CURRICULUM VITAE

DR. W. LOWELL MORGAN

PRESENT POSITION (since 1987):

Principal Physicist & Professional Consultant in Applied Physics

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EDUCATION:

Ph.D. (Physics) The University of Windsor 1976

M.A. (Physics) Wayne State University 1972

B.S.E. (Physics) The University of Michigan 1969

B.S.E. (Chemical Engineering) The University of Michigan 1969 (minor in English)

PROFESSIONAL EXPERIENCE:

Visiting Scholar, Flinders University of South Australia, 2007

NSF Sr. Visiting Scholar, ITAMP, Harvard-Smithsonian Center for Astrophysics, 1996

CNRS Visiting Scientist, Univ. Paul Sabatier & CNRS, Toulouse, France, 1991-1992

NATO Sr. Research Fellow, Dept. of Applied Mathematics & Theoretical Physics, Queen's Univ. of Belfast, UK, 1992

NATO Sr. Guest Researcher & Visiting Professor, Dept. of Chemistry, Univ. of Bari, Italy (1991)

Visiting Scientist, Australian National University (1991)

Adjunct Professor of Physics, University of Denver, 1988-1991

Acting Director, Atomic Collisions Data Center, Joint Institute for Laboratory Astrophysics (JILA), 1988-1989

Visiting Fellow, Joint Institute for Laboratory Astrophysics (JILA), University of Colorado, 1987-1988

Physicist, Laser & Nuclear Weapons Programs, Physics Department, Lawrence Livermore National Laboratory, 1978-1987

Visiting Scientist, AT&T Bell Laboratories, 1986

Lecturer, University of California at Davis-Livermore, 1984-1987

Research Associate, Joint Institute for Laboratory Astrophysics (JILA), University of Colorado, 1976-1978

Assistant Research Physicist, Environmental Research Institute of Michigan, 1968-1974

CONSULTING:

Thrivaltech & Plasma Flow 2017-present

Electric Propulsion Laboratory 2015-present

Aurtas, Inc. (Canada) 2013-2019

HE Laboratory, Ltd. (Japan)

Produced Water Solutions, Inc.

Auxsol Inc.

Program on Counter-Terrorism Preparedness and Training, Institute for Security Technology Studies, Dartmouth College

U.S. Air Force High Energy Laser Directorate (AFRL)

Synopsis, Inc. (Switzerland)

Peak Materials, Inc.

Plasmatronics, Inc.

Nanohmics, Inc.

Draka, Inc. (Netherlands)

Dow Chemical

Air Products and Chemicals

Fluent, Inc. (Tokyo)

Toshiba (Tokyo)

Tokyo Electron (Tokyo & Austin)

Sandia National Labs

Sematech International

Lawrence Livermore National Laboratory (1973-2008)

McDonnell Douglas Aerospace

3M Corp.

Idaho National Engineering Laboratory (EG&G, Idaho)

PROFESSIONAL AND TECHNICAL SOCIETIES:

American Physical Society, Fellow

American Chemical Society

AAAS

IEEE, Life Member

American Vacuum Society

Executive committee of Gaseous Electronics Conference, 1982-84 and 1990-1992; Treasurer, 1990-1992; Webmaster 1995-present

AWARDS:

Fellow of the American Physical Society (2021)

IEEE Life Member (2021)

NSF Visiting Scholar, Center for Astrophysics, Harvard University (1996)

NATO Sr. Guest Researcher & Visiting Professor, Dept. of Chemistry, Univ. of Bari, Italy (1991)

NATO Sr. Research Fellow, Dept. of Applied Mathematics & Theoretical Physics, Queen's Univ. of Belfast, UK, 1991-1995

RESEARCH INTERESTS & EXPERIENCE:

Applied Physics & Scientific Computation

Plasma Processing, Gas Discharge, & Plasma Chemistry modeling, simulation, & experiments

Transport processes in Gases, Plasmas, and Liquids

Simulation of Gas-Surface interaction processes

Atomic and Molecular collision processes

Use of Artificial Neural Networks, genetic algorithms, fuzzy logic, and other unusual computational methods in physics

Monte Carlo & molecular dynamics methods in molecular & plasma physics

Biophysical quantum molecular & ionic processes in brain neurons, axons, and synapses

PUBLICATIONS ARRANGED BY TOPIC:

PLASMAS, PLASMA CHEMISTRY, & TRANSPORT PROCESSES

"Study of Striations in a Spherically Symmetric Hydrogen Discharge", W. Lowell Morgan and Montgomery W. Childs, Plasma Sources Science & Tchnology (February 2015).

"Evaporation of Salt Water in a Mist Coflowing With Propane and Air", W. Lowell Morgan and Louis A. Rosocha, IEEE TPS (December 2015)

"Water Treatment and Power Co-Generation Using Hydrothermal, Supercritical Water Produced by Pulsed Electric Discharges," W.L. Morgan and L.A. Rosocha, IJPEST, 2013.

"The Physics and Chemistry of an RF Needle in a Salt Water Aerosol", W.L Morgan and L.A. Rosocha, IEEE Transactions on Plasma Science, December 2012.

"Ion Chemistry in Hydrothermal, Supercritical Aqueous Sodium Chloride Fluid Ablated from a Liquid Surface", W.L. Morgan, IEEE Transactions on Plasma Science, December 2012.

"Surface Electrical Discharges and Plasma Formation On Electrolyte Solutions", W.L. Morgan and L.A. Rosocha, Chemical Physics (July, 2011).

"FLYCHK: The population modeling capability – past, present, & future," H-K Chung, MH Chen, WL Morgan, Y Ralchenko, and RW Lee, Journal of Quantitative Spectroscopy and Radiative Transfer (2007).

"FLYCHK: Generalized population kinetics and spectral model for rapid spectroscopic analysis for all elements," H-K Chung, MH Chen, WL Morgan, Y Ralchenko, and RW Lee, High Energy Density Physics **1,** 3 (2005).

"FLYCHK: An extension to the K-shell spectroscopy kinetics model FLY," H.-K. Chung, W.L. Morgan, and R.W. Lee, Journal of Quantitative Spectrscopy and Radiative Transfer **81**, 107. (2003).

“Cross section set and chemistry model for the simulation of *c*-C_4F_8 plasma discharges,” G.I. Font, W.L. Morgan, and G. Mennenga, Journal of Applied Physics **91**, 3530 (2002).

"Electron collision data for plasma chemistry modeling," W.L. Morgan, *Advances in Atomic, Molecular, and Optical Physics* **43** (2000).

"Plasma chemistry of low pressure processing discharges in Cl2," W.L. Morgan, Plasma Chemistry and Plasma Processing, (2000).

"Modeling the plasma chemistry of a pulsed corona discharge in dry and humid air," W.L. Morgan, M. Jacob, and E.R. Fisher, Plasma Chemistry and Plasma Processing, (1996).

"Comparison of collision rates in PIC-MCC, Monte Carlo, and Boltzmann codes," J.P. Verboncoeur, G.J. Parker, B.M. Penetrante, and W.L. Morgan, Journal of Applied Physics **80**, 1299 (1996).

"Analysis of spectra from laser produced plasmas using a neural network," A.L. Osterheld, W.L. Morgan, J.T. Larsen, B.K.F. Young, and W.H. Goldstein, Phys. Rev. Letters **73**, 1505 (1994).

"The use of artificial neural networks in plasma spectroscopy," W.L. Morgan, J.T. Larsen, and W.H. Goldstein, J. Plasma. Spectros. and Radiat. Transfer **51**, 247 (1994).

"Artificial neural networks for plasma x-ray spectroscopic analysis," J.T. Larsen, W.L. Morgan, and W.H. Goldstein, Rev. Sci. Instrum. **63**, 4775 (1992).

"Artificial neural networks for computing in plasma physics," W.L. Morgan, in Modeling and Engineering of Plasmas, ed. E. Marode (1992).

"An air breakdown kinetic model," A.E. Rodriguez, W.L. Morgan, *et al*., Journal of Applied Physics **70**, 2015 (1991).

"'ELENDIF77': a time-dependent Boltzmann solver for partially ionized plasmas," W.L. Morgan and B. Penetrante, Computer Physics Communications **58**, 127 (1990).

"A bibliography of electron swarm data: 1979-1989," W.L. Morgan, JILA Atomic Collision Data Center Report No. 33, Univ. of Colorado (March, 1990).

"Non-Thermal Effects on Hydrogen Line Profiles," R. W. Lee and W. L. Morgan, Phys. Rev. A **32**, 448 (1985).

"Non-Maxwellian Electrons in a Laser Produced Sodium Plasma," W. L. Morgan, Appl. Phys. Letts. **42**, 790 (1983).

"Electron Energy Distributions in Photolytically Pumped Lasers," W. L. Morgan, R. D. Franklin, and R. A. Haas, Appl. Phys. Letts. **38**, 1 (1981).

"Kinetic Processes in Ar/Kr/F_2 Laser Mixtures," W. L. Morgan and A. Szoke, Physical Review A **23**, 1256 (1981).

"Two-Electron-Group Model and Boltzmann Calculations for Low-Pressure Gas Discharges," W. L. Morgan and L. Vriens, J. Appl. Phys. **51**, 5300 (1980).

"'ELENDIF': A Computer Program that Solves the Boltzmann Equation for a Partially Ionized Gas," JILA Information Center Report No. 19 (June 1979).

"Effects of O_2 on Low Pressure CO-Laser Discharges," W. Lowell Morgan and Edward R. Fisher, Physical Review A **16**, 1186 (1977).

SELECTED LXCat Publications

LXCat: an Open-Access, Web-Based Platform for Data Needed for Modeling Low Temperature Plasmas by Leanne C. Pitchford, Luis L. Alves, Klaus Bartschat, Stephen F. Biagi, Marie-Claude Bordage, Igor Bray, Chris E. Brion, Michael J. Brunger, Laurence Campbell, Alise Chachereau, Bhaskar Chaudhury, Loucas G. Christophorou, Emile Carbone, Nikolay A. Dyatko, Christian M. Franck, Dmitry V. Fursa, Reetesh K. Gangwar, Vasco Guerra, Pascal Haefliger, Gerjan J. M. Hagelaar, Andreas Hoesl, Yukikazu Itikawa, Igor V. Kochetov, Robert P. McEachran, W. Lowell Morgan, Anatoly P. Napartovich, Vincent Puech, Mohamed Rabie, Lalita Sharma, Rajesh Srivastava, Allan D. Stauffer, Jonathan Tennyson, Jaime de Urquijo, Jan van Dijk, Larry A. Viehland, Mark C. Zammit, Oleg Zatsarinny, Sergey Pancheshnyi.
Plasma Process. Polym. 2016, DOI: 10.1002/ppap.201600098

Comparisons of sets of electron–neutral scattering cross sections and swarm parameters in noble gases: I. Argon by L C Pitchford, L L Alves, K Bartschat, S F Biagi, M C Bordage, A V Phelps, C M Ferreira, G J M Hagelaar, W L Morgan, S Pancheshnyi, V Puech, A Stauffer and O Zatsarinny.

L C Pitchford et al 2013 J. Phys. D: Appl. Phys. 46 334001.
Comparisons of sets of electron–neutral scattering cross sections and swarm parameters in noble gases: II. Helium and Neon by L L Alves, K Bartschat, S F Biagi, M C Bordage, L C Pitchford, C M Ferreira, G J M Hagelaar, W L Morgan, S Pancheshnyi, A V Phelps, V Puech and O Zatsarinny.
L L Alves et al 2013 J. Phys. D: Appl. Phys. 46 334002.
Comparisons of sets of electron–neutral scattering cross sections and swarm parameters in noble gases: III. Krypton and xenon by M C Bordage, S F Biagi, L L Alves, K Bartschat, S Chowdhury, L C Pitchford, G J M Hagelaar, W L Morgan, V Puech and O Zatsarinny.
M C Bordage et al 2013 J. Phys. D: Appl. Phys. 46 334003.

The LXCat project: Electron scattering cross sections and swarm parameters for low temperature plasma modeling by S. Pancheshnyi, S. Biagi, M.C. Bordage, G.J.M. Hagelaar, W.L. Morgan, A.V. Phelps, L.C. Pitchford.
Pancheshnyi, S. et al., 2012. The LXCat project: Electron scattering cross sections and swarm parameters for low temperature plasma modeling. Chemical Physics, 398, pp.148–153.

ATOMIC & MOLECULAR PHYSICS

"Comparisons of sets of electron-neutral scattering cross sections and swarm parameters in noble gases: I. Argon", Pitchford, et al., Journal of Physics D **46**, 334001 (2013).

"Comparisons of sets of electron-neutral scattering cross sections and swarm parameters in noble gases: II. Helium & Neon", Alves, et al., Journal of Physics D **46**, 334002 (2013).

"Comparisons of sets of electron-neutral scattering cross sections and swarm parameters in noble gases: III. Krypton & Xenon", Bordage, et al., Journal of Physics D **46**, 334003 (2013).

"The LXCat project: Electron scattering cross sections and swarm parameters for low temperature plasma modeling," Pancheshnyi, Biagi, Bordage, Hagelaar, Morgan, Phelps, and Pitchford, Chemical Physics **398**, 148 (2012).

“Electron collision cross sections in Tetraethoxysilane (TEOS),” W.L. Morgan, C. Winstead, and V. McKoy, Journal of Applied Physics **92**, 1663 (2002).

“Electron transport properties and collision cross sections in C_2F_4,” K. Yoshida, S. Goto, H. Tagashira, C. Winstead, B.V. McKoy, and W.L. Morgan, Journal of Applied Physics **91**, 2637 (2002).

“Electron cross section set for CHF_3,” W.L. Morgan, C. Winstead, and V. McKoy, Journal of Applied Physics **90**, 2009 (2001).

"Stratospheric heavy ozone: the symmetric isomer," W.L. Morgan and D.R. Bates, Planetary & Space Science **40**, 1573 (1992).

"Tidal termolecular ionic recombination," W.L. Morgan and D.R. Bates, J. Phys. B **25**, 5421 (1992).

"Test of a numerical optimization algorithm for obtaining cross sections for multiple collision processes from electron swarm data," W.L. Morgan, J. Phys. D **26**, 209 (1993).

"A critical evaluation of low energy electron cross sections for plasma processing: I. Cl2, F2, and HCl; II. SiH4, CF4, and CH4", W.L. Morgan, Plasma Chemistry and Plasma

Processing **12**, 449 (1992); also JILA Atomic Collisions Data Center Report No. 34 (1991).

"The use of numerical optimization algorithms to obtain cross sections from electron swarm data," W.L. Morgan, Phys. Rev. A **44**, 1677 (1991).

"The feasibility of using neural networks to obtain cross sections from electron swarm data," W.L. Morgan, IEEE Trans. on Plasma Science **19**, 250 (1991).

"New recombination mechanism: tidal termolecular ionic recombination," D.R. Bates and W. L. Morgan, Physical Review Letters **64**, 2258 (1990).

"Ion-Dipolar Molecule Rate Coefficients," W. L. Morgan and D. R. Bates, The Astrophysical Journal **314**, 817 (1987).

"Adiabatic Invariance Treatment of Hitting Collisions between Ions and Symmetrical Top Dipolar Molecules," D. R. Bates and W. L. Morgan, J. Chem. Phys. **87**, 2611 (1987).

"Computer Experiments on Electron-Ion Recombination in an Ambient Medium; Gases, Plasmas, and Liquids," W. L. Morgan, in Recent Studies in Atomic and Molecular Processes, ed. A. E. Kingston (1987).

"Molecular Dynamics Simulation of Geminate Recombination by Electrons in Liquid Methane," W. L. Morgan, J. Chem. Phys. **84**, 2298 (1986).

"Electron-Ion Recombination in High Pressure Gases," W.L. Morgan, in Swarm Studies and Inelastic Electron-Molecule Collisions, ed. L. C. Pitchford, *et al*. (1986).

"Electron Recombination in Water Vapor," W. L. Morgan, J. Chem. Phys. **80**, 4564 (1984).

"Molecular Dynamics Simulation of Electron-Ion Recombination in a Nonequilibrium, Weakly Ionized Plasma," W. L. Morgan, Phys. Rev. A **80**, 979 (1984).

"Vibrational Relaxation and Laser Extraction in KrF," W. L. Morgan, N. W. Winter, and K. C. Kulander, J. Appl. Phys. **54**, 4275 (1983).

"Mutual Neutralization in Rare Gas Halides," B. L. Whitten, W. L. Morgan, and J. N. Bardsley, J. Chem. Phys. **78**, 1339 (1983).

"Monte Carlo Simulation of Electron-ion Recombination at High Pressure," W. L. Morgan and J. N. Bardsley, Chem. Phys. Letts. **96**, 93 (1983).

"Enhancement of Rate of Mutual Neutralization by an Ambient Gas," David R. Bates and Wm. Lowell Morgan, Chem. Phys. Letts. **101**, 18 (1983).

"Monte Carlo Calculations of Two and Three Body Ionic Recombination," B. L. Whitten, W. L. Morgan, and J. N. Bardsley, J. Physics B **15**, 319 (1982).

"Theory of Ion-Ion Recombination in Plasmas," W. L. Morgan, J. N. Bardsley, J. Lin, and B. L. Whitten, Physical Review A **26**, 1696 (1982).

"Plasma Shielding Effects on Ionic Recombination," Wm. Lowell Morgan, Barbara L. Whitten, and J. Norman Bardsley, Physical Review Letters **45**, 2021 (1980).

SURFACE PHYSICS & CHEMISTRY

"The physics of ion impact cathode heating," W.L. Morgan, L.C. Pitchford, and S. Boisseau, Journal of Applied Physics **74**, 6534 (1993).

"Simulating growth of Mo/Si multilayers," W.L. Morgan and D.B. Boercker, Applied Physics Letters **59**, 1176 (1991).

"Computer simulation of the dynamics of physical and chemical processes on surfaces," W.L. Morgan, in The Physics of Ionized Gases (SPIG-90), ed. D. Veza (Nova Science Publishers).

"Universal resputtering curve," W.L. Morgan, Applied Physics Letters **55**, 106 (1989).

"Molecular Dynamics Simulation of the Physics of Thin Film Growth on Si: Effects of the Properties of Interatomic Potential Models," W.L. Morgan, in Atomistic Modeling of Materials: Beyond Pair Potentials, V. Vitek and D.J. Srolovitz, eds., (Plenum Press, New York, 1989).

"Dynamical Simulation of Liquid and Solid Metal Self-Sputtering," W. L. Morgan, Journal of Applied Physics **65**, 1265 (1989).

"Enhanced Diffusion and Collisional Desorption on the Substrate Surface During Sputter Deposition," W.L. Morgan, H.F. Rizzo, and K.C. Kulander, LLNL UCRL-100181 (1988).