

# FRANK S. BARNES

## Title

Distinguished Professor  
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## Home Address

225 Continental View Drive  
Boulder, Colorado 80303-4516  
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## Date and Place of Birth

July 31, 1932 -- Pasadena, California

## Education

B.S., Princeton University, 1954 (Electrical Engineering)  
M.S., Stanford University, 1955 (Electrical Engineering)  
Engineer, Stanford University, 1956 (Electrical Engineering)  
Ph.D., Stanford University, 1958 (Electrical Engineering)

## Professional Experience

Distinguished Professor, Department of Electrical Engineering  
University of Colorado, Boulder, Colorado 1997-

Professor, Department of Electrical Engineering  
University of Colorado, Boulder, Colorado 1965-1997

Director of Interdisciplinary Telecommunications Program  
University of Colorado, Boulder, Colorado 1971-74, 1996-1998

Acting Chairman, Department of Electrical Engineering  
University of Colorado, Boulder, Colorado 1989-1990

Acting Dean, College of Engineering and Applied Science  
University of Colorado, Boulder, Colorado 1980-1981

Chairman, Department of Electrical Engineering  
University of Colorado, Boulder, Colorado 1964-1980

Associate Professor, Department of Electrical Engineering  
University of Colorado, Boulder, Colorado 1959-1965

Physicist, U.S. National Bureau of Standards  
Boulder, Colorado 1959-1962

Research Associate, Colorado Research Corporation  
Denver, Colorado 1958-1959

Fulbright Professor, College of Engineering  
Baghdad, Iraq 1957-1958

Research Assistant, Stanford University  
Stanford, California 1955-1957

Engineer, Denver Research Institute  
Denver, Colorado 1954 (summer)

### **Selected Professional Activities**

Representative for Cu on Solar Tech 2007-2009  
President, Bioelectromagnetics Society 2000-2001

U.S. Chair Commission K of URSI 1999- 2002

Member, Educational Advisory Board, National Communications Forum, 1990-1999

Executive Editor, *Annual Reviews of Telecommunications*, 1993-

Editor, *IEEE Transactions on Education*, 1988-1994

Member, IEEE Press Board, 1986-1992

Chair, IEEE Publication Review Board, 1986

Chair, University of Colorado, Telecommunications Executive Committee

Member, WHO Document Review on VDT's, 1985

Chair, IEEE Educational Activities Board - Pre-College Guidance Brochure

Commission A of URSI

Board of Directors, Engineering Information, 1984-1990

Board of Directors, Bioelectromagnetics Society (BEMS), 1981-1982 and 1996-1998

Board of Trustees for the Engineering Index, Inc., 1979-1984

Vice Chair, Electrical Engineering Department Heads Association, ASEE, 1978-1979; Chair, 1979-1980

Member, Princeton University, Advisory Council, Electrical Engineering Department, 1971- 1983

Member, ANSI Committee on Laser Safety, 1965-1975

Member, ANSI C95 Committee on Microwave Safety Standards, 1976-1992

Member, URSI Steering Committee, 1976

Chair, ECPD (now ABET) Committee on Advanced Level Accreditation, 1976-1978

Member, NCRP Committee #S39, 1975-1980

Member, IEEE Board of Directors, 1974-1975

Member, IEEE Executive Committee, 1974-1975

Chair, IEEE Electron Devices Society, 1975, Vice Chair 1973-4

Chair, IEEE Publications Board, 1974-1975

Vice President of IEEE for Publications, 1974-1975

Technical Program Committee, MTT International Meeting, 1973

Member, IEEE Nominations and Appointment Committee, 1972

Chair, 1971 NSF Workshop on Non-Ionizing Radiation

Chair, 1971 Electron Ion and Laser Beam Technology Symposium

Chair, Device Research Conference, 1971;

Vice Chair, Student Activities Board, IEEE, 1970

Vice Chair, IEEE Editorial Board, 1970

Member, Editorial Board of *IEEE Spectrum*, 1970-1971

Regional Editor, *IEEE Electronic Letters*, 1969-1975

Member, IEEE Editorial Board, 1968-1970 and 1972

IEEE Electron Device Group, 1968-1973 (AdCom)

Editor, *IEEE Student Journal*, 1968-1970

Member, ECPD Accreditation Team, 1968

### **Service on Advisory and Peer Review Panels**

Invited member for Workshop on "Identification of research priorities for Canada on wireless telecommunication devices and potential biological or adverse health effects" 2008  
 Associate Editor for *ASCE Journal of Energy Engineering* 2007-9  
*Member Princeton Advisory Board for the Keller Centre for Innovation in Engineering Education*  
 Chair of National Research Counsel Committee on the Identification of Research Needs relating to Potential Biological or Adverse Health Effects of Wireless Communication Devices 2007  
 NIH Study Section Member for Nonionizing Radiation 2004  
 Chair of National Research Counsel Committee on Pave Paws Radar, 2001-2004  
 IEEE Prize Paper Selection Committee 1998-2003  
 NATO Post Doc Review on Toxicology for NSF, January 1993  
 Chair, Grant Panel on Toxicology of ELF for NIEHS, February 1992, Durham, NC  
 Study Section on Radiation Biology, NIH, January 1992, Taos, NM.  
 Member, National Science Foundation Review Panels, 1966-1997  
 NIOSH Review, 1996, NIEHS Review, 1997

### **Professional and Honor Societies**

Institute of Electrical and Electronics Engineers, Inc.  
 Sigma Xi; President of Boulder Chapter, 1971  
 American Physical Society  
 American Association for the Advancement of Science  
 Eta Kappa Nu  
 Tau Beta Pi  
 Bioelectromagnetics Society  
 American Society for Lasers and Medicine  
 Aviation Space and Environmental Medicine Society  
 National Academy of Engineering  
 URSI

### **Awards, Honors, etc.**

ITERA's , First Distinguished Researcher Award, from the International Telecommunications Education and Research Association 2006  
 Pinnacles of Inventorship Award from Tech Transfer Univ. of Colo. 2006  
 Colorado Institute of Technology Catalyst Award 2004  
 Bernard M. Gordon Prize from National Academy of Engineering for Innovations in Engineering Education 2004  
 IEEE Education Society 2003 Achievement Award  
 2002 ECE Distinguished Educator Award from ASEE ECE Section  
 National Academy of Engineering, 2001  
 Distinguished Professor, University of Colorado - Boulder, 1997  
 Fellow, International Engineering Consortium, 1995  
 Fellow, American Society for Lasers and Medicine, 1986  
 Fellow, American Association for the Advancement of Science, 1977  
 Fellow, IEEE, 1970  
 Distinguished Lecturer for IEEE Electron Device Society 1994-1997  
 University of Colorado's Centennial Celebration, Engineering Recognition, 1994  
 International Communications Association, Leon Montgomery Award, 1994  
 IEEE Education Meritorious Service Award, 1993  
 American Society for Engineering Education, Centennial Certificate, 1993.  
 IEEE, EAB Meritorious Service Award, 1989  
 International Communications Association, Certificate of Merit, 1989  
 Distinguished Engineering Alumni Award, University of Colorado, 1986  
 Max S. Peters Service Award, College of Engineering, 1985  
 IEEE Centennial Award, 1984  
 Stearns Award, University of Colorado, 1980

Faculty Mentor for two President's Senior Award Winners, 1967 and 1969  
 Faculty Research Lecturer, 1965  
 Curtis McGraw Research Award, ASEE, 1965

## Patents

- 13 Patent filed for May ,2006 “MULTI-EXCITATION DIAGNOSTIC SYSTEMS AND METHODS FOR CLASSIFICATION OF TISSUE” with Priya N. Werahera, John Daily, M. Scott Lucia, Adrie van Bokhoven, E. David Crawford,
- 12“A Voltage-Tunable Phased Array Antenna Apparatus Including Ferroelectric Material,” U.S. Patent #5,589,845 (Yandrowski, Price, Barnes, Hermann, Scott)( Zhang, Wu) issued Dec. 31, 1996.
- 11“Tuneable Microwave Devices Incorporating High Temperature Superconducting and Ferroelectric Films” (Barnes , Price, Herman, Yandrowski, and Scot), U. S. Patent #5,472,935 issued Dec. 5, 1995.
- 10“Amplifying and Synchronizing Signals In Optical Computing System” (Barnes) U.S. Patent #5,295,010 issued Mar. 15, 1994.
- 9“Recording Head Suspension Utilizing Superconductor Means,”U.S. Patent # 5,082,827 issued January 21, 1992.
- 8“Storing Information-bearing Signals in a Superconductive Environment Using Vortices as Digital Storage Elements,” U.S. Patent # 5,079,219 issued 1992.
- 7“Unitary Skate Assembly Having Vertical Spring Means” (Barnes and Baer), U.S. Patent # 4,993,725 issued February 19, 1991.
- 6“Superconductor Magnetic Reading and Writing Heads” (Barnes and Dugas), U.S. Patent #4,971,947 issued November 20, 1990.
- 5“Superconductor Devices for Disk Drives,” U.S. Patent # 4,926,082 issued May 15, 1990.
- 4“Superconductor Magnetic Reading and Writing Heads,” U.S. Patent #4,971,947 issued Nov. 20, 1990 and reissued as U.S. Patent # RE35212 on Apr. 16, 1996.
- 3“Superconductor Devices Useful for Disk Drives and the Like,” U.S. Patent # 4,843,504 issued June 27, 1989.
- 2“Resonant Pile Driving System,” U.S. Patent # 4,645,016 issued February 24, 1987.
- 1“Quantum State Memory,” U.S. Patent #3,754,988 issued Aug. 28, 1973.

## Publications

- 190 Effects of 900-MHZ Radio Frequencies on Chemotaxis of Human Neutrophils in Vitro” Ashraf, A.,Cheema , M., Tambawala, M. , Laterza, R., Zhou, E., Rathnabharathi K., Barnes, F.
- 189, Hu, C.J, Barnes, F.S. “ A New Approach to the Design of a Small Power Network Using a Self Control Re-Usable Energy Source” Proceeding of the Tenth IASTED International Conference Power and Energy Systems (PES 2008) April 2008
188. Barnes, F. Levine J. G, Martin. R, Moutoux. February 2008. CAES and Pumped Hydro for today’s Utility Scale Energy Storage Needs. Renewable Power Generation Conference 2008. Pen Well. Las Vegas, NV.

187. Levine, J. F, Barnes. 2007. Potential Pumped Hydroelectric Storage Sites in Colorado. Electrical Energy Storage Applications and Technologies (EESAT).
- 186 “The effect of ultrasonic irradiation on doxorubicin-induced cytotoxicity in three human bladder cancer cell lines” with Caroline Arthur<sup>a</sup>, Thomas Flaig<sup>b,\*</sup>, Lih-Jen Su<sup>b</sup>, Richard Denney<sup>c</sup>, , L. Michael Glodé<sup>b</sup>. to be published in Ultrasonics.
- 185 *The CRC Handbook on Biological Effects of Electromagnetic Fields*, 3<sup>rd</sup> Edition Edited with Ben Greenebaum Nov. 2006
- 184 “Interaction of DC and ELF Electric Fields with Biological Materials and Systems,” Chapter 5 in *The CRC Handbook on Biological Effects of Electromagnetic Fields*, 3<sup>rd</sup> Edition Edited by Frank Barnes and Ben Greenebaum Nov. 2006
- 183 “Setting Standards in the Presence of Developing Scientific Understanding” Electromagnetic Biology and Medicine To be published Nov 2006
- 182 “Online Laboratory for Optical Circuits Courses: Effective concept mapping” with Driss Benhaddou and Deniz Gurkan, Harshita Kodali Engineering Technology Department, University of Houston Ed McKenna, Alan Mickelson ASEE-GSW regional meeting 2006
- 181 Biological Effects and Electromagnetic Fields" with Bonnie Slaten Handbook of Electrical Engineering Editor Richard Dorff. Chapter 7.3 pp7-33 to 7-54 CRC January 2006
- 180 “Mechanisms for Electric and Magnetic Fields Effects on Biological Cells” Advances in Magnetics IEEE Transactions on Magnetics, Vol41, No 11, November 2005. pp 4219- 4224
- 179 “Dielectric Slab Rotman Lens with Tapered Slot Antenna Array” with Jaeheung Kim IEE Proceeding Microwave Antenna Propagation , 2005 online no. 20045118 pp 1-6, doi:101049/ip-map:20045118
178. ASSESSING THE EFFECTIVENESS OF DISTANCE NETWORKING LABORATORY EXPERIENCES [Session S3F: Labs: Remote & Local] Douglas C. Sicker, Tom Lookabaugh, Jose Santos and Frank Barnes, At FIE in October of 2005
177. "Carriers' Spatial Separation Nonlinearity in Quantum Wells" with Fahhad Alharbi, Journal of Modern Optics, Vol. 52, No. 16, 10 Nov. 2005, pp 2279-2292
- 176 E-learning Environmental Design of a Distributed Online Laboratory for Optical Circuits Courses Edward McKenna\*, Randal Direen\*, Frank Barnes\*, Deniz Gurkan, Alan Mickelson\*, and Driss Benhaddou University of Houston/\*University of Colorado June 2005 ASSEE
- 175 “Dielectric Slab Rotman Lens for Microwave/Millimeter-Wave Applications” with Jaeheung Kim and Choon Sik Cho. IEEE Transactions on Microwave Theory and Techniques Vol. 53. No 8 August 2005
- 174 “ An Assessment of Potential Health Effects from Exposure to PAVE PAWS Low-Level Phased-Array Radiofrequency Energy” National Academic Press. Committee chair, 14 coauthors. February 2005
- 173 “Dielectric Slab Rotman Lens” with Jaeheung Kim, Choon Sik Cho, IEEE Microwave and Wireless Components Letters, Vol 15, No 5 May 2005
172. “Frequency and Amplitude Windows in the Combined Action of DC and Low Frequency AC Magnetic Fields on Ion Thermal Motion in a Macromolecule: Theoretical Analysis” with Mikhail Zhadin, Bioelectromagnetics Vol. 26, No 4, pp323-330, May 2005
- 171 “ A Theoretical Study of the Effects of RF Fields in the Vicinity of Membranes” with Y. Kwon, Bioelectromagnetics Vol 26 , No 2 p 118-124 ,2005
- 170 “Opportunities and Challenges for Engineering Education as Seen from an Interdisciplinary Telecommunications Master’s Degree Program” The Bridge winter 2004, p55-61

- 169 "Some Frontiers for Engineering Education" 2004 Gordon Prize Lecture, Journal of Engineering Education July 2004
- 168 "Iterative method for designing a dual-phase-conjugation- mirror-resonator with multiple apertures" with Young Kwon, , Applied Optics January 2004
- 167 "A New Frontier In Engineering Education: Importing Courses" Proceeding of FIE Oct 2003
- 166 "Inadequate Models Make For Evaluation Make Universities Less Than They Can Be" Proceeding of FIE Oct 2003
- 165 "Analysis of Bragg fiber with unequal layers" with Anak Muthitacharoen, Submitted Applied Optics Nov. 2002
- 164 "Effects of Low-Level 50 Hz Magnetic Fields on the Level of Host Defense and on Spleen Colony Formation," H. A. Korneva, V. A. Grigoriev, E. N. Isaeva, S. M. Kaloshina, F. S. Barnes, *Bioelectromagnetics* 20:57-62, 1999.
- 163 "A Model for the Detection of Weak ELF Electric and Magnetic Fields," *Bioelectrochemistry and Bioenergetics*, 47(1998)207-212, 1999.
- 162 "Combined Action of Static and Alternating Magnetic Fields on Ionic Current in Aqueous Glutamic Acid Solution" (Zhadin M.N., primary author) *Bioelectromagnetics* 19:41-45, 1998.
- 161 "Doped Ba<sub>0.6</sub> Sr<sub>0.4</sub> TiO<sub>3</sub> Thin Films For Microwave Device Applications At Room Temperature," with Huey-Daw Wu, *Integrated Ferroelectrics*, 22(1-4)291-305, 1998.
- 160 "Real-Time, Multi-Channel Computerized Electrogastrograph," with Mingying Zhou, Hui Zhang, Robert Shaw, *IEEE Transactions on Biomedical Engineering* . 44(12): 1228-1236, December 1997.
- 155 "Vibratory Excavation and Anchoring Tools for the Lunar Surface," with J. L. Klosky, S. Sture, H. Ko, *Proceedings of SPACE '96 Conference*, Albuquerque, NM, June 1996.
- 154 "Mechanical Properties of JSC-1 Lunar Regolith Simulant," with J. L. Klosky, S. Sture, and H. Ko, *Proceedings of SPACE '96 Conference*, Albuquerque, NM, June 1996.
- 153 "Effects of Pulsed Acoustic and Mechanical Stimuli on the Excitability of Isolated Neuronal and Cardiac Cells," with Richard T. Mihran, Sean K. Lineaweaver, and Howard Wachtel, *Appl. Occup. Environ Hyg.* 11(4), 1-4, April 1996.
- 152 "Biological Effects of Radio Frequency Fields," with V. E. Irizarry-Sepulveda, *Worldwide Wireless Communications*, Frank S. Barnes, Ed., National Engineering Consortium, 1995 (released February 1996).
- 151 *Worldwide Wireless Communications*, Frank S. Barnes, Ed., National Engineering Consortium, 1995 (released February 1996).
- 150 "Interaction of DC and ELF Electric Fields with Biological Materials and Systems," in *The CRC Handbook on Biological Effects of Electromagnetic Fields*, C. Polk and E. Postow, Eds., 103-147, CRC Press, Boca Ration, Florida, Jan 1, 1996.
- 149 "The Effects of Electric and Magnetic Fields on Chemical Reaction Rates in Biological Systems," *Biofizika* (Russian Journal of Biophysics), 41/4, p.790-797, 1996.
- 148 "The Effects of Electric and Magnetic Fields on Chemical Reaction Rates in Biological Systems," *Biological Effects of Magnetic and Electromagnetic Fields*, S. Ueno, Ed., Plenum Press, 1996.

- 147"Coaxial Lines for Multiphase Power Distribution," with P. Harwick and A. Banerjee, *Journal of Bioelectromagnetics* 17, 162-164 (1996).
- 146"Typical Electric and Magnetic Field Exposures at Power Line Frequencies and their Coupling to Biological Systems," in Advances in Chemistry Series No. 250, *Biological Effects of Environmental Electromagnetic Fields*, Martin Blank, Ed., American Chemical Society Books, Washington, D.C., Dec 1995.
- 145"Effect of Electromagnetic Fields on the Level of Host Defense Reaction and on the Spleen Colony Formation," with V. A. Grigoriev, E. N. Isaeva, S. M. Kaloshina, E. A. Korneva, *Proceedings of Abs. Int. Co-Conf. on Environmental Pollution (ICEP'95) and Proceedings of Neuroimmuno Interactions and Environment (ICONE'95)*, St. Petersburg, Russia, 114, July 17-24, 1995.
- 144"Augered Foundation Elements for Lunar Operations," with J. Ledlie Klosky, Stein Sture, Hon-Yim Ko, *Proceedings of the Colorado School of Mines at Meeting on Mining and Construction*, 1995.
- 143"Some Microwave Applications of BaSrTiO<sub>3</sub> and High Temperature Superconductors" with John Price, Allen Hermann, Zhihang Zhang, Huey-Daw Wu, David Galt, Ali Naziripour, *Integrated Ferroelectrics*, vol. 8, 171-184, 1995.
- 142"Editorial: new challenges for engineering education", *IEEE Transactions on Education*, vol. 37, (2), 119-121, May 1994.
- 141"Editorial: engineering education under attack", *IEEE Transactions on Education*, vol. 37, (1), 1-2, February 1994.
- 140"Mechanisms for Biological Changes Resulting from Electric and Magnetic Fields," *Proceedings of the 1994 Japan-U.S. Science Seminar on Electromagnetic Field Effects Caused by High Voltage Systems (Modeling, Characterization, Measurements, Mitigation)*, Sapporo, Japan, 1994.
- 139"Typical Electric and Magnetic Field Exposures at Power Line Frequencies and Their Coupling to Biological Systems," *Proceedings of the 1994 Japan-U.S. Science Seminar on Electromagnetic Field Effects Caused by High Voltage Systems (Modeling, Characterization, Measurements, Mitigation)*, Sapporo, Japan, 1994.
- 138"Fabrication of Ba<sub>1-x</sub>Sr<sub>x</sub>TiO<sub>3</sub> tunable capacitors with Tl<sub>2</sub>Ba<sub>2</sub>Ca<sub>1</sub>Cu<sub>2</sub>O<sub>x</sub> electrodes," with A. Outzourhit, J. U. Trefny, Z.-H. Zhang, J. Cleckler and A. M. Hermann, *Physica C*, 387-394, 1994.
- 137"Dielectric properties of thin film SrTiO<sub>3</sub> grown on LaAlO<sub>3</sub> using YBa<sub>2</sub>Cu<sub>3</sub>O<sub>7-x</sub> microstrip resonators", with H. D. Wu, D. Galt, J. Price and J.A. Beall, Proceedings for the SPIE - The International Society for Optical Engineering Conference, in January 1994, Los Angeles, California, High-T<sub>c</sub> Microwave Superconductors and Applications, R.B. Hammond and R.S. Withers, Eds., vol. 2156, 131-140.
- 136"Voltage tunable capacitors using high temperature superconductors and ferroelectrics", with H. D. Wu, Z. Zhang, C. Jackson and A. Kain, *IEEE Transactions on Superconductivity*, September 1993.
- 135"The case for liberal engineering programs - and an approach to implementing them", with H. Wachtel and R. Ravenel, 1992 Frontiers in Education Conference.
- 134"Mass and energy tradeoffs of axial penetration devices on lunar soil simulant", with M. P. Nathan, H.Y. Ko and S. Sture, Proc. of Amer. Civil Engrs., vol. I, 441-457, W. Z. Sadeh, S. Sture, and R. J. Miller, Eds., 3rd International Conference on Engineering, Construction and Operations in Space C, Denver, Colorado, 31 May-4 June 1992.

133 "A theoretical basis for coupling via induced currents to biological systems for ultra fast switched magnetic fields," New York Academy of Sciences, 1992.

132 "Some engineering models for interactions of electric and magnetic fields with biological systems", *Bioelectromagnetics*, Supplement 1, 67-85, 1992.

131 "The use of high temperature superconducting films for the magnetic storage of information", with J. Cairns, Z.Zhang and M. Dugas, *IEEE Transactions on Magnetics*, vol. 28, (5), 2077-2080, 1992.

130 "Radically focusing fiber optic probes for laser angioplasty", with R.T. Mihran and H. D. Wu, *Biomedical Optics*, January 1992.

129 "Modification of the 1979 "Denver wire code" for different wire or Plumbing types", with E. Leeper, N. Wertheimer, D. Savitz and H. Wachtel, *Bioelectromagnetics*, vol. 12, (5), 315-318, November 1991.

128 "A one room school house plan for education", with C.H. Marbury, L. Lawsine and R.N. Nicholson, *IEEE Transactions on Education*, vol. 34, (4), November 1991.

127 "Editorial: some sources of hazards, safety, and electrical engineering," *IEEE Transactions on Education*, vol. 34, (3), 209-210, August 1991.

126 "Modulation of nerve excitability *in vitro* by pulsed ultrasound", with R.T. Mihran and H. Wachtel, *Innovation Et Technologie En Biologie Et Medicine*, vol. 12, (1), 53-63, 1991.

125 "Engineering properties of lunar regolith and their impact on mining", with Perkins, S. Sture and H. Y. Ko, *Proceedings of the International Symposium on Mine Mechanization and Automation*, June 1991.

124 "Laser ablation of biological material using focused and pulsed laser beam", with K.S. Lee and M. Mertz, Sung Kyun Kwan University Collection of Technical Papers (Science & Technology Section), vol. 42, (1), special edition, April 1991.

123 Microlenses. coupling light to optical fiber, H.D. Wu and F.S. Barnes, Eds., IEEE Press, New York, 1991.

122 "A theory of shot noise in quantum wells and applications in resonant tunneling heterojunction bipolar transistors," with J. Han, *IEEE Transactions on Electron Devices*, 38, 2, 237-241, February 1991.

121 "Editorial", *IEEE Transactions on Education*, vol. 33, (4), 313, November 1990.

120 "The effects of time varying magnetic fields on biological materials," *IEEE Transactions on Magnetics*, vol. 26, (5), September 1990.

119 "Transient modification of membrane potential and conductance by single ultrasound bursts modulates neuronal excitability," with R.T. Mihran and H. Wachtel, Annual International Conference of IEEE Engineering in Medicine and Biology Society, vol. 12, (1), 1990.

118 "Optical response of bulk Bi-Sr-Ca-Cu-O," with W. Eidelloth, *IEEE Journal of Quantum Electronics*, 25 (11), 2405-2409, 1989.

117 "Suspension in magnetic recording using high  $T_c$  superconductors," with B. R. Scharf and M. Dugas, *IEEE Transactions on Magnetics*, 25 (5), 3230-3232, 1989.

116 "Radio-microwave interactions with biological materials," *Health Physics*, 56 (5), 759-766, 1989.

- 115"Josephson junctions with bulk  $\text{YBa}_2\text{Cu}_3\text{O}_{7-x}$ ,  $\text{Bi}_2\text{Sr}_2\text{CaCu}_2\text{O}_x$  and  $\text{Tl}_2\text{Ca}_2\text{Ba}_2\text{Cu}_3\text{O}_{10+x}$ ," with W. Eidelloth, S. Geller, K.-Y. Wu, Z.Z. Sheng, and A.M. Hermann, *IEEE Trans. on Magnetism*, 25 (2), 939-942, 1989.
- 114"The use of wiring configuration and wiring codes for estimating externally-generated electric and magnetic fields," with D. Savitz, H. Wachtel and J. Fuller, *Bioelectromagnetics* 10, 13-21, 1989.
- 113"Applications of high temperature superconductors to recording heads," with M. Dugas, W. Eidelloth, *IEEE Trans on Magnetism* 24 (6), 2395-2397, 1988.
- 112"Pair tunneling and weak links in bulk  $\text{Tl}_2\text{Ca}_2\text{Ba}_2\text{Cu}_3\text{O}_{10+x}$  up to 77 K," with W. Eidelloth, Z. Z. Sheng and A. M. Hermann, *Applied Physics Communications* 8 (4), 191-200, 1988.
- 111"An M.S. curriculum in telecommunications," with Julian Holtzman, *IEEE Transactions on Education* 31, (3), 213-214, August 1988.
- 110"Interdisciplinary M. S. Program in Telecommunications at the University of Colorado," with R. Shain, *Telematics and Informatics* 5 (2), 115-120, 1988.
- 109"Case-control study of childhood cancer and exposure to 60-hertz magnetic fields," with D. Savitz, H. Wachtel, E. John and J. Tvrdik, *Amer. J. Epidemiol.* 128 (1), 21-38, 1988.
- 108"Mechanisms of interaction of magnetic fields with biological systems," *IEEE Trans. on Magnetics* 24 (4), 2101-2104, 1988.
- 107"Case control study of childhood cancer and electromagnetic fields," with D. Savitz, *Amer. J. Epidemiol.*, 126 (4), 780, 1988.
- 106"Editorial: new directions for the IEEE Transactions on Education", *IEEE Transactions on Education*, vol. 21, (2), 53, May 1988.
- 105"Case-control study of childhood cancer and residential exposure to electric and magnetic fields," Contractor's Final Report, with D. Savitz and H. Wachtel, report for the New York State Power Lines Project, Wadsworth Center for Laboratories and Research, Albany, NY, 1987.
- 104"Simple side coupler for coupling between laser diode and single-mode optical fiber," with K. S. Lee. *Applied Optics* 26 (12), 2294-2296, June 1987.
- 103"A Potentially Low-Noise Avalanche Diode Microwave Amplifier," with W.-H. Su and K. F. Brennan, *IEEE Transactions on Electron Devices* ED-34 (5), 966-972, May 1987.
- 102"Vertical cavity surface emitting laser structure in molecular beam epitaxial GaAs/AlGaAs using a multilayered dielectric mirror", with Dave Christenson, topical meeting on semiconductor lasers Southwest Optics Conference of Optical Society of America, February 1987. NOTE: This was first the conference on surface emitting lasers.
- 101"Some possible limits on the minimum electrical signals of biological significance," pp. 339-347 in Mechanistic approaches to interactions of electric and electromagnetic fields with living systems, M. E. Blank and E. Findl, Eds., Plenum Press, New York, 1987.
- 100"Use of optical fiber heads for optical disks," with K. S. Lee and A. W. Smith, *Applied Optics* vol. 25 (22), 4010-4012, November, 1986.
- 99"Chapters 1: "Interaction of DC electric fields with living matter," and 2: "Extremely low frequency (ELF) and very low frequency electric fields, rectification, frequency sensitivity, noise, and related phenomena," pp. 99-138 of Part II of The CRC handbook of biological effects on electromagnetic fields, Charles Polk and Elliot Postow, Eds., CRC Press, Boca Ration, Florida, 1986.

- 98"Injection Locking of Pacemaker Cells", with A. Smoller, A. Sheppard, Proceedings of the 9th Annual Conference, IEEE Engineering in Medicine and Biology Society, 1986.
- 97"Microlenses on the End of Single Mode Optical Fibers for Laser Applications," with K.S. Lee, *J. Applied Optics*, vol. 24, 3134-3139, October, 1985.
- 96"Forces on Biological Particles in Electric Fields," invited article, *J. Bioelectricity*, vol. 4 (2), 285-299, 1985.
- 95"Cell membrane temperature rate sensitivity as predicted from the Nernst equation," *J. BEMS*, vol. 5, 113, 1984.
- 94"An exposure system for variable electromagnetic field orientation electrophysiological studies," with J.D. Forster, H. Wachtel, R. Bowman and J. Frazer, *IEEE Microwave Theory & Technology*, Vol. MTT-33, (8), 674-680, August 1985.
- 93"Thickness dependence of the reflection coefficient from thin semiconductor films and measurements of the conductivity," with Baruch Divon, *Solar Cells*, vol. 6, 125-132, 1982.
- 92"Graduate school or work?," *IEEE Potentials*, December 1981 (Winter 1982 issue).
- 91"Noncontact measurement of microwave induced changes in frog heart beating rhythms," with R. Chalker and H. Wachtel, paper no. I-11, Bioelectromagnetic Society 3rd Annual Conference, Washington, D.C., August 9-12, 1981.
- 90"Microwave induced hypokinesia -- Effects of varying pulse intensity and width," with H. Wachtel, W.B. Stavinoha, A.T. Modak, and A.P. Dean, paper no. E-7, Bioelectromagnetic Society 3rd Annual Conference, Washington, D.C., August 9-12, 1981.
- 89"Some thoughts on accreditation in light of the experiment on advanced level accreditation," *Engineering Education*, Spring 1981.
- 88"Nonlinear impedance and low frequency dispersion effects of a polyelectrolyte under high sinusoidal fields," with C.J. Hu, in *Proceedings of the Division of Physical Chemical Symposium on Biological Effects of Non-Ionizing Radiation*, ACS Symposium Series, No. 157, K.F. Illinger, Ed., 255-270, 1981.
- 87"Enrollment: expansion, limitations, or retrenchment: possible courses of action," presented at ASEE Annual Meeting, Amherst, Massachusetts, June 1980. Also in *Engineering Education*, February 1981.
- 86"Millimeter wave ellipsometer," with T. L. Thorpe and D. S. Gage, *Proceedings of the Society of Photo-Optical Instrumentation Engineers*, vol. 248, S.K. Deb, Ed., 158-165.
- 85"Millimeter wave Fabry-Perot interferometer for the measurement of the conductivity of thin films for solar cells," with D. S. Gage and L. Lewin, *Proceedings of the Society of Photo-Optical Instrumentation Engineers*, vol. 248, S. K. Deb, Ed., 148-157.
- 84"Nonlinear interactions of electromagnetic waves with biological materials," with C. J. Hu, in Nonlinear Electromagnetics, P. Uslenghi, Ed., Academic Press, New York, 391-426, 1980.
- 83"Short microwave pulses cause ultrastructural membrane damage in neuroblastoma cells," with M. M. Webber, L. A. Seltzer and K. N. Prasad, *Journal of Ultrastructure Research*, vol. 71, 321-330, 1980.
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