Curriculum Vitæ
G. Bruce Mainland

ADDRESSES:

PROFESSIONAL: Department of Physics
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RESIDENCE: Philadelphia, PA

PROFESSIONAL: PREPARATION:

Research Associate, The Ohio State University, October, 1974 - August, 1975

Post-Doctoral Scholar, Dublin Institute for Advanced Studies, Dublin, Ireland, September, 1972 - September, 1974

Research Associate, The University of Texas at Austin, January-August, 1972

Ph.D. (Theoretical Physics), The University of Texas at Austin, 1971

B.S. (Engineering Physics), Cornell University, Ithaca, New York, 1967

ACADEMIC POSITIONS:

Professor Emeritus, The Ohio State University at Newark, July, 2012-present

Professor, The Ohio State University at Newark, October, 1987-June, 2012

Visiting Associate Professor, The University of Texas at Austin, July-December, 1984

Associate Professor, The Ohio State University at Newark, October, 1980-September, 1987

Assistant Professor, The Ohio State University at Newark, September, 1975-September, 1980

FIELDS OF SPECIALIZATION: Quantum Vacuum, Relativistic Wave Equations

AWARDS:

The Ohio State University

Teaching

2005 Alumni Award for Distinguished Teaching

The Ohio State University Newark

Research

2006 Scholarly Accomplishment Award

Provost's Award for Faculty Scholarship Excellence, 1986

Teaching

The Robert A. Barnes Award for Exemplary Teaching, 2007

Thomas J. Evans Teaching Excellence Award, 1998

The Robert A. Barnes Award for Exemplary Teaching, 1993

Thomas J. Evans Teaching Excellence Award, 1980

Service

Faculty Service Award, 1994

BIBLIOGRAPHY

QUANTUM VACUUM: REFEREED ARTICLES

1. G. B. Mainland and B. Mulligan. How vacuum fluctuations determine the properties of the vacuum. *J. Phys.: Conf. Ser.*, 1239:012016, 2019. 11$^{\text{th}}$ Biennial Conference on Classical and Quantum Relativistic Dynamics of Particles and Fields (IARD), Mérida, Yucatán, Mexico (2018).

2. G. B. Mainland and B. Mulligan. Polarization of vacuum fluctuations: source of the vacuum permittivity and speed of light. *Found. Phys.*, 50:457–480, 2020.

3. G. B. Mainland and B. Mulligan. Properties of the quantum vacuum calculated from its structure. *J. Phys.: Conf. Ser.*, 2021. 12$^{\text{th}}$ Biennial Conference on Classical and Quantum Relativistic Dynamics of Particles and Fields (IARD)(2020) to be published.

BETHE-SALPETER EQUATION: SELECTED, REFEREED ARTICLES

1. G. B. Mainland and L. A. Parson. Derivation of the coordinate system that separates the Bethe-Salpeter equation for the Wick-Cutkosky model. *J. Math Phys.*, 32:1072–1075, 1991.

2. G. B. Mainland and J. R. Spence. Numerical solutions to the partially-separated, equal-mass, Wick-Cutkosky model. *Few-Body Syst.*, 19:109–120, 1995.

3. G. B. Mainland. Numerical method for solving two-body, bound-state Bethe-Salpeter equations for unequal constituent masses. *Few-Body Syst.*, 26:27–41, 1999.

4. G. B. Mainland. The importance of boundary conditions in solving the bound-state Bethe-Salpeter equation. *Few-Body Syst.*, 33:71–88, 2003.

5. G. B. Mainland. Solving the two-body, bound-state Bethe-Salpeter equation. *Computat. Physics*, 192:21–35, 2003.

6. G. B. Mainland. The role of boundary conditions in solving finite-energy, two-body, bound-state Bethe-Salpeter equations. *Computat. Physics*, 197:610–623, 2004.

7. G. B. Mainland. Bethe-Salpeter solutions with complex coupling constants. *Prog. Theor. Phys.*, 111:923–942, 2004.

8. G. B. Mainland. General relativistic bound states of a fermion and a scalar interacting via a massive scalar. *Few-Body Syst.*, 39:101–122, 2006.

9. G. B. Mainland. Zero-energy solutions of the Bethe-Salpeter equation for a spinor-scalar system exchanging photons. *Prog. Theor. Phys.*, 119:263–284, 2008.

10. G. B. Mainland. Positive-energy, bound-state, Bethe-Salpeter solutions of a spinor and a scalar exchanging photons. *Prog. Theor. Phys.*, 121:1–28, 2009.

11. G. B. Mainland. Are leptons, quarks or both highly relativistic bound states of a minimally interacting fermion and scalar? *Few-Body Syst.*, 50:439–441, 2011.

12. G. B. Mainland. Using analytical solutions at large momentum transfer to obtain zero-energy, bound-state, Bethe-Salpeter solutions of a scalar and spin-1/2 fermion exchanging photons. *Few-Body Syst.*, 56:197–218, 2015.

MONOGRAPH

1. A. Bohm, P. Kielanowski, and G. B. Mainland. *Quantum Physics: States, Observables and Their Time Evolution.* Springer Nature B. V., Dordrecht, The Netherlands, 2019.

REFEREED ARTICLES

1. G. B. Mainland and A. Bohm. Meson and baryon semileptonic decays. *Phys. Rev.*, D2:919–921, 1970.

2. A. Bohm and G. B. Mainland. Dirac representation of the relativistic symmetries. *Fortschr. Physik*, 18:285–304, 1970.

3. G. B. Mainland. A vector contribution to the decay $\Sigma^- \to \Lambda + e^- + \nu_{\bar{e}}$. *Nuovo Cimento*, 5A:597–602, 1971.

4. A. Bohm and G. B. Mainland. Transition operators in an algebraic model for hadrons. *Phys. Rev.*, D5:872–876, 1972.

5. G. B. Mainland. Self-mass of leptons. *Nuovo Cimento*, 8A:536–540, 1972.

6. G. B. Mainland and E. C. G. Sudarshan. Heisenberg equations of motion for the charged spin-3/2 fields. *Phys. Rev.*, D8:1088–1090, 1973.

7. G. B. Mainland and L. O'Raifeartaigh. Fixed point theorem for the Poincaré group. *Int. J. Theor. Phys.*, 8:465–471, 1973.

8. A. Bohm and G. B. Mainland. Generalizations of the Dirac equation. *Nuovo Cimento*, 18A:308–326, 1973.

9. G. B. Mainland and L. O'Raifeartaigh. Derivation of unified gauge theory from a generalized minimal principle. *Nuovo Cimento Lett.*, 10:733–736, 1974.

10. G. B. Mainland, L. O'Raifeartaigh, and T. Sherry. Point transformations and renormalization in the unitary gauge. *Nuc. Phys.*, B79:503–525, 1974.

11. G. B. Mainland and E. C. G. Sudarshan. Poincaré invariance of the spin-3/2 field in the presence of a minimal external electromagnetic interaction. *Phys. Rev.*, D10:3343–3349, 1974.

12. G. B. Mainland. Poincaré generators for the free spin-3/2 field. *Proceedings of the Royal Irish Academy*, 74:87–90, 1974.

13. K. Geer, G. B. Mainland, W. F. Palmer, and S. S. Pinsky. Electromagnetic production and decay of $\psi(3105)$. *Phys. Rev.*, D11:2480–2483, 1975.

14. G. B. Mainland and L. O'Raifeartaigh. Point transformation and renormalization in the unitary gauge for non-abelian fields. *Phys. Rev.*, D12:489–502, 1975.

15. G. B. Mainland and K. Tanaka. Spontaneously broken abelian-gauge-invariant supersymmetric model. *Phys. Rev.*, D12:2394–2396, 1975.

16. G. B. Mainland and K. Tanaka. Supersymmetric gauge model for the electron and its neutrino. *Phys. Rev.*, D13:2318–2321, 1976.

17. G. B. Mainland, E. Takasugi, and K. Tanaka. Low-energy theorems in supersymmetry. *Phys. Rev.*, D14:1065–1071, 1976.

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19. G. B. Mainland, E. Takasugi, and K. Tanaka. Classical solutions with both instantons and anti-instantons. *Nuovo Cimento Lett.*, 19:556–560, 1977.

20. T Hagiwara, T. Kitazoe, G. B. Mainland, , and K. Tanaka. Cabibbo current and CP violation in a six quark gauge model. *Phys. Lett.*, 76B:602–604, 1978.

21. T. Kitazoe, G. B. Mainland, , and K. Tanaka. Vacuum expectation values of Higgs scalars in a $\mathrm{SU(2)_L \times SU(2)_R \times U(1)}$ gauge model. *Phys. Rev.*, D19:1601–1604, 1979.

22. G. B. Mainland and K. Tanaka. Flavor violation in six-quark gauge models. *Phys. Rev.*, D20:1241–1243, 1979.

23. G. B. Mainland and D. M. Scott. Quantization of a charge-magnetic dipole model in 2+1 dimensions. *Nuovo Cimento Lett.*, 35:401–404, 1982.

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28. G. B. Mainland. Helicity eigenstates of a relativistic spin-0 and spin-1/2 constituent bound by minimal electrodynamics: zero orbital angular momentum, zero four-momentum solutions. *J. Math. Phys.*, 29:128–138, 1988.

29. A. Bohm, M. Gadella, and G. B. Mainland. Gamow vectors and decaying states. *Am. J. Phys.*, 57:1103–1108, 1989.

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NON-REFEREED CONFERENCE PROCEEDINGS

1. G. B. Mainland. Group theoretical basis for the Dirac equation. In A. O. Barut and W. E. Brittin, editors, *Lectures in Theoretical Physics, Vol. XIII*, pages 349–360. Colorado Associated University Press, Boulder, CO, 1971.

2. G. B. Mainland and L. O'Raifeartaigh. Reduction of the Weinberg unified Lagrangian to a simple model. In *Proceedings of the Nijmegen Colloquium on Group Theoretical Methods in Physics*, 1973.

3. G. B. Mainland and L. O'Raifeartaigh. Postscript to unified gauge theory. In *Proceedings of the Marseilles Colloquium on Group Theoretical Methods in Physics*, 1974.

4. G. B. Mainland and K. Tanaka. Fermion number conservation in supersymmetric Lagrangians. In *Proceedings of the Fifth International Conference in Neutrino Science, Balaton, Hungary*, 1975.

5. G. B. Mainland. A general, numerical method for solving two-body, bound-state Bethe-Salpeter equations: finite-energy solutions of a spin-0 and spin-1/2 constituent bound by scalar electrodynamics. In *Proceedings of the 19th European Few-Body Conference, Groningen, The Netherlands*, 2004.

6. G. B. Mainland. Could leptons, quarks or both be highly relativistic bound states of a minimally interacting fermion and scalar? In *eConf C090726.*, Proceedings of Division of Particles and Fields of the American Physical Society, 2009.

7. G. B. Mainland. Are leptons, quarks or both highly relativistic bound states of a minimally interacting fermion and scalar? *Few-Body Syst.*, 50:439–441, 2011. 21st European Conference on Few-Body Problems in Physics, Salamanca, Spain (2010).