Jacob J. Leventhal

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University degrees	B.S. (Engineering Physics)	Washington University (St. Louis)	1960
	Ph. D. (Physics)	Univ. of Florida (Gainesville)	1965
Academic	University of Florida	Teaching Assistant	1960-65
	University of Missouri - St. Louis	Assistant Professor	1968-71
	University of Missouri - St. Louis	Associate Professor	1971-76
	University of Missouri - St. Louis	Professor	1976-87

	University of Missouri - St. Louis	Curators' Professor	1987-2012
	University of Missouri - St. Louis	Founders Curators' Professor	2012-2015
	University of Missouri - St. Louis	Curators' Distinguished Professor Emeritus	2015-
Postdoctoral	Brookhaven National Lab.	Post-Doctoral Fellow	1965-68

Honors

- NSF Fellow – 1964
- Fellow American Physical Society - 1977
- Presidential Research Award (University of Missouri) 1982
- Curators' Professor – 1987
- Lecturer International Centre for Theoretical Physics, Trieste, Italy 1989
- American Physical Society Award for Research at an Undergraduate Institution 1990

  The citation for this award reads:

  For his studies of energy transfer in atomic collisions, and for his research on photoionization processes in atoms and molecules, and for his long-term involvement of undergraduate students in his research program.
- Office of Research Award (University of Missouri) 1992

Research interests

- Experimental studies of atomic properties and parameters.
- Experiment and theory relating to the quantum/classical boundary.
- Experimental studies of photoionization of laser excited atoms.

Teaching

- Most undergraduate and several graduate physics courses.
- Developed and pioneered the use of four campus interactive television course teaching graduate Atomic & Molecular Physics.
- Coaching of PhD Candidates for the qualifying examination.
- Authoring textbooks on Physics for graduate and undergraduate studies.

Some Career Highlights

- First "home-grown" Curators' Professor at UMSL (1987). That is, the first person honored with an appointment as Curators' Professor who began their career as an Assistant Professor at UMSL. The majority of the work done by the three prior UMSL Curators' Professor honorees, the work that led to this honor, was performed at other institutions. In fact, all three had been hired at UMSL as full Professors. This is an important distinction, especially for an experimental physicist, because there were no experimental facilities available at UMSL in 1968. The promised laboratory did not exist – there was nothing but a bare floor. Moreover, none of the requisite support facilities for experimental physics (electronics shop, machine shop and technicians) existed. The entire Atomic & Molecular Physics Laboratory had to be built from scratch as did all the departmental facilities. This was all done without the aid of graduate students or postdoctoral fellows. During the

building of the laboratory and the support facilities research was, however, carried out, data were acquired and papers were published in major journals on theoretical aspects of atomic and molecular physics. In 1970 the first apparatus was completed and in 1970 the first journal article based on data from the UMSL Atomic & Molecular Physics Laboratory were published.

▪ While performing experiments using the first apparatus, the one completed in 1970, construction of a new apparatus was begun in 1971. This ambitious new project was designed to detect and analyze light emerging from ion-molecule collisions at extremely low energies. The project was undertaken because the analysis of light would provide data of a much more detailed nature than previously available using more conventional kinematic methods. Because the ion beam energies were to be low, the intensities of the incident ion beams would, necessarily, be weak as would be the light signals emanating from the interactions. Unfortunately, the referees of proposals that were submitted to federal funding agencies unanimously agreed that this light signal would be so weak as to be undetectable. They therefore recommended against funding. Although federal agencies would not fund the project, Research Corporation did fund it with three modest, but extremely important grants, all of which were reviewed (obviously not by the same reviewers). After several years, late one night, the light signal was detected and analyzed. The event was celebrated with members of the cleaning crew in Stadler Hall, toasting these new data with Coca Colas from a vending machine. Publications in The Physical Review Letters and Chemical Physics Letters followed shortly thereafter as did federal funding (1974).

▪First UMSL recipient of the University of Missouri Presidential Research Award (1982).

▪The first observations of ultraviolet emissions from H_3 molecules were made in the UM-St. Louis Atomic & Molecular Physics Laboratory (1985).

▪Invited to lecture at the International Centre for Theoretical Physics, Trieste, Italy (1989).

▪5th recipient of the American Physical Society (APS) Prize for a Faculty Member for Research in an Undergraduate Institution (1990). Other recipients are faculty at Amherst, Haverford, Swarthmore and Williams.

▪Two papers, Hezel et. al. (1992), designated by the American Journal of Physics as among their "Most Memorable" of first 60 years of publication.

▪The accepted value of the ionization energy of sodium as quoted by the US National Institute of Standards and Technology (formerly the National Bureau of Standards) was measured in the UM-St. Louis Atomic & Molecular Physics Laboratory (1998).

▪Invited to give numerous talks at national and international meeting as well as at major institutions around the world. The latter include the Max Planck Institutes in Germany, the École Normale Supérieure in Paris and the Scuola Normale Superiore in Pisa. Also included are many major institutions in the US such as Cornell, Princeton and Yale.

Lectures

Too many talks have been presented over the years to be listed here. Below is a small sampling of institutions at which major talks were presented.
USA: Cornell, Colorado, Dartmouth, Illinois, NIST, Princeton, Texas, Tulane, William & Mary, Yale.
Abroad: École Normale Supérieure (Paris), Hahn-Meitner Institute (Berlin), International Centre for Theoretical Physics (Trieste),Max Planck Institutes (Germany), Scuola Normale Superiore (Pisa), University of Pisa, Utrecht University (Netherlands).

Publications

(refereed scientific journals)

T.L. Bailey, R. L. Champion, L. D. Doverspike and J. J. Leventhal, "Angular and Energetic Studies of Reactive Ion-Neutral Collisions", *in IVth International Conference on the Physics of Electronic and Atomic Collisions*, p 237, Science Bookcrafters, Inc. (1965)

L. Friedman, J. J. Leventhal and T. F. Moran, "Energy Transfer in Ion-Impact Mass Spectra. Application to Structural Mass Spectrometry", *J. Am. Chem. Soc.* 88, 5050 (1966).

J. J. Leventhal and L. Friedman, "Diatomic Ion-Molecule Reactions: $N_2^+ - N_2$, $CO^+ - CO$ and $O_2^+ - O_2$", *J. Chem. Phys*. **46**, 997 (1967).

J. J. Leventhal, T. F. Moran and L. Friedman, "Molecular Resonant Charge Transfer Processes; $H_2^+ - H_2$ and $N_2^+ - N_2$", *J. Chem. Phys*. *46*, 4666 (1967).

J. J. Leventhal and L. Friedman, "Charge Transfer and Proton Transfer in Polyatomic Ion-Molecule Systems", *J. Chem. Phys*. **48**, 1559 (1968).

J. J. Leventhal and L. Friedman, "Experimental Determination of D_3^+ Dissociation Energy", *J. Chem. Phys.* **49**, 1974 (1968).

M. DePas, J. J. Leventhal and L. Friedman, "Experimental Study of Heat of Proton Solvation", *J. Chem. Phys*. **49**, 5543 (1968).

L. Friedman, J. J. Leventhal and T. F. Moran, "Mass Spectrometer Utilizing an Ion Beam for Ionization of the Gas to be Analyzed", U. S. Patent #3,392,280. Issued to the Atomic Energy Commission.

J. J. Leventhal and L. Friedman, "Energy Transfer in the De-Excitation of

(H_3^+)* by H_2", *J. Chem. Phys*. **50**, 2928 (1969).

R. Hubbard, M. Bohn and J. J. Leventhal, "Emission Regulator for Use in High Intensity Electron Impact Ion Source", *Nuc. Instr. and Meth*. **72**, 351 (1969).

G. R. North and J. J. Leventhal, "Model for Electron Transfer Cross Sections for Molecular Systems", in *VIth International Conference on the Physics of Electronic and Atomic Collisions*, p 60, MIT Press (1969).

G. R. North and J. J. Leventhal, "Two Channel Model for Electron Transfer in Ion – Molecule Collisions", *J. Chem. Phys*. **51**, 4236 (1969).

M. DePas, J. J. Leventhal and L. Friedman, "Tandem Mass Spectrometer Study of D_3^+ and Solvated Derivatives", *J. Chem. Phys*. **51**, 3748 (1969).

G. R. North, P. B. James and J. J. Leventhal, "Reply to Comment on 'Two Channel Model for Electron Transfer in Ion-Molecule Collisions'", *J. Chem. Phys*. **52**, 6452 (1970).

J. J. Leventhal and G. R. North, "Study of Calibration, Resolution and Transmission of an Electrostatic Velocity Selector", *Rev. Sci. Instr*. **42**, 120 (1971).

J. J. Leventhal, "Energetics of HeH^+ Formed in H_2^+ – He Collisions", *J. Chem. Phys*. **54**, 3279 (1971).

J. J. Leventhal, "Collision Mechanism Leading to the Formation of NO^+ in O^+ – N_2 Collisions", *J. Chem. Phys*. **54**, 5102 (1971).

J. J. Leventhal, "Experimental Investigation of the Energetics of Ion-Molecule Reactions of Ground State C^+ Ions with N_2 and O_2", *J. Chem. Phys*. **55**, 465 (1971).

K. E. Maher, G. J. McClure and J. J. Leventhal, "Electron Transfer and Ion-Atom Interchange in C^+ – CO Collisions", *J. Chem. Phys.* **55**, 5549 (1971).

K. E. Maher and J. J. Leventhal, "Energy Transfer in Electron Exchange Reactions at Low Kinetic Energies", *Phys. Rev. Lett*. **27**, 1253 (1971).

J. J. Leventhal and L. Friedman, "Ar^+ – C_2Cl_4 Reactions and Their Role in the Collection of $^{37}Ar^+$ Produced by Solar Neutrinos", *Phys. Rev. D* **6**, 3338 (1972).

H. H. Harris and J. J. Leventhal, "Production of Excited OD^+ in O^+ – D_2 Collisions at Low Relative Energies (below 4 eV)", *J. Chem. Phys*. **58**, 2333

(1973).

T. R. Grossheim, J. J. Leventhal and H. H. Harris, "Production of He^+ in He_2^+ – He Collisions Near Threshold", *Phys. Rev. A* **7**, 1591 (1973).

P. B. James, G. R. North, J. J. Leventhal and H. H. Harris, "Energetics of Proton Transfer in H_3^+ – D_2 Collisions", in *VIIIth International Conference on the Physics of Electronic and Atomic Collisions*, p 111, Institute of Physics (1973).

H. H. Harris, T. R. Grossheim and J. J. Leventhal, "Energy Dependence of the Cross Section for Collision-Induced Dissociation of CO^+ Near Threshold", in *VIIIth International Conference on the Physics of Electronic and Atomic Collisions*, p 107, Institute of Physics (1973).

J. J. Leventhal, "Reexamination of Product Peaks Near Centroid", *J. Chem. Phys.* **58**, 4710 (1973).

T. R. Grossheim, J. J. Leventhal and H. H. Harris, "Post-Threshold Behavior for CO^+ Collision Induced Dissociation", *Chem. Phys. Lett*. **22**, 137 (1973).

H. H. Harris, M. G. Crowley, T. R. Grossheim, P. J. Woessner and J. J. Leventhal, "Binding Energy of H_3^+", *J. Chem. Phys*. **59**, 6181 (1973).

G. R. North and J. J. Leventhal, "Classical Superposition Phenomena in $H_2^+(v=0)$ – He Reactive Collisions", *Chem. Phys. Lett*. **23**, 600 (1974).

G. R. North, H. H. Harris, J. J. Leventhal and P. B. James, "Model for $H_2^+(v=0)$ – He Collisions Above 2 eV", *J. Chem. Phys*. **61**, 5060 (1974).

H. H. Harris, M. G. Crowley and J. J. Leventhal, "Luminescence from He^+ – O_2 Collisions at Low Energy", *Chem Phys. Lett*. **29**, 540 (1974).

H. H. Harris, M. G. Crowley and J. J. Leventhal, "Luminescence from $C^+(H_2,H)CH^+$ Below 20 eV", *Phys. Rev. Lett*. **34**, 67 (1975).

H. H. Harris and J. J. Leventhal, "N_2^+ Meinel Radiation from O^+ – N_2 Collisions", *IXth International Conference on the Physics of Electronic and Atomic Collisions*, p 991, University of Washington Press (1975).

J. J. Leventhal and H. H. Harris, "Photon Emission from O^+ – H_2 Reactive Scattering", *IXh International Conference on the Physics of Electronic and Atomic Collisions*, p575, University of Washington Press (1975).

J. J. Leventhal, J. D. Earl and H. H. Harris, "Anomalous Vibrational State Distribution in $N_2^+(B^2\Sigma_u^+)$ after He_2^+ – N_2 Charge Transfer", *Phys. Rev. Lett*.

35, 719 (1975).

H. H. Harris and J. J. Leventhal, "Ultraviolet Emission in $O^+ - H_2$ Reactive Scattering", *J. Chem. Phys*. **64**, 3185 (1976).

G. H. Bearman, H. H. Harris and J. J. Leventhal, "Energy Transfer in He – N_2 and H – N_2 Collisions at 100 – 1000 eV", *Xth International Conference on the Physics of Electronic and Atomic Collisions, Commissariat a L'energie Atomique*, p286 (1977).

G. H. Bearman, H. H. Harris, J. J. Leventhal and J. D. Kelley, "Vibronic Excitation in Ion-Molecule Collisions", *Xth International Conference on the Physics of Electronic and Atomic Collisions*, Commissariat a L'energie , p197 (1977).

G. H. Bearman, J. D. Earl, R. J. Pieper, H. H. Harris and J. J. Leventhal, "Ionic Excitation in Low Energy Charge Transfer Collisions Between He_2^+ and some Diatomic Molecules", *Phys. Rev. A* **13**, 1734 (1976).

G. H. Bearman, H. H. Harris and J. J. Leventhal, "Ultraviolet Emission from CO_2^+ Produced in Low Energy $He_2^+ - CO_2$ Collisions", *Appl. Phys. Lett*. **28**, 345 (1976).

G. H. Bearman, J. D. Earl, H. H. Harris and J. J. Leventhal, "Selective Excitation in Charge Transfer Collisions with Ne_2^+", *Appl. Phys. Lett*. **29**, 108 (1976).

G. H. Bearman, F. Ranjbar, H. H. Harris and J. J. Leventhal, "Product State Distribution from CO^{++} - H_2 Electron Transfer", *Chem. Phys. Lett*. **42**, 335 (1976).

G. H. Bearman, J. D. Earl, H. H. Harris, P. B. James and J. J. Leventhal, "Rydberg Excitation of NO in H^+ – NO Collisions Near Threshold", *Chem. Phys. Lett*. **44**, 471 (1977).

G. H. Bearman, H. H. Harris and J. J. Leventhal, "Charge Transfer Excitation Channels in Positive Ion – N_2O Collisions at Low Energy", *J. Chem. Phys*. **66**, 4111 (1977).

F. Ranjbar, H. H. Harris and J. J. Leventhal, "CdII Excitation in Slow He^+ – Cd and He_2^+ – Cd Collisions", *Appl. Phys. Lett*. **31** 385 (1977).

J. D. Kelley, G. H. Bearman, H. H. Harris and J. J. Leventhal, "Dynamic Model for Vibronic Excitation in Low Energy Atom-Molecule Collisions", *Chem. Phys. Lett*. **50**, 295 (1977).

J. D. Kelley, G. H. Bearman, H. H. Harris and J. J. Leventhal, "Vibronic Excitation in Atom-Diatom Systems: N_2^+ – He Collisions", in *State-to-State Chemistry*, edited by P. R. Brooks and E. F. Hayes, ACS Symposium Series, p171 (1977).

G. H. Bearman and J. J. Leventhal, "Excited State Production in Collisions of H and He with N_2, CO and O_2 over the Energy Range 150 – 2400 eV", *Phys. Rev. A* **17**, 80 (1978).

G. D. Myers, J. G. Ambrose, P. B. James and J. J. Leventhal, "Spin Conservation in Double Electron Capture Collisions", *Phys. Rev. A* **18**, 85 (1978).

J. D. Kelley, G. H. Bearman, H. H. Harris and J. J. Leventhal, "Energy Transfer in Atom-Diatom Collisions: Vibronic Excitation", *J. Chem. Phys*. **68**, 3345 (1978).

G. H. Bearman and J. J. Leventhal, "Inelastic Processes Leading to Excited State Formation in He^+ and H^+ Collisions with Na and K", *Phys. Rev. A* **18**, 68 (1978).

G. D. Myers and J. J. Leventhal, "Inelastic Collisions of 2-800 eV He^+ and He_2^+ with Mg and Zn Atoms", *Phys. Rev. A* **18**, 434 (1978).

G. H. Bearman and J. J. Leventhal, "Ionization and Energy Pooling in Laser-Excited Na Vapor", *Phys. Rev. Lett*. **41**, 1227 (1978).

G. D. Myers, J. L. Barrett and J. J. Leventhal, "Excited State Formation in Collisions Between Simple Ions and Li Atoms", *Phys. Rev. A* **20**, 797 (1979).

J. L. Barrett and J. J. Leventhal, "Electron Transfer and Excitation in Low Energy N_2^+ – Alkali Atom Collisions", *J. Chem. Phys*. **71**, 4015 (1979).

J. L. Barrett and J. J. Leventhal, "Soft X-Ray Emission from He^{++} – Li Collisions", *Appl. Phys. Lett*. **36**, 869 (1980).

V. S. Kushawaha and J. J. Leventhal, "Energy Pooling in Na(3p) – Na(3p) Collisions", *Phys. Rev. A* **22**, 2468 (1980).

V. S. Kushawaha, C. E. Burkhardt and J. J. Leventhal, "Laser Enhanced Lyα Production in Collisions between Hydrogen Ions and Sodium Atoms", *Phys. Rev. Lett.* **45**, 1686 (1980).

J. L. Barrett and J. J. Leventhal, "Selective Formation of He^+(n=3) in He^{++} – Li Collisions", *Phys. Rev. A* **23**, 485 (1981).

J. L. Barrett, M. G. Mlynczak and J. J. Leventhal, "Charge Transfer Excitation in Low Energy Collisions Between Rare Gas Ions and Cadmium Atoms", *J. Chem. Phys*. **75**, 2705 (1981).

V. S. Kushawaha and J. J. Leventhal, "Laser Photodissociation of Na_2^+", *J. Chem. Phys*. **75**, 5966 (1981).

V. S. Kushawaha and J. J. Leventhal, "Associative Ionization in Laser-Excited Sodium Vapor", *Phys. Rev. A* **25**, 346 (1982).

V. S. Kushawaha and J. J. Leventhal, "Formation of Na(5s) and Na(4d) in Na(3p)/Na(3p) Energy Pooling Collisions", *Phys. Rev. A* **25**, 570 (1982).

W. P. Garver, M. R. Pierce and J. J. Leventhal, "Measurements of Atomic Densities Using Radiation Trapping", *J. Chem. Phys*. **77**, 1201 (1982).

G. I. Gellene, D. A. Cleary, R. F. Porter, C. E. Burkhardt and J. J. Leventhal, "Electronic Energy Transfer in Near Resonant Electron Capture Collisions of H_2^+ with Metal Atoms: Radiative and Non-radiative Transitions", *J. Chem. Phys.* **77**, 1354 (1982).

J. J. Leventhal, "Atomic Collision Processes in Laser-Excited Sodium Vapor", in *Photon Assisted Collisions and Related Topics*, Edited by N. K. Rahman and C. Guidotti, Harwood (1982).

J. J. Leventhal, "Ionization Mechanisms in Laser-Irradiated Sodium Vapor", in *Proceedings of the International Conference on Lasers '82*, p 115, Edited by R. C. Powell, STS Press (1982).

M. Allegrini, W. P. Garver, V. S. Kushawaha and J. J. Leventhal, "Ion Formation in Laser Irradiated Sodium Vapor", *Phys. Rev. A* **28**, 199 (1983).

E. Arimondo, C. E. Burkhardt and J. J. Leventhal, "Optical Selection Rules in Inelastic Collisions", *Phys. Rev. A* **28**, 3640 (1983).

J. J. Leventhal, "The Emission of Light from Excited Products of Charge Exchange Reactions", in Volume 3 of *Gas Phase Ion Chemistry: Ions and Light*, Edited by M. Bowers, p 309, Academic Press (1984).

J. M. Preses, C. E. Burkhardt, W. P. Garver and J. J. Leventhal, "Photoionization of Magnesium Near Threshold", *Phys. Rev. A* **29**, 985 (1984).

M. Allegrini, W. P. Garver, V. S. Kushawaha and J. J. Leventhal, "Atomic and Molecular Collisions in Laser-Irradiated Sodium Vapor: Pulsed and cw Experiments", in *Collisions and Half-Collisions in a Laser Field*, Edited by

N. K. Rahman and C. Guidotti, p109, Harwood (1984).

C. E. Burkhardt, W. P. Garver, V. S. Kushawaha and J. J. Leventhal, "Ion Formation in Sodium Vapor Containing Rydberg Atoms", *Phys. Rev. A* **30**, 652 (1984).

C. E. Burkhardt, W. P. Garver and J. J. Leventhal, "Off-Resonance Production of Ions in Laser-Excited Sodium Vapor", *Phys. Rev. A* **31**, 505 (1985).

C. E. Burkhardt, D. L. Earsom, T. L. Daulton, W. P. Garver, J. J. Leventhal, G. I. Gellene and R. F. Porter, "Energy Partitioning in He_2^+/K Collisions", *J. Chem. Phys*. **82**, 3646 (1985).

J. M. Preses, C. E. Burkhardt, R. L. Corey, D. L. Earsom, T. L. Daulton, W. P. Garver, J. J. Leventhal, A. Z. Msezane and S. T. Manson, "Photoionization of the Excited 3p State of Sodium: Experiment and Theory", *Phys. Rev. A* **32**, 1265 (1985).

A. B. Raksit, R. F. Porter, W. P. Garver and J. J. Leventhal, "Bound-Free Ultraviolet Emission from Triatomic Hydrogen", *Phys. Rev. Lett*. **55**, 378 (1985).

M. Allegrini, S. Gozzini, L. Moi, C. E. Burkhardt, M. Ciocca, R. L. Corey, W. P. Garver and J. J. Leventhal, "Ion Formation in Sodium Vapor Containing Laser Selected Rydberg Atoms", in *Laser Spectroscopy VII*, Edited by T. W. Hansch and Y. R. Shen, p 90, Springer-Verlag (1985).

M. Ciocca, M. Allegrini, E. Arimondo, C. E. Burkhardt, W. P. Garver and J. J. Leventhal, "Negative Ion Formation in Rydberg Atom Interactions (n = 7 - 40)", *Phys. Rev. Lett*. **56**, 704 (1986).

C. E. Burkhardt, R. L. Corey, W. P. Garver, J. J. Leventhal, M. Allegrini and L. Moi, "Ionization of Rydberg Atoms", *Phys. Rev. A* **34**, 80 (1986).

C. E. Burkhardt, M. Ciocca, W. P. Garver, J. J. Leventhal and J. D. Kelley, "Forbidden Transitions to Atomic Rydberg States in Optical Collisions", *Phys. Rev. Lett*. **57**, 1562 (1986).

M. Allegrini, E. Arimondo, E. Menchi, C. E. Burkhardt, M. Ciocca, W. P. Garver, S. Gozzini, J. J. Leventhal and J. D. Kelley, "State Mixing in Collisions Involving Highly Excited Barium Atoms", *Phys. Rev. A* **38**, 3271 (1988).

C. E. Burkhardt, J. L. Libbert, Jian Xu, J. J. Leventhal and J. D. Kelley, "Absolute Measurement of Photoionization Cross Sections of Excited Atoms:

Application to Determination of Atomic Beam Densities", *Phys. Rev. A* **38**, 5949-5952 (1988).

J. J. Leventhal, "Highly Excited Atoms: Creation and Annihilation"- Lecture I, in *College on Atomic and Molecular Physics: Photon Assisted Collisions in Atoms and Molecules*, International Centre for Theoretical Physics, Trieste, (1989).

J. J. Leventhal, "Highly Excited Atoms: Creation and Annihilation"- Lecture II, in *College on Atomic and Molecular Physics: Photon Assisted Collisions in Atoms and Molecules*, International Centre for Theoretical Physics, Trieste, (1989).

J. J. Leventhal, "Highly Excited Atoms: Creation and Annihilation"- Lecture III, in *College on Atomic and Molecular Physics: Photon Assisted Collisions in Atoms and Molecules*, International Centre for Theoretical Physics, Trieste, (1989).

C. E. Burkhardt, M. Ciocca, J. J. Leventhal and J. D. Kelley, "Role of the Valence Electron in Reactive Processes: Penning Ionization by a Rydberg Atom", *Phys. Rev. Lett*. **65**, 2351 (1990).

C. E. Burkhardt, M. Ciocca, J. J. Leventhal, E. Arimondo, T. Bergeman and S. T. Manson, "Photoionization of Rydberg Atoms Very Near Threshold", *Nuc. Instr. and Methods in Physics Research B* **56/57**, 313 (1991).

C. E. Burkhardt and J. J. Leventhal, "A Classical Model for Angular Momentum Mixing of Rydberg States", *Phys. Rev. A* **43**, 110 (1991).

L-W He, C. E. Burkhardt, M. Ciocca, J. J. Leventhal and S. T. Manson, "Absolute Cross Sections for the Photoionization of the 6s6p ^{1}P Excited State of Barium", *Phys. Rev. Lett*. **67**, 2131 (1991).

T. P. Hezel, C. E. Burkhardt, M. Ciocca and J. J. Leventhal, "Classical View of the Stark Effect in Hydrogen Atoms", *Am. J. Phys*. **60**, 324 (1992).

T. P. Hezel, C. E. Burkhardt, M. Ciocca, L-W He and J. J. Leventhal, "Classical View of the Properties of Rydberg Atoms: Application of the Correspondence Principle", *Am. J. Phys*. **60**, 329 (1992).

C. E. Burkhardt, M. Ciocca, J. J. Leventhal and J. D. Kelley, "The Role of the Valence Electron in Binary Atomic Processes", pp 147-149 in *Atomic and Molecular Physics*, Edited by C. Cisneros, I. Alverez and T. J. Morgan (World Scientific, New Jersey, 1992).

M. Ciocca, C. E. Burkhardt, J. J. Leventhal and T. Bergeman, "Precision

Stark Spectroscopy of Sodium: Improved Values for the Ionization Limit and Bound States", *Phys. Rev. A* **45**, 4720 (1992).

C. E. Burkhardt, M. Ciocca, J. J. Leventhal and J. D. Kelley, "Augmented Long Range Attraction in Collisions Involving a Rydberg Atom", *Phys. Rev. A* **46**, 5795(1992).

L-W He, C. E. Burkhardt, M. Ciocca, J. J. Leventhal and S. T. Manson, "Reply to Comment on 'Absolute Cross Sections for the Photoionization of the 6s6p ^{1}P Excited State of Barium'", *Phys. Rev. Lett*. **69**, 693 (1992).

C. E. Burkhardt and J. J. Leventhal, "Probing the Floquet Structure of Highly Excited Atoms Using AC/DC Stark Spectroscopy", pp 460-469 in *Atomic Physics*, Edited by H. Walther, T. W. Hänsch and B. Neizert (American Institute of Physics, New York, 1993).

Y. Zhang, M. Ciocca, L-W He, C. E. Burkhardt and J. J. Leventhal, "Measurement of Atomic Polarizabilities Using Floquet Spectroscopy", *Phys. Rev. A* **50**, 1101-1106 (1994).

Y. Zhang, M. Ciocca, L-W He, C. E. Burkhardt and J. J. Leventhal, "Floquet Spectroscopy of Hydrogenic States: Classical and Quantal Descriptions", *Phys. Rev. A* **50**, 4608-4617 (1994).

L-W He, C. E. Burkhardt, M. Ciocca, J. J. Leventhal, H.-L. Zhou and S. T. Manson, "Correlation Effects in the of Photoionization of Ba(6s6p $^1P_1$): Determination of Cross Sections for Production of Specific Final J-States", *Phys. Rev. A* **51**, 2085-2093 (1995).

J. F. Baugh, M. Ciocca, D. A. Edmonds, P. T. Nellesen, C. E. Burkhardt and J. J. Leventhal, "Polarizability of a Hydrogenic State", *Phys. Rev. A* **54**, R4641-R4644 (1996).

J. F. Baugh, D. A. Edmonds, P. T. Nellesen, C. E. Burkhardt and J. J. Leventhal, "Atomic Polarizabilities: Quantal and Classical Perspectives" *Am. J. Phys*. **65**, 602-605 (1997).

J. F. Baugh, D. A. Edmonds, P. T. Nellesen, C. E. Burkhardt and J. J. Leventhal, "Coherent States Composed of Stark Eigenfunctions of the Hydrogen Atom", *Am. J. Phys.* **65**, 1097-1102 (1997).

J. F. Baugh, W. P. Garver, C. E. Burkhardt and J. J. Leventhal, "Population of Stark wave-packet states by cw laser excitation", *Phys. Rev. A* **58**, R785-R788 (1998).

J. F. Baugh, C. E. Burkhardt, J. J. Leventhal and T. Bergeman, "Precision

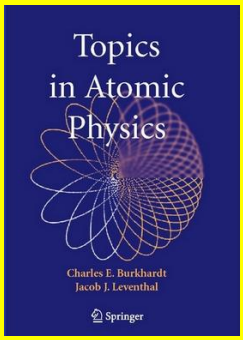
Stark spectroscopy of sodium ^{2}P and ^{2}D states", *Phys. Rev. A* **58**, 1585-1588 (1998).

C. E. Burkhardt and J. J. Leventhal, "Lenz vector operations on spherical hydrogen atom eigenfunctions"", *Am. J. Phys.* **72**, 1013-1016 (2004).

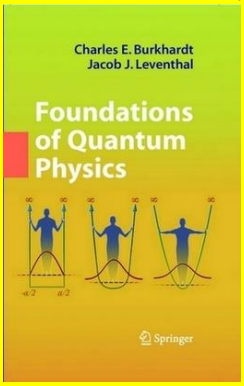
C. E. Burkhardt and J. J. Leventhal, "Vibration-rotation coupling in a Morse oscillator", *Am. J. Phys.* **75**, 686-689 (2007).

Publications (books)

C. E. Burkhardt and J. J. Leventhal, *Topics in Atomic Physics*, Springer, New York, ISBN: 0387257489, 2005.



C. E. Burkhardt and J. J. Leventhal, *Foundations of Quantum Physics*, Springer, New York, ISBN: 978-0-387-77651-4, 2008.



J. D. Kelley and J. J. Leventhal, *Problems in Classical and Quantum Mechanics (Extracting the Underlying Concepts)*, Springer, New York ISBN: 978-3-319-46664-4, 2016.