

Curriculum Vitae

Paul Michael Grant

Home

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Profession

Condensed Matter Physicist
Science Writer

Current Status & Situation

Visiting Scholar in Applied Physics, Stanford
IBM Research Staff Member Emeritus
EPRI Science Fellow (Retired)
Principal, W2AGZ Technologies (www.w2agz.com)

Career Summary

2004 – Present

W2AGZ Technologies

San Jose, CA

Principal

- W2AGZ Technologies was formed in late 2003 as an energy technology consultancy. Please visit <http://www.w2agz.com> for more information.
E-Mail: w2agz@pacbell.net; paul@w2agz.com
- Current clients are EPRI, DOE and DOD

2005 – 2008

Stanford University

Palo Alto, CA

Visiting Scholar in Applied Physics

- Investigation of density functional and band structure methods as search tools for meta-stable phases of copper monoxides for use as potential hosts for new magnetic and/or superconducting compounds

1997 – 2003

EPRI

Palo Alto, CA

Science Fellow

- In collaboration with Chauncey Starr, EPRI's Founder, developed the SuperGrid concept, a vision of an energy society based on a green, non-eco-invasive symbiosis of nuclear, hydrogen and superconducting technologies, supplemented by solar roof and urban biomass combustion renewables.

- Monitor and report emerging developments in energy science and technology on behalf of EPRI leadership and our electric utility membership.
- Help formulate and participate in EPRI's \$38 M Strategic Science and Technology program, a major component being the world's first superconducting ac cable to be put into service in an electric utility.
- Provide internal consultant services to EPRI technical staff on issues involving basic energy physics.
- Serve on Board of Directors of the Council on Superconductivity for American Competitiveness (CSAC), working with DOE and Congress to create and maintain present \$40 M annual federal program to assist development of power applications of superconductivity.
- EPRI media spokesperson on energy science.

1993 - 1997

EPRI

Palo Alto, CA

Executive Scientist

- Retired from IBM after a 40 year career to accept position at the Electric Power Research Institute to administer EPRI's efforts in advanced materials.
- Responsible for creating \$3.5 M annual EPRI program on power applications of high temperature superconductivity, including transmission/distribution cable prototypes, high temperature superconductor wire development, and a search for new superconducting materials.
- Initiated an innovative equity-based collaboration with American Superconductor Corporation to commercialize "second generation" high temperature superconductor wire which to date has netted EPRI a \$4.3 M return.
- Initiated a \$1.5 M annual EPRI "beyond silicon" effort on wide bandgap semiconductor material improvement to serve as a future platform for high power bipolar electronics.
- Supported a \$400 K annual program on polymeric light emitting diodes as a new, highly efficient light source (this effort was cited in the text of the 2000 Nobel Prize in Chemistry).

1992 – 1993

IBM Research Division

San Jose, CA

Research Staff Member

- Performed ac susceptibility measurements to probe dynamic behavior of "stripe domains" in high temperature superconducting layered copper oxide perovskites.
- Re-packaged molecular orbital/energy band electronic software previously created for personal research on conducting organic and polymer materials for commercial distribution and sale.

1990 - 1992

IIM-UNAM

Mexico City, MX

Professor of Materials Science

(On sabbatical from IBM to the Instituto de Investigaciones en Materiales, Universidad Nacional Autónoma de México)

- Studied the oxygen partial pressure phase diagram of the “n-type” high temperature superconductor system, in collaboration with IIM staff.
- Performed fermion Monte Carlo simulations on a variety of quasi-crystalline Heisenberg spin models.

1987 - 1990

IBM Research Division

San Jose, CA

Research Staff Member/

Coordinating Manager for

High Temperature Superconductivity

Programs

- Initiated, organized and led the IBM Almaden Research Center effort in high temperature superconductivity.
- Collaborator in research leading to the discovery of the atomic structure of $\text{YBa}_2\text{Cu}_3\text{O}_{7-y}$, the world’s first material to superconduct at the temperature of liquid air, and the basis of many emerging applications today.
- Discovered superconductivity in oxygen-rich $\text{La}_2\text{CuO}_{4+x}$, engendering follow-on research in many other institutions leading to the discovery of stripe domains unique to the ground state of all layered copper oxide perovskites.
- Participated in the discovery of $\text{Tl}_2\text{Sr}_2\text{Ca}_2\text{Cu}_3\text{O}_{10+x}$, which, until 1993, held the world record for the highest transition temperature at 125 K.
- Investigated the ground state of $\text{PrBa}_2\text{Cu}_3\text{O}_{7-y}$, and why it is the only non-superconducting example of a layered copper oxide perovskite.
- Studied the nature of superconductivity in the $\text{Nd}_{2-x}\text{Ce}_x\text{CuO}_4$ family of “n-type” compounds.
- Designated an official spokesperson for IBM’s high temperature superconductivity program to the media and at internal and external sales and marketing events, with speaking engagements in 24 countries over 18 months, including Northern Ireland to Cuba.

1984 - 1987

IBM Research Division

San Jose, CA

Research Staff Member/

Manager – Condensed

Matter Physics Group

- Initiated program to study exchange bias mechanism between magneto-anisotropic antiferromagnetic FeMn and ferromagnetic FeNi. This research led to the perfection of IBM’s magnetoresistive head technology, now used in the majority of computer hard disks manufactured throughout the world, and to the later discovery and application of the giant magnetoresistance effect.
- Member of divisional task force that defined corporate storage technology roadmap to develop $> 1 \text{ Gbit/in}^2$ hard disk capacity (actual results today $> 40 \text{ Gbits/in}^2$).

1983 – 1984

IBM Research Division

San Jose, CA

Technical Staff/

Vice President for Storage

And I/O Technologies

- Drafted strategy for basic science program at the new IBM Almaden Research Center in San Jose.
- Member of corporate task force defining advanced printing and display technologies, the latter resulting in the IBM/Toshiba alliance to manufacture the Thin Film Transistor/Liquid Crystal active matrix flat panel color display used in almost every laptop computer produced today.
- In collaboration with the Institute of Theoretical Physics/UC Santa Barbara, performed fermion Monte-Carlo simulations of the physical properties of the spin-1/2 quantum XY-model and the disordered Heisenberg spin chain.

1973-1983

IBM Research Division

San Jose, CA

Research Staff Member/

Solid State Physics Group

- Co-founded, with R. L. Greene, the research project on conducting organic and polymer materials in the San Jose Research Laboratory. This group consequently gained an international reputation for excellence in this frontier area of condensed matter physics.
- Researched optical properties, specific heat, frequency dependent transport, heterojunction properties, photoemission, XANES/EXAFS, phototransport and band structure of charge transfer complexes, inorganic superconducting polymers, organic conducting polymers and organic superconductors. Participated in the discovery of superconductivity in polysulfur nitride, $(\text{SN})_x$, the first superconducting polymer. During this period, published over 50 papers in the peer-reviewed scientific literature on organic conductors and superconductors.

1970 - 1973

IBM Research Division

San Jose, CA

Technical Staff/

Director, Materials and

Manufacturing Technology

Center – San Jose

- Responsible for the development, resource allocation and coordination of site-wide laboratory automation applications -- optical spectroscopy, mass spectroscopy, x-ray diffraction, thermal analysis, laser spectroscopy, transport, and time-sharing software support.
- Helped create the IBM data acquisition and control operating system that evolved into National Instrument's LabView, the most widely used DACS program in the world.

1965- 1970

IBM Research Division

San Jose, CA

Research Staff Member/

Physics Department

- Researched optical properties and electronic structure of magnetic insulators and semiconductors -- lanthanide garnets, chromium trihalides and europium chalcogenides.

- Pioneered the application of digital computers to data acquisition and control of optical spectroscopy and data analysis. Participated in major IBM marketing and sales efforts to promote applications of laboratory automation.

1960 - 1965

IBM Corporation

Kingston, NY

Sr. Associate Engineer/

Graduate Student, Applied

Physics, Harvard University

- Attended Harvard University under the IBM Resident Study Fellowship Program, receiving the AM and PhD degrees in Applied Physics.
- Thesis Topic: Optical Properties of Thin Germanium Films. This was the seminal work which changed the research direction of the Harvard semiconductor group from high pressure studies of bulk semiconductors to optical properties of thin films.
- Research Associate, Gordon McKay Laboratory, 1965
- Postdoctoral Assignment, Imperial College, London, 1965
- IBM summer work (1961): High-power ruby laser group at the IBM Kingston Development Laboratory.

1956 - 1960

IBM Corporation

Kingston, NY

*Associate Engineer/
Undergraduate Student,
Electrical Engineering
and Physics, Clarkson
University*

- Attended Clarkson University under the IBM Educational Program, receiving the BSEE degree, summa cum laude.
- Summer Experience:
 - AN/FSQ7 defense computer operating system software development.
 - Thin permalloy film magnetic memory development.
 - Electroluminescence flat panel display development.
 - Epitaxial silicon film growth by halide disproportionation and chemical vapor deposition for space applications. Built what was perhaps the first in-situ reflection high energy electron diffraction (RHEED) equipped vacuum film deposition system later used to perform part of my doctoral work

1954 - 1956

IBM Corporation

Kingston, NY

*Programmer/
AN/FSQ7 Project*

- Attended IBM Programming School
- Posted to MIT Lincoln Laboratory as reliability/diagnostic programmer on the air defense SAGE (later NORAD) AN/FSQ7 prototype, the world's first supercomputer.
- Wrote reliability/diagnostic programs for MIT's TX0, the world's first all-transistor computer.

1953 - 1954

IBM Corporation

Poughkeepsie, NY

Employee/Technician

- Hired as pin setter in the bowling alleys of the IBM Poughkeepsie Employee's Country Club.
- Transferred to mail room of the IBM Poughkeepsie High Street Laboratory.
- Promoted to Technician, High Street Laboratory, responsible for assisting engineering staff in design and construction of the SAGE prototype computer.

Education

1961 - 1965

Harvard University

Cambridge, MA

- PhD in Applied Physics, Gordon McKay Laboratory.
- Thesis Advisors: Profs. William Paul (Chair), Harvey Brooks and Nicolas Bloembergen (Physics Nobel Laureate, 1981).
- Thesis Topic: Optical Properties of Thin Germanium Films.

1960 - 1961 **Harvard University** **Cambridge, MA**
• AM in Applied Physics

1956 - 1960 **Clarkson University** **Potsdam, NY**
• BS in Electrical Engineering, Summa Cum Laude
• Senior Class Valedictorian; Edwina Clarkson Prize
• President: Eta Kappa Nu and Tau Beta Pi Honor Societies
• Senior Thesis Projects:

- Germanium Hall Effect Amplifier
- Esaki Tunnel Diode Memory System
- Electroluminescence/Photoconductor Amplifier
- Solution of the Kronig-Penney Model for an Arbitrary Crystal Potential

1951-1953 **Wappingers Central School** **Wappingers Falls, NY**
• High School Diploma
• Faculty Prize in American History
• Member, Debating Team
• Varsity Letters: Soccer, Track & Field

1949 - 1951 **Oakwood Academy** **Poughkeepsie, NY**
• Varsity Letters: Soccer, Golf

Honors and Awards

- Physics Today 50th Anniversary Essay Prize, 1999
Researchers Find Extraordinarily High Temperature Superconductivity in Bio-Inspired Nanopolymer
- Elected Senior Life Fellow of the American Physical Society, 1998
- EPRI Chauncey Starr Award, 1997
Contributions to the development of superconducting cables
- Nature Magazine “Scientist as Science Writer” Award, 1994
- Cátedra Patrimonial de Excelencia, Nivel II, 1992
Fellowship Award by the Mexican National Science Foundation
- IBM Outstanding Technical Achievement Award, 1989
High Temperature Superconductivity
- IBM Invention Achievement Award, 1987
Outstanding Invention Disclosure Record
- IBM Outstanding Technical Achievement Award, 1985
QuietWriter Printer Technology
- IBM Research Division Award, 1975
Superconductivity in $(SN)_x$
- IBM Research Division Award, 1973
Terminal Emulator for the IBM System/7

- IBM Research Division Award, 1970
Assembler Code Translator for the IBM System/7
- National Science Foundation Fellowship, 1962
- Clarkson University Trustee's Scholarship, 1958
- New York State Regents Scholarship, 1956

Professional Activities

- Senior Life Fellow, American Physical Society
 - Division of Condensed Matter Physics
 - Division of Materials Physics
 - Forum on Industrial and Applied Physics (Member, Executive Committee, 2003-05)
 - Forum on Public Affairs
 - International Physics Group
 - Center for the History of Physics
 - Forum on Education (Member, Executive Committee, 2004-06)
- Fellow, Institute of Physics, United Kingdom
- Member, Materials Research Society
- Chair, Numerous Sessions at Meetings of the APS and MRS
- Media Coordinator for Condensed Matter Physics, American Physical Society, 1996 – 1998.
- Member, Peer Review Panel, DOE Superconductivity Program for Electric Power, 1996 - Present
- Member, Science Advisory Board of the Texas Center for Superconductivity, University of Houston, 1997 – Present
- Member, Board of Directors, Council on Superconductivity for American Competitiveness (CSAC), 1996 – Present
- Member, External Review Panel, University of Wisconsin Materials Research Science and Engineering Center, 1998 – Present
- Co-Organizer with W. Nevins, APS Division of Plasma Physics Mini-Conference on Advanced Fuels for Fusion, DPP General Meeting, New Orleans, November, 1998.
- Participant, NSF/ONR Workshop on Research Opportunities in Superconductivity, Monterey, CA, 1998
- Member, North American Editorial Board, Journal of Superconductivity Science and Technology, 1998 – Present.
- Chair/Organizer, Press Conference on Breakthrough in YBCO Superconducting Tape Technology, MRS Spring Meeting, San Francisco, 1995.
- Member, Program Committee, XIII Winter Meeting on Low Temperature Physics, Vista Hermosa, Morelos, Mexico, 1992
- Member, Program Committee, High Temperature Superconductivity, Mechanisms and Materials Conference, Stanford University, 1989
- Associate Editor, Modern Physics Letters: Rapid Communications in High Temperature Superconductivity, 1988 – 1994

- Member, Advisory Board, New York Center for Superconductivity, SUNY-Buffalo, 1988 – 1990
- Advisor/Consultant to the Silicon Valley Technology Center, “The Tech Museum,” 1987 – 1989
- External Advisory Panel of the Electric Power Research Institute Program on Power Applications of Superconductivity, 1987 - 1989

Presentations

Selected Invited Professional Presentations and Talks

Complete list of invited presentations available on request

- **“Whither Superconductivity?,”** The Path to Room Temperature Superconductivity, Loen, Norway, June, 2007.
- **“Superconducting Lines for the Transmission of Large Amounts of Power over Great Distances: Garwin-Matisoo Revisited 40 Years Later!,”** Applied Superconductivity Conference, Seattle, August, 2006.
- **“System, Construction and Integrations Issues for Long Distance, High Capacity, Ceramic HTSC dc Cables: Garwin-Matisoo Revisited!,”** 6th Pacific Rim Conference on Ceramic & Glass Technology, Maui, September, 2005.
- **“Cryo-Delivery Systems for the Co-Transmission of Chemical and Electrical Power,”** Cryogenic Engineering Conference – International Cryogenic Materials Conference, Keystone, August, 2005.
- **“The SuperGrid: Symbiosis of Nuclear, Hydrogen and Superconductivity,”** World Engineers’ Conference, Shanghai, China, November, 2004.
- **“Overview of HTS Power Cable Projects in the United States,”** Symposium on HTS Cable Application, Kunming, China, June, 2004.
- **“The Energy SuperGrid,”** IEEE-PES Panel on Future Transmission System Options for Long-Term Energy Sustainability, Denver, June, 2004.
- **“The Global Energy SuperGrid,”** The Next 1000 Years, Rockefeller University, New York, October, 2003.
- **“The Energy SuperGrid,”** MIT Symposium on Nuclear Energy and the Hydrogen Economy, Cambridge, September, 2003.
- **“The SuperGrid: Combined Delivery and Storage of Electricity and Hydrogen,”** JiCABLE-METS Meeting, Paris, France, June, 2003.
- **“MgB₂ and Its Application to Electric Power,”** American Ceramic Society Conference, St. Louis, May, 2002.
- **“US Government/Industry Superconductivity Partnership Initiative,”** International Superconductivity Symposium, Kobe, Japan, September, 2001.
- **“Cost/Performance Analysis of HTS Wires & Tapes,”** International Cryogenics Conference, Montreal, July, 1999.
- **“The Energy-Environment Problem and Superconductivity Technology,”** International Symposium on Superconductivity XI, Fukuoka, Japan, November, 1998.
- **“High Temperature Superconductivity in Power Engineering,”** International Cryogenics Engineering Conference, Bournemouth, UK, July, 1998.

- ***“Advances in Superconducting Technology in the USA,”*** Escuela Leonardo da Vinci, Bologna, Italy, July, 1998.
- ***“Power Transmission Lines,”*** (Session on Accelerator Physics Issues in Future Hadron Colliders at Fermilab) APS Spring Meeting, Columbus, April, 1998.
- ***“Superconductivity: Power in the Fast Lane,”*** IEEE Power Engineering Winter Meeting, Atlanta, February, 1998.
- ***“Cables for Power Systems,”*** NATO Advanced Summer Institute on Applications of Superconductivity, Loen, Norway, 1997.
- ***“Power System Applications of HTS in the United States,”*** International Symposium on Superconductivity IX, Sapporo, Japan, October, 1996.
- ***“ $T_C = 125\text{ K}$ in Tl 2223: A New World Record by the IBM Almaden High- T_C Team,”*** (Special Session on Late-Breaking Results) International Conference on High Temperature Superconductivity: Mechanisms and Materials, Interlaken, February, 1988.
- ***“Recent High- T_C Studies at IBM Almaden,”*** Plenary Speaker at the National American Chemical Society Meeting, September, 1987.
- ***“High- T_C Activities at the Almaden Research Center: Discovery of Superconductivity in Undoped La_2CuO_4 ,”*** Berkeley Conference on Unusual Mechanisms in Superconductors, May, 1987.
- ***“Structure of the Superconducting Phase in Above 90K YBaCuO Compounds,”*** with R. B. Beyers, E. M. Engler, S. S. P. Parkin and G. Lim, Special Session on High- T_C Oxides (*The Woodstock of Physics*), American Physical Society March Meeting, New York, 18 March 1987.
- ***“Band Structure of Superconducting Charge Transfer Salts,”*** American Physical Society March Meeting, Los Angeles, 1983.
- ***“Electronic Structure of Extended π -Electron Systems,”*** American Chemical Society Meeting, Las Vegas, September, 1980.
- ***“Electronic Structure of Quasi-One-Dimensional Organic Charge Transfer Salts: Models Suggested by Optical, Photoemission, and Energy Loss Experiments,”*** Gordon Conference on Molecular Materials, July, 1977.

Selected Public Presentations and Talks

Complete list of public presentations available on request

- ***“SuperCities & SuperGrids: A Vision for Long-term Sustainable and Environmentally Compatible Energy Independence for North America,”*** Physics Colloquium, University of California – Davis, 1 December 2008.
- ***“The 1987 High- T_C ‘Woodstock’ Session and High- T_C at IBM,”*** 20th Anniversary of High- T_C Superconductivity ‘Woodstock’ Session, 2007 American Physical Society Meeting, Denver, CO, March, 2007.
- ***“SuperCities and SuperGrids: Teratechnology Energy Societies for an Exajoule World,”*** Brown Bag Science Seminar, Ohlone Community College, Fremont, CA, April, 2006.
- ***“The Energy SuperGrid,”*** The Energy Council, Tulsa, OK, October, 2003.

- ***“Bringing Power to the People – The Coming Age of Superconductivity,”*** Public Plenary Lecture, Applied Superconductivity Conference, Virginia Beach, September, 2000.
- ***“Superconductivity,”*** American Association of Physics Teachers: Secondary Science Teachers Conference, UC Santa Barbara, CA, August, 2000.
- ***“From Nanowatts to Gigawatts – A Life in Electricity,”*** Convention of High School Science Teachers, UT-Austin, TX, June, 2000.
- ***“What’s ‘Super’ About Superconductivity? A Millennium Progress Report,”*** Public Plenary Session, with J. R. Schrieffer, C. W. Chu, H. Weinstock and D. Gubser, M²S-HTSC Conference, Houston, TX, February, 2000.
- ***“High Temperature Superconductivity,”*** Harriet Shriver Rogers Lecture, School of Engineering Colloquium, Johns Hopkins University, 1990.
- ***“High Temperature Superconductivity: A High School Science Project,”*** Regional Conference of High School Science Teachers, Queen's University, Belfast, Northern Ireland, November, 1988.
- ***“News Coverage of High Temperature Superconductivity,”*** Special Panel Discussion, American Physical Society March Meeting, 1988.
- ***“Superconductors: New Materials That Could Change Our World,”*** Distinguished Lecturer, Smithsonian Series in Frontiers of Science, July, 1987.
- ***“High Temperature Superconductivity: As Easy As 1-2-3,”*** Inaugural Lecture, Silicon Valley Technology Center (The Tech Museum), June, 1987.

Publications

Book Reviews

- ***“Plugged into the Matrix,”*** Book Review (*The Grid: A Journey Through the Heart of Our Electrified World*, Phillip F. Schewe, Joseph Henry Press, 2007), Nature **447**, 145 (2007).
- ***“The Moses of Silicon Valley,”*** Book Review (*Broken Genius: The Rise and Fall of William Shockley, Creator of the Electronic Age*, Joel N. Shurkin, Macmillan Science, 2006), Nature **442**, 631 (2006).
- ***“Science Exiled,”*** Book Review (*Politicizing Science: The Alchemy of Policymaking*, ed. Michael Gough, Hoover Institution, 2003), Nature **425**, 663 (2003).
- ***“London Calling,”*** Book Review (*A Thread Across the Ocean*, John Steele Gordon, Simon & Schuster, 2002), Nature **420**, 744 (2002).
- ***“Handbook of Applied Superconductivity,”*** Book Review, Physics World, 1998.
- ***“Fields of Influence,”*** Book Review (*Driving Force: The Natural Magic of Magnets*, J. D. Livingston, Harvard University Press, 1996), Nature **380**, 679 (1996).
- ***“Devices and Developments,”*** Book Review (*Applied Superconductivity*, ed. R. B. Poeppel, Elsevier, 1994), Nature **371**, 449 (1994).

Popular Articles

- ***“The Future of Energy Supply: Could SuperCables deliver both hydrogen and electricity via a SuperGrid?”*** Power Magazine **151**(5), 15 May 2007.
- ***“A Power Grid for the Hydrogen Economy,”*** with C. Starr and T. Overbye, Scientific American, July, 2006, p.76.
- ***“Might ‘Hydricity’ SuperCables Eventually Deliver Both Hydrogen and Electricity?”*** Platts Transmission & Distribution Source Book, Fall 2005, p.17.
- ***“Nuclear Energy’s Contribution to the City of the Future,”*** Nuclear Future **1**, 17 (2005).
- ***“Hydrogen Lifts Off – With a Heavy Load,”*** The Nuclear Engineer **45**, 47 (2004).
- ***“Energy for the City of the Future,”*** The Industrial Physicist, February/March 2002, p.22.
- ***“Will MgB₂ Work?”*** The Industrial Physicist, October/November 2001, p.22.
- ***“The Big Chill,”*** New Scientist **172**, 36 (2001).
- ***“Researchers Find Extraordinarily High Temperature Superconductivity in Bio-Inspired Nanopolymer,”*** Physics Today, May, 1998.
- ***“High-Temperature Superconductivity: Four Years Since Bednorz and Mueller,”*** Advanced Materials **2**, 232 (1990).
- ***“Do-It-Yourself Superconductors,”*** New Scientist **115**, 36 (1987).
This article, the story of how a California high school chemistry class verified high temperature superconductivity at 90 K only three months after its discovery and four months before the awarding of the Nobel Prize, was distributed to all members of Congress at the request of then Rep. Miller (R-PA). Moreover, the International Center for Theoretical Physics, an agency of UNESCO, made some 30,000 reprints available to secondary schools in the developing nations.
- ***“Computers Team Up,”*** with T. R. Lusebrink and D. G. Taupin, Industrial Research, November 1972, p. 50.

Commentary & Opinion

- ***“Chauncey Starr,”*** (Obituary), Physics Today, June 2007, p.79
- ***“Chauncey Starr (1912-2007),”*** News & Views (Obituary), Nature **447**, 789 (2007).
- ***“Chauncey Starr: A Personal Memoir,”*** Power Magazine, June 2007.
- ***“Sun, Atom Can Help Fill Energy Needs,”*** Letter to the Editor, San Jose Mercury-News, 15 January 2006.
- ***“Let Her Parents Decide,”*** Letter to the Editor, San Jose Mercury-News, 23 March 2005.
- ***“Path to Cloning is Now Wide Open,”*** Letter to the Editor, San Jose Mercury-News, 14 February 2004.
- ***“Technology Exists to Repair the Grid,”*** Letter to the Editor, San Jose Mercury-News, 19 August 2003.
- ***“Hydrogen Lifts Off – With a Heavy Load,”*** Commentary, Nature **424**, 130 (2003).
- ***“Columbia and Afghanistan,”*** Letter to the Editor, San Jose Mercury-News, 4 February 2003.

- **“Scientific Credit and Credibility,”** Commentary, *Nature Materials* **1**, 139 (2002).
- **“Is a Bell Tolling at Bell Labs?,”** Commentary, *Nature* **417**, 789 (2002).
- **“Fight During Ramadan,”** Letter to the Editor, *San Jose Mercury-News*, 20 November 2001.
- **“Up on the C₆₀ Elevator,”** News & Views, *Nature* **413**, 264 (2001).
- **“Rehearsals for Prime Time,”** News & Views, *Nature* **411**, 532 (2001).
- **“Sleepless in Seattle,”** High-T_C Update, March 2001 (<http://www.iitap.iastate.edu/htcu/grantcomment.html>)
- **“Currents Without Borders,”** News & Views, *Nature* **407**, 139 (2000).
- **“A Victory for Consumers,”** Letter to the Editor, *San Jose Mercury-News*, 31 May 2000.
- **“Kansas Makes a Monkey of Itself,”** Correspondence, *Nature* **400**, 810 (1999).
- **“A Worthy Hero for Boys and Men,”** Letter to the Editor, *San Jose Mercury-News*, 10 March 1999.
This op-ed, a homily on the death of Joe DiMaggio, received the Mercury-News “Silver Pen” award for 1999.
- **“Woodstock of Physics Revisited,”** Commentary, *Nature* **386**, 115 (1997).
- **“Counting the Ten-Year Returns,”** News & Views, *Nature* **381**, 559 (1996).
- **“Superconducting Superwires,”** News & Views, *Nature* **375**, 107 (1995).
- **“Another December Revolution?,”** News & Views, *Nature* **367**, 16 (1994).
This article won Nature’s 125th Anniversary “Scientist as Science Writer” Prize.

Selected Technical Papers Published in Peer-Reviewed Journals

Complete list (> 100) available on request

- **“Superconducting Lines for the Transmission of Large Amounts of Power over Great Distances: Garwin-Matisoo Revisited 40 Years Later!,”** *IEEE Trans. Appl. Supercond.* (to be published).
- **“Cryo-Delivery Systems of Chemical and Electrical Power,”** *Adv. Cryo. Eng.* (appearing).
- **“The SuperCable: Dual Delivery of Chemical and Electrical Power,”** *IEEE Trans. Appl. Supercond.* **15**, 1810 (2005).
- **“Potential Electric Power Applications for Magnesium Diboride,”** *Mat. Res. Soc. Symp. Proc.* **689**, 3 (2002).
- **“Cost Projections for High Temperature Superconductors,”** with T. P. Sheahen, Applied Superconductivity Conference, Palm Springs, CA, September 1998 (<http://arxiv.org/ftp/cond-mat/papers/0202/0202386.pdf>).
- **“Superconductivity and Electric Power: Promises, Promises...Past, Present and Future,”** *IEEE Trans. Appl. Supercon.* **7**, 112 (1997).
- **“The Impact of Superconductivity on Electricity in the 21st Century,”** with T. R. Schneider, Proceedings of the 16th World Energy Council Congress, Tokyo, Japan, 1995.
- **“Role of Oxygen in PrBa₂Cu₃O_{7-y}: Effect on Structural and Physical Properties.”** with M. E. López-Morales, D. Ríos-Jara, J. Tagüeña, R. Escudero, S. La Placa, A. Bezinge, V. Y. Lee, and E. M. Engler, *Phys. Rev.* **B41**, 6655 (1990).

- ***“Evidence for Superconductivity in Undoped La_2CuO_4 ,”*** with S. S. P. Parkin, V. Y. Lee, E. M. Engler, M. L. Ramirez, J. E. Vazquez, G. Lim, R. D. Jacowitz and R. L. Greene, *Phys. Rev. Letters* **58**, 2482 (1987).
- ***“Superconductivity Above Liquid Nitrogen Temperature: Preparation and Properties of a Family of Perovskite-Based Superconductors,”*** with E. M. Engler, V. Y. Lee, A. I. Nazzal, R. B. Beyers, G. Lim, S. S. P. Parkin, M. L. Ramirez, J. E. Vazquez and R. J. Savoy, *J. Am. Chem. Soc.* **109**, 2848 (1987).
- ***“Superconductivity Above 90 K in the Compound $\text{YBa}_2\text{Cu}_3\text{O}_x$: Structural, Transport, and Magnetic Properties,”*** with R. B. Beyers, E. M. Engler, G. Lim, S. S. P. Parkin, M. L. Ramirez, V. Y. Lee, A. Nazzal, J. E. Vazquez and R. J. Savoy, *Phys. Rev.* **B35**, 7242 (1987).
- ***“Monte Carlo Studies of the Quantum XY Model in Two Dimensions,”*** with E. Loh, Jr., and D. J. Scalapino, *Phys. Rev.* **B31**, 4712 (1985).
- ***“Electronic Structure of the 2:1 Charge Transfer Salts of TMTCF,”*** *J. Physique* **44**, C3-847 (1983).
- ***“Broken-Symmetry Band Structure of Ditetramethyltetraselenafulvalene- X [$(\text{TMTSF})_2X$],”*** *Phys. Rev. Letters* **50**, 1005 (1983).
- ***“Electronic Structure of Conducting π -Electron Systems,”*** with I. P. Batra, *Synth. Met.* **1**, 193 (1980).
- ***“Orthogonalized-Plane-Wave Band Structure of Polymeric Sulfur Nitride, $(\text{SN})_x$,”*** with W. E. Rudge, *Phys. Rev. Letters* **35**, 1799 (1975).
- ***“Low-Temperature Specific Heat of Polysulfur Nitride, $(\text{SN})_x$,”*** with R. L. Greene and G. B. Street, *Phys. Rev. Letters* **34**, 89 (1975).
- ***“Temperature Dependence of the Near-Infrared Optical Properties of Tetrathiofulvalinium Tetracyanoquinodimethane (TTF)(TCNQ),”*** with R. L. Greene, G. C. Wrighton and G. Castro, *Phys. Rev. Letters* **31**, 1311 (1973).
- ***“Interleaving Slow- and Rapid-data-rate Experiments with a Time-sharing Laboratory Automation System,”*** *IBM J. Res. Develop.* **15**, 293 (1971).
- ***“Dependence of the E_1 Reflectivity Structure in EuO on Temperature and Doping,”*** *J. Appl. Phys.* **42**, 1771 (1971).
- ***“Optical Properties of Thin Germanium Films in the Wavelength Range 2000-6000 Angstroms,”*** with W. Paul, *J. Appl. Phys.* **37**, 3110 (1966).

Patents and Patent Publications

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- ***“Science Education: The First Application of High Temperature Superconductivity,”*** with David Pribyl (Chemistry Instructor, Gilroy High School), US Information Agency Television Program, “WorldNet Today,” June, 1988.
- ***“Race for the Superconductor,”*** appearance on PBS NOVA, April, 1988 (The producer...and the cast...were awarded an Emmy for outstanding documentary).
- ***“Breakthrough in Superconductivity,”*** appearance on ABC Good Morning America, April, 1987.

Personal and Family Interests

I was taught to ski by my parents when I was five years old, and have skied every winter of my life since. I competed in club skiing while a youngster and in college. I served 20 years on the National Ski Patrol, beginning in 1963 while in graduate school as a professional with the Mt. Snow, Vermont, organization. In 1965, I co-founded the volunteer ski patrol at Alpine Meadows, Lake Tahoe, California. During my tenure at Alpine Meadows, I held Avalanche Proficiency Certification from the US Forest Service and won several awards for mountain rescue operations. I also held paramedic certification from the American Association of Orthopedic Surgeons and the University of California Medical School, San Francisco. I retired from active ski patrol duty in 1983 and now enjoy skiing and other mountain activities with my family (I have seven children and two grandchildren).