David B. Reiss, PhD

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Scientist and R&D Professional: Experienced across a broad swath of corporate, government, academic, and intellectual environments with the experience to act as a liaison between the their various landscapes.

I have held positions at a premier government laboratory, a Silicon Valley start-up, an Internet infrastructure start-up, a top-tier defense contractor, as the scientific communications director for Stephen Wolfram for *A New Kind of Science*, as a consultant, and a variety of academic fellowship and teaching positions.

A thread running through all of my work—whether basic research, R&D, or consulting in Science and Technology—has been to clarify and energetically develop roughly defined ideas at an early stage of their definition and to create communication links between different scientific, technical, and intellectual cultures.

Professional Experience:

Scientific Arts, LLC, May 1999 - Present: *Sole proprietorship,* Consulting Services

Synopsis: Consulting for various clients including: Spectral Sciences Inc. (projects include creation of models of earthshine reflection for remote spectral sensing, also models of the effects of earth based artificial lights on remote sensing systems); KLA-Tencor Corp. (projects include creating of tools for flight paths of electrons in electro-optical systems, creation of Mathematica user interfaces for simulation tools, Mathematica CAD application for electro-optical design); Wolfram Research Inc. (wide variety of projects including creation of advertising materials, example applications, etc…); Centra Technology, Inc.; Los Alamos National Laboratory (project to create original model of explosive detonation in small composite objects). Creation of an add-on product for *Mathematica*.

Wolfram Solutions, Nov. 2007 - Present: *Principal Consultant*

Synopsis: Contract consulting for Wolfram Solutions, the consulting arm of Wolfram Research Inc. Consulting projects in essentially any computational field with an emphasis on solutions in Mathematica. Examples include: creating a Mathematica-based recommendation engine infrastructure deployed on the Amazon Cloud for a start-up company; architecture and development tools to launch a project for creating CDF (Computable Document Format) versions of middle school mathematics curriculum materials for a major publisher; creation of web-based (webMathematica) simulation tools for a major integrated circuit manufacturing company.

Centra Technology Inc. August 2003–April 2006: *Senior Scientist*

Synopsis: R&D into novel approaches to the detection of underground facilities using inexpensive small sensors. Awarded a DARPA contract to pursue this work and subcontracted BBN to perform related experimental work. R&D in others areas of mathematical modeling, simulation, and visualization for various government institutions. Numerous studies on emerging technologies and their relevance to the work of the DHS and other government institutions.

Wolfram Research Inc. April 2001–October 2002: *Scientific Communications Director*, Stephen Wolfram Science Group

Synopsis: Direct advisor to Stephen Wolfram on a wide range of matters pertaining to the completion, promotion, and communication of his book "A New Kind of Science" (http://www.wolframscience.com). Advisor and consultant to Stephen Wolfram on many internal Wolfram Research Inc. company matters.

Weema Technologies Inc., March 2000–October 2000: *Director of Development*

Synopsis: Employee number six in early stage start-up company that aimed to provide the infrastructure for streaming rich media over the Internet.

Responsible for management of the general research efforts of the R&D group. Spearheaded the creation of the product development group, advised on technology and business strategy, and interfaced with venture capitalists and other actual and potential investors.

Raytheon Electronic Systems Inc., July 1997–May 1999: *Principle Systems Engineer*, Project Management Office: Radar and Technology Programs

Synopsis: Technical lead and management for the development and analysis of advanced algorithms for upgraded early warning phased array radars.

Developed and analyzed a specific novel detection algorithm to increase the efficiency of phased array radars. Algorithm analysis for the optimal use of a mixture of coherent and non-coherent pulse integration. In all cases wrote reports and made recommendations on schedule. Management of and participation in algorithm development efforts for Upgraded Early Warning Radars for National Missile Defense.

MicroUnity Systems Engineering Inc., April 1995–July 1996: *Senior Member of Technical Staff*

Synopsis: General physical and mathematical modeling services pertaining to this mid-stage start-up company's long term technology strategy. Competitive and technical analysis for business development.

Feasibility analysis of a new technique for transmitting and receiving cellular radio signals based on widely distributed antenna arrays. Patent disclosure.

Business plan development under a very tight schedule for the video compression and network equipment markets. Presented to investment bankers for potential IPO. Recruited and coordinated market research consultants and reported on the business potential company's technology.

Developed and execution of a plan for MicroUnity's involvement in University Liaison programs.

MIT Lincoln Laboratory, October 1989–March 1995: *Member of Technical Staff*

Synopsis: Mathematical analysis and numerical simulation of radar detection, by means of the diffracted electromagnetic surface wave, of low altitude targets that are beyond the geometrical horizon. Wrote a major Lincoln Laboratory external report.

Novel numerical technique (using Padé approximants) for the computation of spherical earth diffractive radio wave propagation.

New algorithms for the evaluation of site-specific radio wave propagation over a spherical earth.

Comparative study of the relative performance of infrared sensor detection algorithms for detecting small targets against background clutter. Tested algorithms against a large real world database of digital infrared imagery. Also extended this investigation to neural networks.

Investigated the statistical properties of digital infrared background imagery. Constructed analytical and phenomenological models of infrared clutter. Developed methods for modeling the parameters of the associated multivariate distributions functions.

University of Wisconsin, January 1988–October 1989: *Postdoctoral fellow*

AT&T Bell Laboratories, October 1987–January 1988: *Member of Technical Staff*

University of Minnesota, 1986–1987: *Assistant Professor*

University of Minnesota, 1983–1986: *Postdoctoral fellow*

University of Washington, 1981–1983: *Postdoctoral fellow*

University of California at Santa Cruz, 1981 (spring quarter): *Postdoctoral fellow*

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Education: **Ph.D.** *(Theoretical Physics) 1981, California Institute of Technology*

Thesis advisor: Pierre Ramond
Thesis: "Some Topics in Grand Unified Models and the Cosmological Baryon Asymmetry"

B.S. *(Physics) 1975, State University of New York at Stony Brook*

Traditional Teaching Experience:

Instructor at the NKS Summer School, 2006:

— Teaching and mentorship for exceptional students interested in pursuing research in Stephen Wolfram's "A New Kind of Science." See http://wolframscience.com/summerschool/.

Ph.D. advising and collaboration with graduate students as well as advising undergraduates:

— Shared advisor duties for two Ph.D. students at University of Wisconsin (H. Dreiner and J. Lopez) Ph.D.'s awarded in 1989.

— Shared advisor duties on masters thesis for Ph.D. student G. Huang at MIT, MS awarded in 1992.

A variety of both undergraduate and graduate courses over the years. This has included:

— Introductory physics, winter and spring quarters 1986-7: University of Minnesota.
— Modern physics (Special Relativity for physics majors), fall quarter 1986 : University of Minnesota.
— Introductory physics, fall quarter 1985 : University of Minnesota.
— Modern physics (for engineers), fall quarter 1984: University of Minnesota.
— Graduate particle physics: spring quarter 1981: University of California at Santa Cruz.
— Five years as a recitation instructor at CalTech including the teaching of special topics sections for advanced students.
— In addition I have taught portions of courses on mathematical methods of physics, advanced quantum theory, field theory, electrodynamics, and others.

Projects with undergraduates at MIT Lincoln Laboratory:

— With MIT (VI-A) undergraduate student a study of pattern recognition issues in infrared signal processing (Summer 1993.)
— With MIT undergraduate student construction of a *Mathematica* package for the analysis of electromagnetic wave propagation and diffraction around objects on a spherical earth. (Summer 1992.)
— With visiting summer student to explore constructing a *Mathematica* package to implement an algorithm for the computation of elliptic integrals. (Summer 1992.)
— With visiting summer High School student (Mentor for "The center for excellence in education") to analyze the diffraction limited properties of an infrared sensor by examining data using the planet Mercury as a "point" source. (Summer 1992.)

Invited lectures (see publications section for the variety of topics):

— Seminars and colloquia at: DARPA, Wolfram Research, CalTech, Yale, U. of Pennsylvania, U. of Minnesota, U. of Wisconsin, U. of Iowa at Ames, SLAC, U.C. Santa Cruz, U.C. Irvine, Carnegie-Mellon U., Ohio State U., Northeastern U., Hewlett Packard Laboratory, U. of Florida at Gainesville, U. of Alabama, U. of Washington, Reed College, Cal. Poly State U. at San Luis Obispo, U.C. Riverside, U. of Delaware, U. of Virginia, U. of British Columbia, U. of Arizona, U. of New Mexico, MIT, MicroUnity Systems Engineering, and numerous presentations at MIT Lincoln Laboratory and many government institutions.

Citizenship: United States

Publication and Report List For David Reiss

1. “Every document is an expression: The reach of Mathematica 6,” Mathematica in Education and Research, Volume 12, Number 3, 2007, pgs 218-234.
2. Software tutorial and documentation for a new *Mathematica* product, “A WorkLife FrameWork,” released 3rd quarter 2006. The documentation is approximately 400 pages. (I created and developed the product—approximately 50,000 lines of Mathematica code.)
3. A considerable variety of internal and external CENTRA Technology, Inc. reports, 2003—2005.
4. “Optimal coherent noncoherent interpolation,” Raytheon Technical Report, May 1998.
5. “Super coherent/noncoherent integration,” Raytheon Technical Report, April 1998.
6. A proprietary MicroUnity internal report on an advanced distributed wireless system, 1995-96.
7. Patent application covering the intellectual property for the above item (with John Moussouris and Graham Mostyn), 1996.
8. "Some thoughts on infrared clutter modeling," MIT Lincoln Laboratory Technical Memorandum No. 106L-0041, August 1994.
9. "Spatial signal processing for infrared detection," MIT Lincoln Laboratory Project Report, CMT-181, September 1994 (distinct from below).
10. "Spatial signal processing for infrared detection," SPIE conference on Signal and Data Processing of Small Targets, SPIE 2235, April 1994.
11. "The utility of threshold behavior as an estimate of linear filter performance," MIT Lincoln Laboratory Technical Memorandum No. 106L-0026, August 1993.
12. "Propagation over knife edge obstacles on a spherical earth," MIT Lincoln Laboratory Project Report, CMT-168. (With G. Huang, R. Shin and J. Eidson.)
13. "Long wavelength infrared signature reduction through paint selection," MIT Lincoln Laboratory Technical Memorandum No. 106L-0010, September 1992. (With D. Cebula.)
14. "Autocorrelation functions and matched filters: some explorations," MIT Lincoln Laboratory Technical Memorandum No. 106L-0006, September 1992.
15. "Some aspects of infrared backgrounds," MIT Lincoln Laboratory Technical Memorandum No. 106L-0005, August 1992.
16. "A simple Gaussian fitting algorithm," MIT Lincoln Laboratory Technical Memorandum No. 106L-0002, June 1992.
17. "Propagation over a knife edge on spherical earth," Abstract: PIERS (Progress In Electromagnetics Research Symposium), July 1991;Cambridge, MA. (With G. Huang, R. Shin and J. Kong.)
18. "The use of Padé approximants to calculate the zeros of the residue series for diffraction around a spherical earth," Abstract in PIERS (Progress In Electromagnetics Research Symposium), July 1991; Cambridge, MA.
19. "Surface wave radars," MIT Lincoln Laboratory Project Report No. CMT-155, August 1990.
20. "Propagation loss analysis for a bistatic radar system using television broadcasts as an emitter," MIT Lincoln Laboratory Project memorandum 46PM-CMT-0015, July 1990. (With Serpil Ayasli.)
21. "An alternative method to correct data from the infrared measurement system detector," MIT Lincoln Laboratory Technical Memorandum No. 46L-0420, May 1990.

Publication and Report List For David Reiss

22. "Chiral fermions imply no massless scalar adjoints in the free fermionic formulation of the heterotic superstring," University of Wisconsin, Madison preprint (1989). (With H. Dreiner, J. Lopez and D. Nanopoulos.)
23. "No massless scalar adjoints from N=1, D=4 heterotic strings in the free fermionic formulation," Physics Letters **B216**, 283 (1989). (With H. Dreiner, J. Lopez and D. Nanopoulos.)
24. "String model building in the free fermionic formulation," Nuclear Physics **B320**, 401 (1989). (With H. Dreiner, J. Lopez and D. Nanopoulos.)
25. "Global cosmic strings, Nambu-Goldstone bosons and their constraints on unification," Physics Letters **B215**, 256 (1988). (With R. Holman.)
26. "Cosmological domain wall problem in the $E_8 X E_8'$ superstring theory," Physical Review **D38**, 1141 (1988). (With T. Kephart and R. Holman.)
27. "On the viability of rank-six superstring models," Nuclear Physics **B296**, 129 (1988). (With K. Olive and B. Campbel.)
28. "The fate of the m_b/m_τ mass relation in superstring theories," Nuclear Physics **B288**, 152 (1987). (With R. Holman.)
29. "Fermion masses and phenomenology in SO(10) or SU(5) superstring compactifications," Physics Letters **176B**, 74 (1986). (With R. Holman.)
30. "Fermion mass matrices in $E_8 X E_8'$ superstring theories," Physics Letters **166B**, 305 (1985). (With R. Holman.)
31. "Strong coupling phase transitions in supersymmetric grand unified models," Physics Letters **158B**, 305 (1985).
32. "Transition from weak to strong coupling in QCD and in grand unified models at high temperature," Nuclear Physics **B263**, 207 (1986). (With J. Kapusta and S. Rudaz.)
33. "Nonstandard fermion mass matrices and nucleon decay," Physical Review **D30**, 118 (1984). (With S. Rudaz.)
34. "Fractional charges, monopoles and peculiar photons," Physical Review Letters **50**, 317 (1983). (With S. Barr and A. Zee.)
35. "Peccei-Quinn symmetries without domains," Physical Review **D26**, 2176 (1982). (With S. Barr and X.C. Gao.)
36. "Families, the invisible axion and domain walls," Physics Letters **116B**, 227 (1982). (With S. Barr and A. Zee.)
37. "Can the family group be a global symmetry?" Physics Letters **115B**, 217 (1982).
38. "Invisible axion at an intermediate symmetry breaking scale," Physics Letters **109B**, 365 (1982).
39. "Calculation of cosmological baryon asymmetry in grand unified gauge models," Nuclear Physics **B201**, 16 (1982). (With J. Harvey, E. Kolb and S. Wolfram.)
40. "Mass relations and neutrino oscillations in an SO(10) model," Nuclear Physics **B199**, 223 (1982). (With J. Harvey and P. Ramond.)
41. "Some Topics in Grand Unified Models and the Cosmological Baryon Asymmetry," Ph.D. Thesis, California Institute of Technology (1981).
42. "The neutral lepton mass matrix," Proceedings of the Madison conference (American Institute of Physics, New York), 451 (1981). (With J. Harvey and P. Ramond.)

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43. "Cosmological baryon-number generation in grand unified models," Physical Review Letters **47**, 391 (1981). (With J. Harvey, E. Kolb and S. Wolfram.)

44. "Cosmological constraints on heavy weakly-interacting fermions," Nuclear Physics **B177**, 456 (1981). (With J. Harvey, E. Kolb and S. Wolfram.)

45. "CP violation and mass relations in SO(10)," Physics Letters **92B**, 309 (1980). (With J. Harvey and P. Ramond.)

46. "A left-right symmetric model with a useful global symmetry," Physics Letters **80B**, 87 (1979). (With P. Ramond.)