

## Changing Higher Education

Major changes occurring in the world are redefining the metrics of excellence for higher education.

### Biography



I am Lloyd Armstrong, University Professor and Provost Emeritus at the University of Southern California. I hold appointments in the USC Rossier School of Education and the USC College of Letters, Arts and Sciences. My research interest is on the research university of the future, with particular focus on the globalization of higher education.

I was Provost and Senior Vice President for Academic Affairs of the University of Southern California from August, 1993 until June, 2005. I chaired the drafting of the Strategic Plan for the University, which was accepted by the Trustees in June of 1994, and of the update of the plan that was approved by the Trustees in October of 1998. Following this Plan, the University significantly revamped its undergraduate programs, greatly encouraged and strengthened interdisciplinary research and teaching, and significantly increased its

already strong emphasis on the benefits of globalization for its faculty and students. The actions called for in the 1994 strategic plan and its update have been instrumental in the dramatic improvement shown by USC over the past decade. More recently, I chaired the drafting of the 2004 Strategic Plan for the University: Building Strategic Capabilities for the University of the 21st Century.

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Prior to coming to USC, I was dean of the school of arts and sciences at the Johns Hopkins University from 1987 to 1993. I arrived at Johns Hopkins in 1969 and rose through the faculty ranks, attaining the rank of professor in 1975. I served as chair of the department of physics and astronomy from 1984-1987.

During the period 1981-1983, I took leave from Hopkins in order to serve as in the dual roles of Program Officer for Atomic, Molecular, and Plasma Physics and Program Officer for Theoretical Physics at the National Science Foundation. I later served on the NSF Advisory Committee for Physics (1985-88), and as a member of the Committee of Visitors of the Physics Division of the NSF (1991).

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I received a B.S in physics from MIT in 1962, and Ph.D. in physics from the University

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of California at Berkeley in 1966. Following graduation, I was a post-doctoral fellow at the Lawrence Berkeley Laboratory (1966-67). After leaving the Lawrence Berkeley Laboratory, I spent two years as a Senior Physicist at the Westinghouse Research Center in Pittsburgh before going to Johns Hopkins.

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I have served on a large number of boards and committees of the National Academy of Sciences/National Research Council, including the Committee on Recommendations for the U.S. Army Basic Scientific Research (1984-87), the Committee on Atomic and Molecular Sciences (1984-89, Chair 1985-88), and the Board on Physics and Astronomy (1989-96, executive committee 1993-96). I served on the Advisory Board of the Institute for Theoretical Physics in Santa Barbara (1992-96, chair 1994-95), of the Institute for Theoretical Atomic, Molecular and Optical Physics at Harvard (1994-97), and the Advisory Board of the Rochester Theory Center for Optical Science and Engineering (1996- 98, chair 1997-98).

I have also served on the boards of directors of the California Council of Science and Technology ( 1994-2005) , the Southern California Economic Partnership (1994-2000), and the Pacific Council on International Policy (1996-2005). I am a member of the Pacific Council on International Policy, and the Council on Foreign Relations. I am on the Advisory Board for Inside Track, Inc. I consult on a wide variety of issues in higher education.

## **Lloyd Armstrong, Jr.**

### **EDUCATION:**

- 1965-1966 Postdoctoral Physicist, Lawrence Radiation  
Laboratory, Berkeley, California
- 1966 University of California, Berkeley, Ph.D. (Physics)  
Field of Thesis: Experimental and Theoretical  
Investigation of Atomic Hyperfine Structure
- 1962 Massachusetts Institute of Technology, B.S.  
(Physics)

### **HONORARY DEGREE:**

- 2005 Hebrew Union College-Jewish Institute of Religion, Doctor of Humane  
Letters

### **POSITIONS HELD:**

- 2005- University Professor and Provost Emeritus  
University of Southern California
- 2005- 2005 Professor of Education, University of Southern California
- 1993-2005 Provost and Senior Vice President for Academic Affairs, University of  
Southern California
- 1993- Professor of Physics, University of Southern California
- 1987-1993 Dean, School of Arts and Sciences, The Johns Hopkins University
- 1985-1987 Chair, Department of Physics and Astronomy, The Johns Hopkins  
University
- 1968-1993 Faculty Member, The Johns Hopkins University
- 1977-1993 Professor of Physics
- 1973-1977 Associate Professor of Physics
- 1969-1973 Assistant Professor of Physics
- 1968-1969 Research Associate

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- 1981-1983      Program Officer for Atomic, Molecular and Plasma Physics; Program Officer for Theoretical Physics; National Science Foundation, Washington, D.C.(on leave-of-absence from Johns Hopkins University)
- 1978-1979      Visiting Fellow, Joint Institute for Laboratory Astrophysics, Boulder, Colorado (on leave-of-absence from Johns Hopkins University)
- 1972-1973      Maitre de Recherche Associe, Centre National de la Recherche Scientifique, Orsay, France (on leave-of-absence from Johns Hopkins University)
- 1967-1968      Senior Physicist, Westinghouse Research Center, Pittsburgh, Pennsylvania

**VISITING POSITIONS:**

- Summer 1983      Visiting Physicist, Centre National de la Recherche Scientifique, Orsay, France
- Summer 1981      Professor d'Echange, Universite de Paris, Paris, France
- Summer 1977      Visiting Physicist, Centre National de la Recherche Scientifique, Orsay, France
- Summer 1976      Consultant, Lawrence Berkeley Laboratory, Berkeley, California
- Summer 1975      Visitor, Aspen Center for Physics, Aspen, Colorado
- Summer 1974      Visiting Professor, University of Cologne, Cologne, Germany
- Summer 1970      Visiting Physicist, Centre National de la Recherche Scientifique, Orsay, France

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### **PROFESSIONAL MEMBERSHIPS:**

Fellow, American Physical Society

### **PROFESSIONAL ACTIVITIES:**

- 1997                      Chair, Workshop on Atomic, Molecular and Optical Physics, Basic Energy Sciences Division of the Department of Energy
- 1996-1998              Member, Advisory Board of the Rochester Theory Center for Optical Science and Engineering. Chair, 1997-98
- 1994-1997              Member, Advisory Board of the Institute for Theoretical Atomic, Molecular, and Optical Physics, Harvard
- 1992-1996              Member, Advisory Board of the Institute for Theoretical Physics, Santa Barbara  
Steering Committee, 1993-1996  
Chair, 1994-95
- 1989-1996              Member, National Academy of Sciences/National Research Council (NAS/NRC) Board on Physics and Astronomy, Executive Committee, 1993-1996
- 1993                      Member, National Academy of Sciences/National Research Council (NAS/NRC) Committee on Atomic and Molecular Sciences Science Assessment Panel
- 1992                      Director, Adriatico Research Conference on Hydrogen Atoms in Intense Electromagnetic Fields, International Center for Theoretical Physics, Trieste, August, 1992
- 1991-1994              Member, National Academy of Sciences/National Research Council (NAS/NRC) Committee on Atomic and Molecular Sciences Panel on Future Opportunities in Atomic, Molecular and Optical Sciences
- 1991                      Chairman, Panel on Quantum and Nonlinear Optics, for Future Research Opportunities in Atomic, Molecular, and Optical Physics, Department of Energy
- 1991                      Member, Committee of Visitors, Physics Division, National Science Foundation

## **Lloyd Armstrong, Jr.**

- 1989-1992 National Academy of Sciences/National Research Council (NAS/NRC) Panel for the National Measurement Laboratory (NML) at the National Institute of Standards and Technology (NIST) Member-at-Large, 1989; Panel for Physics (successor panel following NIST reorganization)
- 1989 Member, Local Organizing Committee, 1989 International Conference on the Physics of Electron and Atomic Collisions (ICPEAC)
- 1987-1988 Member, Nominating Committee for the 1987, 1988 Herbert P. Broida Prize (American Physical Society)
- 1986-1988 Member, American Physical Society Panel on Public Affairs
- 1985-1992 Member, National Academy of Sciences/National Research Council (NAS/NRC) Panel for the Joint Institute for Laboratory Astrophysics of the Board on Assessment of the National Bureau of Standards, Chairman, 1989-92
- 1985-1989 Member, Nominating Committee for the Davisson-Germer Prize (American Physical Society), 1985, 1987, Chairman, 1989
- 1985-1988 Member, National Science Foundation (NSF) Advisory Committee for Physics
- 1984-1990 Board of Editors, Physical Review A
- 1984-1990 Member, Organizing Committee, International Conference on Multiphoton Processes III (ICOMP III), 1984; International Conference on Multiphoton Processes IV (ICOMP IV), 1987; International Conference on Multiphoton Processes V (ICOMP V), 1990
- 1984-1989 Member, National Academy of Sciences/National Research Council (NAS/NRC) Committee on Atomic and Molecular Sciences  
Vice Chairman, 1984-1985  
Chairman, 1985-1988  
Past Chair, 1988-1989  
Chairman, Panel on Facilities, 1984-1985  
Chairman, Panel on Theoretical Atomic and Molecular Sciences, 1984-1985

### **Lloyd Armstrong, Jr.**

- 1984-1987 Member, National Academy of Sciences/National Research Council (NAS/NRC) Committee on Recommendations for the U.S. Army Basic Scientific Research
- 1983-1984 Member, Nominating Committee, Division of Electron and Atomic Physics of the American Physical Society
- 1980 Co-organizer, The Johns Hopkins University Workshop on Atomic Data Needs in Astrophysics
- 1976 Member, Division of Electron and Atomic Physics of the American Physical Society (APS) Program Committee

#### **OTHER ACTIVITIES:**

- 2006 - Member, Advisory Board of Inside Track
- 2001- Member, Council on Foreign Relations
- 1996- 8/26/20108/26/2010 Member, Pacific Council on International Policy
- 1996-2005 Member, Board of Directors of the Pacific Council on International Policy
- 1994-2005 Member, Board of Directors of the California Council on Science and Technology
- 1994-2000 Member, Board of Directors of the Southern California Economic Partnership
- 1994-2000 Member, National Advisory Board of The Johns Hopkins University Center for Talented Youth
- 1989-1993 Member, Governing Board of the University Consortium for Atmospheric Research

#### **RESEARCH FUNDING:**

- 1975-1982 Department of Energy
- 1972-1981 National Science Foundation (no funding 1981-1983  
1983-1990 because was on leave at NSF during that period)

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**SCIENTIFIC PUBLICATIONS:**

1. Magnetic Moments of Rhenium-186 and Rhenium-188 and Analysis of the Rhenium Hyperfine Structure, with Richard Marrus, Phys. Rev. 138, B310 (1965).
2. Nuclear Moments of Americium-241 and 16-h Americium-242 and Analysis of the Hyperfine Fields, with Richard Marrus, Phys. Rev. 144, 994 (1966).
3. Relativistic Effects in Atomic Fine Structure, J. Math. Phys. 7, 1891 (1966).
4. Dependence of Laser Axial Beat Note Amplitude on Zeeman Separation, with Dolores Ali and Tetsuo Hadeishi, UCRL-1750 (September 1966).
5. Matrix Elements of the Coulomb Interaction in Conjugate Configurations, Phys. Rev. 166, 63 (1968).
6. Spin Orbit Constants and the Scaled Thomas Fermi Potential, with R. Liebermann, Journal of Quantitative Spectroscopy and Radiative Transfer 8, 1163 (1968).
7. Relativistic Effects in Atomic Fine Structure. II. J. Math. Phys. 9, 1983 (1968).
8. Symmetry Properties of the Spin-Spin Contact Hamiltonian, Phys. Rev. 170, 122 (1968).
9. Matrix Elements Between Configurations Having Several Open Shells. I. Phys. Rev. 172, 12 (1968).
10. Matrix Elements Between Configurations Having Several Open Shells. II. Phys. Rev. 172, 18 (1968).
11. Magnetic Interactions in Mixed Configurations, with S. Feneuille, Phys. Rev. 173, 58 (1968).
12. Intermediate Coupling Transition Probabilities in Si II, with R. Liebermann, Journal of Quantitative Spectroscopy and Radiative Transfer 9, 123 (1969).
13. Matrix Factorizations for the Coulomb Interaction between Electrons in Atoms, with B. R. Judd, Proc. Roy. Soc. (London) A309, 185 (1969).
14. Crystal Field Induced Configuration Interaction in the Configuration  $(l_n + l_2)^N$ , J. Chem. Phys. 51, 129 (1969).
15. Reduced Spin-Spin Matrix Elements for  $f^n$ , with L. H. Taylor, J. Chem. Phys. 51, 3789 (1969).



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16. Quasiparticles in Atomic Shell Theory, with B. R. Judd, Proc. Roy. Soc. (London) A315, 27 (1970).
17. Atomic Structure Calculations in a Factorized Shell, with B.R. Judd, Proc. Roy. Soc. (London) A315, 39 (1970).
18. Group Properties of Radial Wavefunctions, Supp. to J. de Phys. (Paris) 31, C4-17 (1970).
19. O(2,1) and the Harmonic Oscillator Radial Function, J. Math. Phys. 12, 953 (1971).
20. Group Properties of Hydrogenic Radial Functions, Phys. Rev. 3, 1546 (1971).
21. Theory of the Hyperfine Structure of Free Atoms, (Wiley Interscience, New York, 1971).
22. Coulomb Correction in Nuclear Beta Decay: Elementary Particle Treatment, with C. W. Kim Phys. Rev. C 5, 672 (1972).
23. SO(2,1) and the Hulthen Potential, with B. I. Dunlap, Phys. Rev. A 6, 1370 (1972).
24. Limitation on the Use of Impulse Approximation in Nuclear Decay, with C. W. Kim, Phys. Letters 41B, 39 (1972).
25. Comparison of Impulse Approximation and Elementary Particle Treatment in Nuclear Beta Decay, with C. W. Kim, Phys. Rev. C 6, 1924 (1972).
26. On the Additive Nature of Correlation and Relativistic Effects in Atomic Hyperfine Structure, with S. Feneuille, Phys. Rev. A 8, 1173 (1973).
27. Influence of Photon Statistics on the Block-Siegert Shift, with S. Feneuille, J. Phys. B 6, L182 (1973).
28. Group Theory and Atomic Physics, Proceedings of the Second International Colloquium on Group Theoretical Methods in Physics, Nijmegen, 1973.
29. Relativistic Effects in the Many Electron Atom, with S. Feneuille, Vol. 10 of "Advances in Atomic and Molecular Physics" Ed. by D. R. Bates (Academic Press, 1974).
30. An Open Shell Random Phase Approximation, J. Phys. B. 7, 2320 (1974).
31. Theoretical Analysis of the Phase Shift Measurement of Lifetimes Using Monochromatic Light, with S. Feneuille, J. Phys. B 8, 546 (1975).

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32. Comment Concerning the Study of Autoionizing States Using Parametric Generation, with B. L. Beers, Phys. Rev. Lett. 34, 1290 (1975).
33. Resonant-Multiphoton Ionization Via the Fano Autoionization Formalism, with B. L. Beers and S. Feneuille, Phys. Rev. A 5, 1903 (1975).
34. Exact Solution of a Realistic Model for Two Photon Ionization, with B. L. Beers, Phys. Rev. A 12, 2447 (1975).
35. Phenomenes d'Interferences Dependante du Flux Lumineux dans les Processus Resonnants d'ionization Multiphotonique, with S. Feneuille, J. de Physique 36, L235 (1975).
36. Photoionization Cross Section for Atomic Chlorine Using an Open Shell Random Phase Approximation, with A. Starace, Phys. Rev. A 13, 1850 (1976).
37. Photon Correlation Effects in Resonant Two-Photon Ionization, with P. Lambropoulos and N. K. Rahman, Phys. Rev. Lett. 36, 952 (1976).
38. Relativistic Transition Probabilities in the Li and Be Sequences, with D. Lin and W. Fielder, Phys. Rev. A 14, 114 (1976).
39. Multiconfiguration Hartree-Fock Calculation of Photoionization Cross Sections of the Rare Gases, with J. R. Swanson, Phys. Rev. A 15, 661 (1977).
40. Photoionization of Positive Ions: Outer p Subshells of the Noble Gas Isoelectronic Sequences, with A. Msezane, R. F. Rielman, S. Manson, and J. R. Swanson, Phys. Rev. A 15, 668 (1977).
41. Relativistic Oscillator Strengths for E1 Transitions in the Argon Isoelectronic Sequence, with D. Lin and W. Fielder, Phys. Rev. A 16, 589 (1977).
42. Nonexponential Decay Profile of the 2 S State of He-like Ions, with D. Lin, Phys. Rev. A 16, 791 (1977).
43. Multiconfiguration Hartree-Fock Calculation of Photoionization Cross Sections of the Rare Gases. II. Final State Correlation, with J. R. Swanson, Phys. Rev. A 16, 1117 (1977).
44. Model Calculation of Resonant Multiphoton Ionization, with B. L. Beers, in Electronic and Atomic Collisions, Ed. by G. Watel et. al. (North Holland, 1977).

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45. Theory of Resonant Multiphoton Ionization in Atoms, with S. Feneuille, in *Multiphoton Processes*, Ed. by J. H. Eberly and P. Lambropoulos (John Wiley and Sons, New York, 1978).
46. Multiconfiguration Hartree-Fock Calculation of Magnetic Quadrupole Transition by Be Isoelectronic Sequence, with D. L. Lin and W. Fielder, *Astrophysical Journal* 219, 1093 (1978).
47. Relativistic Effects in Highly Ionized Atoms, in *Structure and Collisions of Ions and Atoms*, Ed. by I. Sellin (Springer-Verlag, 1978).
48. Interference Between Radiative Emission and Autoionization in the Decay of Excited States of Atoms, with C. E. Theodosiou and M. J. Wall, *Phys. Rev. A* 18, 2538 (1978).
49. Short-time Behavior in Multiphoton Ionization, with C. E. Theodosiou, M. Crance and S. Feneuille, *Phys. Rev. A* 19, 766 (1979).
50. Two Photon Ionization of Cs, with C. E. Theodosiou, *J. Phys. B* 12, L87 (1979).
51. Laser Band Width Effect on Two Photon Two Channel Ionization in Cs, with J. H. Eberly, *J. Phys. B* 12, L291 (1979).
52. Bistability Effects in Cooperative Multiphoton Ionization, *J. Phys. B* 12, L719 (1979).
53. Resonance Lineshape and Photoelectron Spectrum in Power Broadened Two Photon Ionization, with S. V. O'Neil, *J. Phys. B* 13, 1125 (1980).
54. Photoionization Cross Sections Using the Multiconfiguration Hartree-Fock and Its Extensions, with W. Fielder, *Physica Scripta* 21, 457 (1980).
55. Variation of the Effective Order of Nonlinearity Near a Minimum in the Two-Photon Ionization Cross Section of Cs, with M. Edwards, *J. Phys. B* 13, L497 (1980).
56. An Adiabatic and Near-Adiabatic Model of Multiphoton Ionization, with H. C. Baker, *J. Phys. B* 13, 4727 (1980).
57. Relativistic Study of E1 and M1 Transitions in the Boron Isoelectronic Sequence, with M. Samii, D. Thon-That, *Phys. Rev. A* 23, 3034 (1981).
58. Bistability in Multiphoton Ionization with Recombination, with H. C. Baker, *Optics Letters* 6, 357 (1981).

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59. Numerology, Hydrogenic Levels, and the Ordering of Excited States in One-Electron Atoms, *Phys. Rev. A* 25, 1794 (1982).
60. Energy Levels of Doubly Excited States of He, with M. Crance, *Phys. Rev. A* 26, 694 (1982).
61. Fluorescence Induced by Resonant Multiphoton Ionization Near an Autoionizing State, with M. Crance, *J. Phys. B* 15, 3199 (1982).
62. Four Wave Mixing Under Double-Resonance Conditions, with M. Crance, *J. Phys. B* 15, 4637 (1982).
63. Relativistic Effects in Many-Body Systems, appeared in *Atomic Physics 8, Proceedings of the Eighth International Conference on Atomic Physics, Goteborg, Sweden, 1982*. Edited by I. Lindgren, A. Rosen and S. Svanberg. (Plenum).
64. Ground State Doublet Separations in the Boron and Fluorine Isoelectronic Sequences, with D. Frye and S. Lakdawala, *Phys. Rev. A* 27, 1709 (1983).
65. Channel-Interaction Effects on the 3p-Subshell Photoionization of Chlorine with W. Fielder, *Phys. Rev. A* 28, 218 (1983).
66. Comparison of MCDF and MCRRPA Transition Energy Calculations in the Be Isoelectronic Sequence, with D. Frye, *Phys. Rev. A* 29, 2220 (1984).
67. Model Study of Multiphoton Ionization in Strong Fields, with M. Edwards and L. Pan, *J. Phys. B* 17, L515 (1984).
68. Model Study of Above Threshold Multiphoton Ionization in Strong Fields, M. Edwards and L. Pan, *J. Phys. B* 18, 1927 (1985).
69. New Approach to Calculating Oscillator Strengths and Transition Energies: Liouville-Dirac-Fock Theory, with D. Frye, *Phys. Rev. A* 31, 2070 (1985).
70. Complex-Rotated Hartree-Fock Method and Its Application to the Be-Shape Resonance, with D. Frye, *Phys. Rev. A* 34, 1692 (1986).
71. Comments on the Effects of the Pondermotive Potential in the Above-Threshold Ionization Process, with L. Pan and J. Eberly, *J. Opt. Soc. Am. B* 3, 1319 (1986)

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72. Dressed State Perturbation Theory for Multiphoton Ionization of Atoms, with L. Pan and B. Sundaram, J. Opt. Soc. Am. B/4, 754 (1987).
73. Role of Excited States in Multiphoton Dynamics, with B. Sundaram, Phys. Rev. A, Phys.Rev. A 38, 152, (1988).
74. Modeling Strong Field ATI, with B. Sundaram, Journal of the Optical Society of America +B,7, 414 (1990).

### **OTHER PUBLICATIONS**

1. Distance Learning: An Academic Leader=s Perspective on a Disruptive Product, Change, November/December, 32, 20 (2000).
2. A New Game in Town: Competitive Higher Education, in Digital Academe: The New Media and Institutions of Higher Education and Learning, eds. Dutton, William H. and Loader, Brian D. Chapter 6. (Routledge, 2002); also in Information, Communication & Society,4, 479 ( 2001)
3. Higher Education and the Global Marketplace: Entrepreneurial Activity in a Dynamic Environment, with Douglas Becker . 2004 Pullias Lecture, USC Center for Higher Education Policy Analysis: <http://www.usc.edu/dept/chepa/pullias.html>
- 4 . Globalization and Higher Education. The Navigator, 6 (1) Fall 2006. USC Center for Higher Education Policy Analysis: <http://www.usc.edu/dept/chepa/pdf/nav2006f.pdf>.