Grant Goodyear, PhD

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Theoretical Chemist, Nuclear Physicist, Modeler, Algorithm Builder, Computational Biochemist, Data Scientist
An expert in using computers, physics, and advanced mathematics to identify and solve critical, large-scale problems. A subject matter expert (SME) in a large team of disparate experts. Respected teacher, mentor, presenter, and writer, with well-honed communication skills, clearly explaining technical ideas and concepts to diverse audiences. Demonstrate approachable and friendly disposition interacting with all organizational levels and globally, including senior management, internal / external business partners, colleagues, junior-level associates, and students.

Technical & Specialized Skills

- SME in nuclear physics, oil well logging and petrophysics, computational reconstruction and inversion, random/disordered systems, thermodynamics, kinetics, statistical mechanics, quantum mechanics, spectroscopy, and soft-condensed matter.
- Computational expertise in Molecular Dynamics, Monte Carlo, MCNP, and discrete ordinates.
- Analytical (mathematical) skills in differential and integral equations, numerical and complex analysis, Bayesian statistics, digital signal processing, and data mining.
- Skilled programmer in Python (especially numerical, scientific, and data-science stacks: numpy, scipy, pandas, Jupyter notebook, sklearn, pymc3, Qiskit), Fortran, C, and C++ (C++11). Knowledgeable in R, Java, and Clojure. All source code kept in git repositories.
- Linux system administrator. Build and maintain multiple high-performance computing clusters using DevOps techniques (Debian preseeds, aptly, and ansible) for provisioning and maintenance.
- Instructor (reviews available), technical writer, and presenter; experience in grant proposal writing.

Education

- **Doctor of Philosophy (PhD)**, Theoretical Physical Chemistry, Brown University, Providence, RI
- **Bachelor of Science (BS)**, Chemistry (with honors), University of Missouri at Columbia, Columbia, MO
- **Bachelor of Science (BS)**, Physics, University of Missouri at Columbia, Columbia, MO

Professional Experience

CORE LABORATORIES, Houston, TX
Senior Scientific Advisor 2020 to Present
Leading development of rapid, more accurate, non-contact porosity and saturation measurement for core analysis. Chair of SPWLA Neutron Porosity standardization committee; referee for SEG and IEEE publications.

GENERAL ASSEMBLY, Houston, TX
Data Science Instructor 2020 to Present
Introducing students and professionals to the world of data science.

HALLIBURTON, Houston, TX
Nuclear Physicist 2006 to 2019
Sensor physics' sole owner of logging-while-drilling neutron porosity fleet. Design and characterize new nuclear tools (not just neutron); support and improve tool responses of existing tools; internationally regarded as expert in this area by customers and competition.

- Designed and optimized, in concert with mechanical and electrical engineers, new best-in-the-industry nuclear well-logging tools using combination of MCNP modeling, experimental measurements, and field logs.
- Solved customer-critical physics support issues for tools run in Malaysia, Thailand, and other parts of the world, interfacing with remote global partners in multiple time zones, retaining market share in those areas.
- Improved and reverse-engineered environmental correction algorithms for legacy tools.
- Constructed urgently needed real-time "blob-tracking" algorithm for an Acoustic tool, despite knowing minimal details of the science behind the tool, delivering solution that avoided delay in development timeline.

- Specified, built, and maintained 900-core high-performance computing cluster for Monte Carlo N-Particle (MCNP) simulations, satisfying DOE requirements for export-controlled software, and performing substantially better than previous iteration.
- Mentored and supported new hires and co-op students that became well-regarded SMEs, and most recently, the manager of the nuclear team.

UNIVERSITY OF TEXAS HOUSTON MEDICAL SCHOOL, Houston, TX
Assistant Professor (Research) 2004 to 2006
Researched methods for three-dimensional reconstruction in high-resolution cryo-electron microscopy.

- Drove effort to migrate existing software from legacy fortran to more easily used combination of C++ and Python; revised software now widely used.

CLEMSON UNIVERSITY, Clemson, SC
Assistant Professor 2001 to 2004
Investigated microscopic reaction kinetics.

- Derived first tractable method that isolated specific microscopic solvent motions that govern the transmission coefficient in chemical reactions, a significant accomplishment as solvent motions are invariably collective.
- Led multi-departmental effort to restructure Undergraduate Physical Chemistry sequence.
- Created new version of Physical Chemistry II course that targeted skills and needs of Chemical Engineers.

Foundational Experience

UNIVERSITY OF HOUSTON, Houston, TX, **Visiting Assistant Professor**

- Computed (numerically) structural integral equations for dissolved electrolytes near charged surfaces, determining multi-body structure of electrolytes ranging from dilute 1-1 and 2-2 electrolytes in water to molten salts, such as KCl. Obtained structures in 1 hour with integral equations that previously took weeks using Molecular Dynamics, making thermodynamic computations computationally feasible.
- Taught first-semester Freshman Chemistry to 100 students, earning positive reviews, and advised graduate students in research and in further development as scientists.

UNIVERSITY OF CALIFORNIA AT DAVIS, Davis, CA, **Postdoctoral Researcher**

- Computationally predicted previously unobserved, but ubiquitous, phenomenon of vibrational inhomogeneities in near-critical supercritical fluids. Decisively explained anomalous spectroscopic results occurring in supercritical fluids near critical point in terms of clear and compelling physical pictures; this work is now the standard reference in the field.
- Wrote necessary Molecular Dynamics computer simulations (all programs written in C / C++).
- Developed statistical-mechanical formalism required to analyze novel physics occurring in these MD simulations.

BROWN UNIVERSITY, Providence, RI, **Graduate Researcher**

- Derived mathematical formalism to give the Generalized Langevin Equation, as applied to solute dynamics, a rigorous, and clear, microscopic foundation, solving long-standing mystery in the field.
- Discovered vibrational relaxation in dense fluids arises not from poorly defined "binary collisions", but rather from collective dynamics that influence a single, important, nearby molecule.
- Mathematically, albeit approximately, solved liquid-theoretic equations required to produce distribution of Instantaneous Normal Modes in a liquid mixture.
- Wrote from scratch the necessary Molecular Dynamics and Monte Carlo computer simulations.

Affiliations

- Society of Petrophysicists and Well-Log Analysts
- Society of Exploration Geologists
- International Association for Mathematical Geosciences
- Society of Petroleum Engineers
- American Chemical Society
- American Physical Society
- Sigma Xi Research Fraternity
- Alpha Chi Sigma Chemistry Fraternity
- Phi Lambda Upsilon Honorary Chemistry Fraternity
- Pi Mu Epsilon Honorary Mathematical Fraternity

Patents

1. US9341738B2, “Systems and methods for neutron detection in nuclear logging tools”, G. Goodyear and D. Luo, Halliburton Energy Services.
2. US9810807B2, “Methods and systems for detecting epithermal and thermal neutrons”, G. Goodyear, Halliburton Energy Services.
3. US10209384B2, “Peak tracking and rejection in acoustic logs”, G. Goodyear, K. T. Walker, and B. Mandal, Halliburton Energy Services.
4. “Well tool for measuring acoustic velocity”, R. Ortiz and G. Goodyear, Halliburton Energy Services. Filed.

Publications

1. “What’s new in borehole nuclear modeling? (A lot!)”, Grant Goodyear, Avneet Sood, Madison Andrews, C.J. Solomon, Mathilde Luycx and CarlosTorres-Verdin, SPWLA 59th Annual Logging Symposium, June 2018.
2. “Unexpected behavior of LWD neutron porosity logs in water-wet, sand-shale sequences”, G. Goodyear, T. J. Parker, K. H. Kok, K. Kyi, H. Mansur, and S. K. Zaman, Interpretation 5, 1-13 (2017).
3. “Borehole and invasion effects of formate-based mud systems on LWD density, neutron, PE, and gamma-ray logs”, P. Cooper, G. Goodyear, G.L. Moake, and J. Truax, Halliburton Energy Services, SPE Annual Technical Conference and Exhibition, Oct. 2011.
4. "Response of LWD density logs at a bed boundary", J. Truax, W. Guo, G. Goodyear, G. Carpenter, and T. Plasek, Halliburton Energy Services, SPWLA 49th annual logging symposium, May 2008.
5. "SPARX, a new environment for cryo-EM image processing", M. Hohn, G. Tang, G. Goodyear, P.R. Baldwin, Z. Huang, P. A. Penczek, C. Yang, R. M. Glaeser, P. D. Adams, and S. J. Ludtke, J. Struct. Bio. 157, pp. 47-55, 2007.
6. "Electrolytes at Charged Interfaces: Ion-Ion-Interface Three-Body Correlation Functions", A. C. Eaton, G. Goodyear, A. D. J. Haymet, Phys. Chem. Chem. Phys. 2001, 3778-3785 (2001).
7. "Domain-Based Characterization of Density Inhomogeneities in Compressible Supercritical Fluids", G. Goodyear, M. W. Maddox, and S. C. Tucker, J. Phys. Chem. B 104, 6240-6247 (2000).
8. "Origins of Atom-Centered Local Density Enhancements in Compressible Supercritical Fluids", M. W. Maddox, G. Goodyear, and S. C. Tucker, J. Phys. Chem. B 104, 6248-6257 (2000).
9. "Correlation between Local and Long-Range Structure in Compressible Supercritical Lennard-Jones Fluids: State-Point Dependence", G. Goodyear, M. W. Maddox, and S. C. Tucker, J. Phys. Chem. B 104, 6258-6265 (2000).
10. "Effect of Critical Slowing Down on Local-Density Dynamics", M. W. Maddox, G. Goodyear, and S. C. Tucker, J. Phys. Chem. B 104, 6266-6270 (2000).
11. "The correlation between local and long-range structure in compressible supercritical fluids", G. Goodyear, M. W. Maddox, and S. C. Tucker, J. Chem. Phys. 112(23), 10327-10339 (2000).
12. "Glass-like behavior in supercritical fluids: The effect of critical slowing down on solute dynamics", G. Goodyear and S. C. Tucker, J. Chem. Phys. 111(21), 9673 (1999).
13. "What causes the vibrational lifetime plateau in supercritical fluids?", G. Goodyear and S. C. Tucker, J. Chem. Phys. (communication) 110, 3643 (1999).
14. "Solute reaction dynamics in the compressible regime", S. C. Tucker and G. Goodyear, Proceedings of the 1998 NATO ASI on Supercritical Fluids, Kemer, Turkey.

15. "The short-time intramolecular dynamics of solutes in liquids. II. Vibrational population relaxation", G. Goodyear and R. M. Stratt, J. Chem. Phys. 107, 3098 (1997).
16. "Instantaneous perspectives on solute relaxation in fluids: The common origins of nonpolar solvation dynamics and vibrational population relaxation", R. E. Larsen, E. F. David, G. Goodyear, and R. M. Stratt, J. Chem. Phys. 107, 524 (1997).
17. "The short-time intramolecular dynamics of solutes in liquids. I. An instantaneous-normal-mode theory for friction", G. Goodyear and R. M. Stratt, J. Chem. Phys. 105, 10050 (1996).
18. "Liquid theory for the instantaneous normal modes of a liquid. II. Solutions", R. E. Larsen, G. Goodyear, and R. M. Stratt, J. Chem. Phys. 104, 2987 (1996).
19. "Molecular origin of friction in liquids", G. Goodyear, R. E. Larsen, and R. M. Stratt, Phys. Rev. Lett. 76, 243 (1996).
20. "What determines the spin states of polynuclear transition-metal complexes?", G. Goodyear and R. M. Stratt, J. Am. Chem. Soc. 115, 10452 (1993).