for Theoretical Physics, UCSB, Santa Barbara); AIP, New York, 1989.

POTENTIALS FROM FIELD THEORY: NON-UNIQUENESS, GAUGE INDEPENDENCE, AND ALL THAT. In *Proceedings of the Program on Relativistic, Quantum Electrodynamical and Weak Interaction Efforts in Atoms* (Institute for Theoretical Physics, UCSB, Santa Barbara); AIP, New York, 1989.

QED IN THE ION AGE. Summary lecture at the 85th Nobel Symposium: *Heavy Ion Spectroscopy and QED Effects in Atomic Systems*, Saltsjobaden, June 29-July 3, 1992;

Published in *Physica Scripta* **T46**, 239, (1993).

LONG-RANGE FORCES IN QUANTUM FIELD THEORY: 23 SKIDOO, 7, COME 11. Symposium in honor of Larry Spruch's 70th Birthday, New York University, April, 1993; in *Comments on Atomic and Molecular Physics* **30**, 129 (1994).

POTENTIAL CONCEPTS, LONG-RANGE FORCES AND BOUND-STATE QED, *Proceedings of the XIVth Moriond Workshop: Particle Astrophysics, Atomic Physics and Gravitation*, Villars-sur-Ollon, January, 1994; World Scientific, Singapore (1995)

THE CONCEPT OF POTENTIAL IN QUANTUM FIELD THEORY, *Proceedings of Quantum Systems: New Trends and Methods*, Minsk, Belarus, May 23-29, 1994; edited by A.O. Barut, et al., World Scientific, Singapore (1995).

LONG-RANGE FORCES, INFRARED DIVERGENCES, AND BOUND-STATE QED; *Proceedings of the Workshop on Quantum Infrared Physics*, Paris, June 6-10, 1994; edited by H.M. Fried and B. Muller; World Scientific, Singapore (1995)

ELECTRON CHARGE, article in *Macmillan Encyclopedia of Physics* (1996).

QUANTUM FIELD THEORY AND THE HELIUM ATOM: 101 YEARS LATER, *Proceedings of QS-96*. Minsk, Belarus, June, 1996; World Scientific, Singapore, (1997).

WHAT IS THE FORCE BETWEEN ELECTRONS?. *Advances in Quantum Chemistry* **30**, 433 (1998)

QUANTUM FIELD THEORY AND HELIUM: SOME LESSONS FOR NUCLEAR AND PARTICLE PHYSICS; *Proceedings of 1997 Nanjing Symposium: 50 Years of Symmetry* (in honor of C.S. Wu)

ON THE QUANTUM THEORY OF LONG-RANGE FORCES, *Proceedings of the Workshop on Casimir Forces*, Harvard Smithsonian Institute for Atomic and Molecular Physics, Cambridge, MA, March, 1998.

COLUMBIA PHYSICS IN THE FIFTIES: UNTOLD TALES, *Proceedings of Symposium in Honor of E. Wichmann*, U.C. Berkeley; *Electronic Journal of Differential Equations*, Conf. 04, 2000, pp. 197-206

C. Summer School Lectures

LONG-RANGE FORCES IN QUANTUM THEORY. In *Cargèse Lectures in Physics*, Vol. 7, ed. M. Levy (Plenum Press, New York, 1977).

FOUNDATIONS OF THE RELATIVISTIC THEORY OF MANY-ELECTRON SYSTEMS. *NATO Advanced Study Institute on Relativistic Effects in Atoms, Molecules, and Solids*, Vancouver, B.C., August, 1981; appeared in *Proceedings*, G. Malli, ed. (Plenum, 1982).

QED AND RELATIVITY IN ATOMIC PHYSICS. *Proceedings of NATO Advanced Study Institute on Atoms in Unusual Conditions*, Cargèse, June 1985; edited by J. P. Briand.

D. Review Articles

MAGNETIC DIPOLE TRANSITIONS IN ATOMIC AND PARTICLE PHYSICS: IONS AND POSITRONS. *Rep. Progr. Phys.* 41, 1781-1838 (1978).

THE DISPERSION THEORY OF DISPERSION FORCES. With G. Feinberg and C.-K Au, *Physics Reports* 180 (2), 83-187 (1989).

E. Contributions to Books

ATOMIC PHYSICS CONSTRAINTS ON THE EXISTENCE OF ULTRALIGHT, ULTRAWEAK BOSONS, with G. Feinberg; *Beg Memorial Volume*, (edited by A. Aly) 1992.

LONG-RANGE ELECTROMAGNETIC FORCES: THEORETICAL FOUNDATIONS, with G. Feinberg; in *Long-range forces: Theory and Recent Experiments in Atomic Physics*, edited by F. Levin and D. Micha (Plenum, New York, 1993).

CHARGE, ELECTRONIC; in *Macmillan Encyclopedia of Physics*, 1996.

F. Ph.D. Theses Directed

1. A. K. Bhatia (1962): "Scattering of the π -Meson from the Deuteron".
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