CURRICULUM VITAE

Edward L. Garwin

Birth date:	March 22, 1933
Education:	BS, Physics, Case Institute of Technology, 1954
	MS, Physics, University of Chicago, 1955
	PhD, Physics, University of Chicago, 1958
Scholarships and Fellowships:	Thompson Products Scholarship, 1953, 1954
	National Science Foundation Fellow, 1955-1957

Employment:

September 1957-July 1958	University of Chicago, Research Assistant
July 1958-June 1959	University of Chicago, Research Associate
June 1959-September 1960	Space Technology Laboratories, Consultant
October 1959-September 1960	University of Illinois, Assistant Professor
September1960-January 1963	Clauser Technology Corporation, Senior Scientist
January 1963-Present	Stanford Linear Accelerator Center, Head - Applied Physics Group Leader - Physical Electronics
April 1969-March 1975	RAND Corporation, Consultant
March 1971-March 1972	Investigator on National Institutes of Health Contract NIH-71-2043
February 1975-March 1976	Searle Cardio-Pulmonary Systems, Inc., Consultant
August 1979-July 1981	Pacific Sierra Research Corp., Consultant

Edward L. Garwin has had extensive experience in physics instrumentation and measurement techniques.

At the University of Chicago, he designed accelerator vacuum systems, high-speed circuitry, and a liquid hydrogen target system, while carrying out research in nuclear physics and meson physics.

At the University of Illinois, he designed a Mossbauer scattering system and its associated electronics for his research program.

At Space Technology Laboratories, he was a consultant on magneto-hydrodynamics, theoretical and experimental physics, and vacuum techniques.

At Clauser Technology Corporation, he conducted research on cryovapor pumping, ultra-high vacuum techniques, and space simulation systems.

In collaboration with members of the Stanford School of Medicine, he has developed a nanosecond light source, and valuable techniques used in nanosecond fluorimetry (see publication number 24 in attached list).

Working with a colleague at the Stanford Linear Accelerator Center, he was involved in a contract with the National Institutes of Health for the development and fabrication of miniature pressure transducers and associated electronic readouts for use in in vivo human heart catheterization.

At the Stanford Linear Accelerator Center, he has done extensive work in ultra-high vacuum techniques, vacuum deposition of thin films, self-supporting anodized films, and low-level electronic measurements in support of his program of investigating secondary emission of alkali-halides and actively engaged in research in superconductivity, optical wavelength shifters for phototubes, and polarized electron sources, for which he developed a demountable, vortex-stabilized, high-power flash lamp which operates with extreme stability for lifetimes in excess of 2×10^7 pulses before requiring adjustment. He has developed a polarized electron source capable of producing 100 mA peak currents of 50% polarized electrons, and is currently involved in research on increased polarization of electron sources, low temperature cleaning techniques for NEA semiconductor surfaces, and surface physics applied to radio-frequency superconductivity and high power klystrons, particularly to develop means of minimizing secondary emission coefficient, multipactor, and surface degradation attendant to atmospheric exposure, with characterization by ellipsometry of surfaces both in ultrahigh vacuum and during atmospheric exposure.

He is a member of the American Physical Society, American Vacuum Society, and of Sigma Xi. He has been an active contributor to his fields of research, where he has published 80 papers on instrumentation, nuclear physics, meson physics, surface physics, and secondary emission. He has been granted six patents, and has written numerous internal Technical Notes.

Edward L. Garwin

Publications

1. Linear gate of 200 millimicrosecond duration, Rev. Sci. Instr., 28, 116 (1957) (with one co-author).
2. Simple zero field indicator for betatrons, Rev. Sci. Instr., 30, 203 (1959) (with two co-authors).
3. Charge independence in the reactions p + d $\longrightarrow \pi^o$ + He^3 and p + d $\longrightarrow \pi^+$ + H^3 at 450 MeV, PRL 2, 269(1959) (with two co-authors).
4. Gamma-ray excitation of the 15.1 MeV level in C^{12}, PR 114, 143 (1959).
5. Linear gate of 20-mμ duration, Rev. Sci. Instr. 30, 373 (1959).
6. Photonuclear cross sections for A^{40}, PR114, 1139 (1959) (with one co-author).
7. Nuclear photon absorption in carbon and oxygen, PR114, 1324 (1959) (with one co-author).
8. Photonuclear reaction energies, PR115, 420 (1959) (with one co-author).
9. Charge exchange scattering of 128-MeV negative pions on hydrogen, PR115, 1295 (1959) (with three co-authors).
10. A high energy gamma ray spectrometer, Nucl. Instr. Methods 5, 247 (1959) (with two co-authors).
11. Gamma rays from the nuclear photoeffect in carbon, oxygen and copper, PR116, 120 (1959) (with one co-author).
12. Betatron energy calibration by magnetic field measurement, Rev. Sci. Instr. 31, 155 (1960) (with five co-authors).
13. Search for the anisotropy of intertia using the Mossbauer effect in Fe^{57}, PRL4, 399 (1960) (with five co-authors).
14. Instrumentation for medium energy gamma-ray scattering measurements, Rev. Sci. Instr. 31, 853 (1960) (with one co-author).
15. Charge exchange scattering of negative pions at 61 MeV and 95 MeV, Phys. Rev. 119, 1096 (1960) (with two co-authors).
16. Cryogenic pumping and space simulation, Chapter 10 of "Cryogenic Technology", edited by R. W. Vance, John Wiley and Sons (1963).
17. Cryogenic pumping and space simulation, Advances in Cryogenic Engineering, Vol. 8, Plenum Press (1963).

18. Some investigations of cryotrapping. Trans. 9th Annual Vac. Symp., Pergamon Press, p. 197 (1963). (With two co-authors).

SLAC-PUBS

SLAC-PUB-0076

19. Accelerator vacuum problems: inline oil trapping between the Stanford Linear Accelerator and the beam switchyard. Trans. Nucl. Sci. NS-12, 740(1965). (With one co-author).

SLAC-PUB-0095

20. Water-cooled beam dumps and collimators for the Stanford Linear Accelerator. Trans. Nucl. Sci. NS-12, 867 (1965). (With two co-authors).

SLAC-PUB-0154

21. Attenuation length for secondary electrons in bulk-density KCl and CsI. J. Appl. Phys. 37, 2916(1966). (With one co-author).

SLAC-PUB-0156

22. Response of low-density KCl foils to multi-MeV electrons.
Advances in Electronics and Electron Physics 22, 635, Academic Press (1966).
(With one co-author).

SLAC-PUB-0166

23. CsI as a high-gain secondary emission material. J. Appl. Phys. 37, 3321(1966). (With one co-author).

SLAC-PUB-0244

24. Nanosecond Fluorimeter. Rev. Sci. Instr. 38, 488(1967). (With three co-authors).

SLAC-PUB-0392

25. Electron-induced desorption of gasses from aluminum. Proc. 4th International Vacuum Congress, Manchester, England, Inst. of Physics and Physical Society, London, p. 131-6, (1968). (With three co-authors).

SLAC-PUB-0405

26. Method of stabilizing high current secondary emission monitors. Symposium on Beam Intensity Measurement, Daresbury (1968). (With one co-author).

SLAC-PUB-0495

27. Detailed study of the electron-phonon interaction in alkali halides, Part I, The transport of electrons with energies between .25 and 7.5eV, J. Appl. Phys. 40, 2766 (1969). (With one co-author).

SLAC-PUB-0516

28. Detailed study of the electron-phonon interaction in alkali halides. Part II, Transmission secondary emission from alkali halides. J. Appl. Phys. 40, 2776, (1969). (With one co-author).

SLAC-PUB-0562

29. RF superconducting materials research at SLAC. Presented at National Particle Accelerator Conf., Washington, D.C. (1969). (With one co-author).

SLAC-PUB-0587

30. Statistics of transmission secondary emission from thin films of alkali-halides. J. Appl. Phys.40, 3936(1969). (With one co-author).

SLAC-PUB-0619

31. Theoretical secondary emission yield of cesiated gallium arsenide. June 1969. Unpublished. (With one co-author).

SLAC-PUB-0623

32. Mechanism of secondary emission and single particle statistics from low-density films of alkali-halides. J. Appl. Phys. 41, 1489 (1970). (With one co-author).

SLAC-PUB-0857

33. Optical transmittance of common Cerenkov counter gases. Nucl. Instr. and Methods 93, 593-594(1971). (With one co-author).

SLAC-PUB-0926

34. Thin dielectric films in superconducting cavities. Lettre al Nuovo Cimento 2, 450 (August 1971). (With one co-author).

SLAC-PUB-0991

35. Resistivity ratio of niobium superconducting cavities. Appl. Phys. Letters 20, No. 4, 154 (February 15, 1972). (With one co-author).

SLAC-PUB-1083

36. Fluxoid quantization and phase transition in hollow superconductors carrying transport current. Lettre al Nuovo Cimento 6, No. 9, 329(March 2, 1973). (With one co-author).

SLAC-PUB-1133

37. Method for elimination of quartz-face phototubes in Cerenkov counters by use of wavelength-shifter. Nucl. Instr. and Methods 107, 365 (1973). (With two co-authors).

SLAC-PUB-1169

38. Permanent multipole magnetic fields stored in superconductors. Appl. Phys. Letters 22, No. 11, 599 (June 1, 1973). (With two co-authors).

SLAC-PUB-1214

39. An investigation of the very incomplete Meissner effect. Lettre al Nuovo Cimento 7, No. 1, 1(May 1973). (With two co-authors).

SLAC-PUB-1277

40. Optical absorption spectra of some potentially interesting gases for Cerenkov counters. (August 1973). (Submitted for publication). (With one co-author).

SLAC-PUB-1356

41. Organic wavelength shifters for improved vacuum ultraviolet detectors. December 1973. Unpublished. (With one co-author).

SLAC-PUB-1446

42. A pulsed source of spin-polarized electrons by photoemission from EuO. Nucl. Instr. and methods 120, 483 (1974). (With four co-authors).

SLAC-PUB-1557

43. Superconductivity, Cryogenics and Vacuum Technology for Linear Accelerators. Proc. 6th Intl. Vacuum Congress, 1974. Japan. Journal Appl. Phys., Suppl. 2, Pt. 1, (1974).

SLAC-PUB-1576

44. Polarized Photoelectrons from Optically Magnetized Semiconductors. Helv. Phys. Acta 47, 393 (1974). (With two co-authors).

SLAC-PUB-1667

45. Electrolytic conductivity detector for trace analysis of H_2, HD, D_2 and Neon in Hydrogen and Deuterium. J. Chromatog. Sci. 14, 541(1976). (With one co-author).

SLAC-PUB-1810

46. Field replication and flux shielding in annular superconductors. IEEE Trans. Magn. MAG-13, No. 1, 205.

47. A high intensity polarized electron source for the Stanford Linear Accelerator. Presented at 1976 Intl. Symposium on GaAs and Related Compounds, Edinburgh, Scotland, 19-22 September 1976. (With three co-authors).

SLAC-PUB-1933

48. Reactive sputter-thinning of large diamonds while preserving excellent crystalline perfection. Proceedings of 7th Int. Vacuum. Congress and 3rd Int. Conf. on Solid Surfaces, Vienna, Austria, September 12-16, 1977, p. 1517.

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49. A LEED probe for surface spin systems. Proc. 7th Int. Vacuum Congress and 3rd Int. Conf. on Solid Surfaces, Vienna, Austria, September 12-16, 1977, p. 2399. (With one co-author).

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50. Parity non-conservation in inelastic electron scattering. Phys. Lett. 77B, 347 (1978). (With nineteen co-authors).

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51. Further measurements of parity non-conservation in inelastic electron scattering. Phys. Lett. 84B, 524 (1979). (With twenty co-authors).

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53. PLEED magnetic surface structure studies at SLAC. Proc. of 4th Intl. Conf. on Solid Surfaces and 3rd European Conf. on Surface Science, Cannes, France. (Suppl. Le Vide les Couches Minces, No. 201) Vol. II, p. 1044, Sept., 1980. (With two co-authors).

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54. Surface studies of materials for superconducting cavities. Proc. of 4th Int. Conf. on Solid Surfaces and 3rd European Conf. on Surface Science, Cannes, France. (Suppl. Le Vide les Couches Minces, No. 201). Vol. II, p. 1092, Sept., 1980. (With three co-authors).

SLAC-PUB-2528

55. Materials and lubrication for gear and bearing surfaces in UHV. Proc. of the 8th Int. Vacuum Congress, Cannes, France (Suppl. Le Vide Les Couches Minces, No. 201) Vol. II, p. 437, Sept., 1980. (With two co-authors). Vakuum-Technik, 31. Jahrgang, Heft 3, p. 67. (With two co-authors).

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56. Oxide effects on photoemission from high current GaAs photocathodes. Vacuum, 31, 553 (1981). (With three co-authors).

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57. Electron-activated carbon diffusion in niobium compounds for RF superconductivity. Vacuum, 31, 597 (1981). (With three co-authors).

58. Materials and lubrication for gear and bearing surfaces in UHV. Vakuum-Technik, 31, Jahrgang, Heft 3, 67(1982). (With two co-authors).

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59. Applications of vacuum technology to novel accelerator problems. Invited paper presented at 1983 Particle Accelerator Conference, Santa Fe, New Mexico, March 21-23, 1983, and published in IEEE Trans. Nucl. Sci., NS-30, 2758 (1983).

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60. RF Superconducting Properties of Thin Films on Niobium. IEEE Trans. Nucl. Sci., NS-30, 3363 (1983). (With six co-authors).

SLAC-PUB-3213

61. Surface properties of metal-nitride and metal carbide films deposited on Nb for RF superconductivity. Presented at IX International Vacuum Congress, V International Conference on Solid Surfaces (IX IVC - V ISCC), Madrid, Spain, Sept. 26-Oct. 1, 1983. (With three co-authors).

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62. Surface studies of Nb, its compounds and coatings. Invited paper, proceedings of the Second Workshop on RF Superconductivity, Geneva, Switzerland, 23-27 July, 1984. CERN, Nov. 1984, Editor, H. Lengeler, pgs. 455-504. (With one co-author).

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63. Secondary Electron Yield and AES Measurements on Oxides, Carbide and Nitride of Niobium. J. Appl. Phys., 59, 3245 (May 1, 1986). (With three co-authors).

SLAC-PUB-3473

64. New radiofrequency technique for deposition of hard carbon films. Journal Vac. Sci. and Technology, 3, 610(1985). (With three co-authors).

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65. Test of the electronic structure of Fe(100) by absorbed current spectroscopy. Presented at the 30th Annual Conference on Magnetism and Magnetic Materials, San Diego, CA, Nov. 27-30, 1984. Published in J. Appl. Phys., 57, 1, 3021, April 15 1985, under title "The Bandstructure of Fe(100) 0-70eV Above the Vacuum Energy." (With five co-authors).

66. Valence band XPS study of Fe at finite temperatures (abstract), J. Appl. Phys., 57, 1, 3043 (April 15, 1985).

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67. Valence band XPS-study of Fe(100) at finite temperatures. Presented at the 30th Annual Conference on Magnetism and Magnetic Materials, San Diego, CA Nov. 27-30, 1984. (With four co-authors).

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68. The ferromagnetic to paramagnetic phase transition of Fe studied by x-ray photoelectron spectroscopy. Solid State Communications, 56, 425-429, (1985).

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69. Energy-dependence of inner potential in Fe from low-energy electron absorption (Target Current). Solid State Communications, 55,6, 543-547, (1985). (With six co-authors).

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71. Properties of TiN Anti-Multipactor Coatings for Klystron Windows. J. Vac. Sci. Technol. A4, 2356 (Sep/Oct 1986). (With four co-authors).

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72. TiN High Temperature Diffusion Barrier for Copper-Gasketed Stainless-Steel Flanges. J. Vac. Sci. Technol., A4, 2537 (Nov/Dec 1986). (With three co-authors).

SLAC-PUB-4078

73. Ultra High-Vacuum Linear-Rotary Transfer Mechanism Utilizing a Bakable Self Lubricating Bearing. Rev. Sci. Instr. 58, 479 (March 1987.) (With three co-authors).

SLAC–PUB–4192

74. Diamondlike carbon high–temperature diffusion barrier for copper–gasketed stainless–steel flanges. J. Vac. Sci. Technol. A5 5, (Sep/Oct 1987.) (With two co–authors).

SLAC-PUB-4196

74. Surface Properties of Cr_2O_3. J. Appl. Phy. 62, 1400 (15 August 1987). (With four co-authors).

SLAC-PUB-4309

75. Diamond-like Antireflective Coatings For Far Infrared Photoconductors. Presented at the E–MRS Meeting, France, June 1–5, 1987. (With four authors).

SLAC-PUB-4698

76. In Situ Growth of Superconducting YBaCuO Using Reactive Electron-Beam Coevaporation. Presented at the IEEE 1988 Applied Super Conductivity Conference, San Francisco, CA, Aug. 21–25, 1988. (With eleven co-authors).

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77. Enhanced electron spin polarization in photoemission from thin GaAs. Appl. Phys. Lett. 55 (16), 1686, 16 October 1989. (With five co-authors).

SLAC-PUB-4817

78. Aerosol Generation by Spark Discharge. J. Aerosol Science 19 5, 639 (1988). (With two co-authors).

SLAC-PUB-4945

79. Oxide Overlayers and the Superconducting RF Properties of Yttrium-Processed High Purity NB*. Accepted for publication in Nuclear Instruments and Methods in Physics Research, Section A. (With three co-authors).

SLAC-PUB-5015

80. Atomic Oxygen Detection by Silver-Coated Quartz Deposition Monitor. Rev. Sci. Instrum. 61 (6), 1747, (June 1990). (With two co-authors).

SLAC-PUB-5420

81. Observation of Strain Enhanced Electron Spin Polarization in Photoemission from InGaAs*. Submitted to Phys. Rev. Lett. (With five co-authors).

Edward L. Garwin

Patents

3,222,449 - "Magnetic Shield Arrangements"

3,315,732 - "High Energy Particle Beam Dump and Heat Sink"

3,479,555 - "Coaxial Light Source with Series Impedance with the Envelope"

3,527,873 - "Composite Superconducting Cable Having a Porous Matrix"

3,588,593 - "Method of Operating An Ion-Getter Vacuum Pump with Gun and Grid Structure Arranged for Optimum Ionization and Sublimation"

4,719,436 - "Stabilized Chromium Oxide Film"

Edward L. Garwin

Technical Notes

63 – 24 Beam Stoppers - I, Unfeasibility of Water-Cooled Foil Stacks at Shower Maximum. April 1963.

63 – 68 Preliminary Heat Transfer Design of a Beam Scraper. August 1963. (With one co-author).

64 – 70 BSY Beam Tube Oil Trapping Tests. August 1964. (With one co-author).

62 – 2 Evaluation of Two Types of Commercially Available Sorption Pumps. January 1965.

65 – 25 Measurement of Shock Front Travel Time in 10-cm Diameter tube. March 1965. (With one co-author).

65 – 72 An Electrical Analog of the HEPL Storage Ring Vacuum System. Revised. March 1966. (With two co-authors).

66 – 29 Photo-Analog Test of Thermal Radiation Exchange in the Storage Ring Cryopump. June 1966. (With one co-author).

67 – 10 Thermal Contact Conductance of Multiple Foil Layers. March 1967. (With one co-author).

68 – 27 High Electric Field Effects in a Superconducting Accelerator. December 1968. (With one co-author).

69 – 2 Use of a Keithley Model 300 Op-Amp as a Log Current Amplifier and Log Ohmmeter. January 1969. (With one co-author).

70 – 37 Emission Spectra of Plastic Scintillators. January 1971. (With one co-author).

71 – 9 Thin Film Dielectric Power Losses in Superconducting Cavities. March 1971. (With one co-author).

71 – 23 Ultrasonic Bonding of Aluminum Wire to Printed Circuit Board. November 1971. (With one co-author).

73 – 2 Hot Lithium Condensation on Room-Temperature Copper. April 1973. (With one co-author).