

Otho Ulrich – Curriculum Vitae

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Latest CV <http://othoulrich.com/cv.pdf>

Code Examples

- Most code examples in this document may be viewed at <http://othoulrich.com/examples>.
- To view some of my personal projects, access my gitlab site at <https://gitlab.adamo.services:45443/>. Use the username "recruiter" with the password "helloguest"; I've added this user to several projects of interest.

Software Engineering Tools

■ Programming Languages and Protocols

*BASH C++ Java Python Javascript NoSQL SQL
Node.js JSP C# Perl Lua Regex C++ stdlib Git*

■ Cloud and System Environments

*GNU/Linux FreeBSD VMware GCP RancherOS
KVM Xen VirtualBox Hadoop*

■ CI/CD and Configuration Management

*Gitlab Github Quay
Docker Jenkins Adamocomp*

■ High-Performance Computing and Data Science

MPI - Protocol for handling messages between parallel computing tasks.
ZFS - File system and logical volume manager with emphasis on scalability and data integrity.
Hadoop - Distributed file system and data analysis platform.
Anaconda / Jupyter - Environment for machine learning and for analyzing and presenting data.
R - Language well-suited to statistical analysis, machine learning, and data presentation.
Torque - Job scheduler that understands Nvidia CUDA protocols.
Slurm - Open-source job scheduler for Linux.

■ Physics Codes

Cloudy - Plasma photoionization simulations developed at the University of Kentucky.
LAMMPS - Open source software for molecular dynamics simulations.
psdlag - Fourier analysis using a max-likelihood optimization to overcome gappy data.

Technical and Practical Skills

- Practiced in creating dynamic pipelines to automate system, application, network, and development operations, with an emphasis on saving time and adding efficiency to the decision-making process.
- Significant programming experience, with strength in many languages and libraries, and emphases on modeling and on scripting to analyze and justify large and inconsistent datasets and automate system tasks.
- Experience automating provisioning systems for cloud and other virtual environments, e.g. VMWare-hosted systems and the Google Cloud Platform.
- Background in maintaining configurations across clustered hosts, and deploying software consistently across hosts in pretooled and custom pipelines.
- Experience providing real-time service delivery goals and monitoring.
- Training and practice in statistical learning, i.e. “Machine Learning,” with a variety of learning models.
- Experience handling large, sparse datasets, i.e. “Big Data,” aided by cluster computing for analysis.
- Comfortable implementing and interfacing with many database systems, incl. SQL and NoSQL solutions.
- Experience with operating and programming for high-performance cluster computing, i.e. “Cloud Computing,” using a variety of task scheduling platforms.
- Practice in statistical analysis, real and complex analysis, Fourier analysis, and potential theory.
- Strong sense of component networks, system control flows, and system abstractions.
- Familiarity with most computer systems, esp. GNU/Linux and BSD, with a strong shell scripting ability.
- Advanced knowledge of physics and inorganic chemistry.
- Practical and theoretical experience with electronics.
- Working knowledge of physics codes and signal analysis codes, especially *Cloudy*, *LAMMPS*, and *psdlag*.
- Strong critical thinking and writing skills, with experience using document-preparation paradigms including LaTeX, Libre Office, Google Docs, Microsoft Office, and MediaWiki, with familiarity of Unicode and markup.
- Developed public speaking presence with practice including 8 years of training, classroom, lecture hall experience, and invited talks.

Education

- 2017-2019** Physics, Astrophysics - University of Kentucky
Differential Geometry and Equations
Advanced Electrodynamics
Statistical Mechanics
Field Theory Mechanics
Computational Physics
Non-relativistic Quantum Mechanics
Modern Pedagogical Theory
- 2013-2017** B.S., Physics, Mathematics - Western Michigan University
Advanced Scientific Writing
Physics Research Procedures
Statistical & Classical Thermodynamics
Machine Learning
Lagrange Multipliers
Laplace Transformations
Fourier Analysis
Electric and Magnetic Properties of Matter
Fundamentals of Electromagnetic Theory: Maxwell's Equations
Atomic Physics
Quantum Wave Theory & Matrix Mechanics
Lagrangian & Hamiltonian Classical Mechanics
Newtonian Mechanics
Transistor Fundamentals, Networks, and Digital Logic
Alternating and Direct Current RCL Networks
Fundamentals of Electronics
Intermediate Scientific Writing
Introductory Potential Theory: Laplace's and Poisson's Equations
Calculus of Complex Variables
Vector-based Differential Geometry
Stellar Astrophysics
Introductory Statistical Mechanics
Keplerian Mechanics
Optics
Classical Wave Theory
Basic Scientific Inquiry
Special Relativity
Introductory Quantum Wave Theory
Philosophy of Science
Introductory Scientific Writing
Ordinary Differential Equations and Systems
Linear Algebra
Statistics
- 2011-2013** Computer Science and Engineering - Washtenaw Community College
Introductory Electromagnetism
Scalar and Vector Fields
Introductory Mechanics & Thermodynamics
Shell Programming
Algorithms
Data and Object Structures
C++ and Java Programming
Differential & Integral Calculus
- 2005** Classical and Jazz Music Performance - Lansing Community College

Technical Experience

Present - 2019 TEKSystems, Ford Motor Company
Network Automation Engineer (DevOps)

- Regularly contribute to and maintain the Network Services Gateway and API, which provides Network-as-a-Service functions using a micro-services stack, leveraging SDN with F5 load balancing. Services include self-service application migrations, load balancing, DDI, firewall, advisories, and other network services, servicing nearly 10,000 internal applications. Automation reduces the operator time necessary to deploy datacenter applications from days to minutes.
- Currently implementing Ford's Google Cloud Platform infrastructure using Terraform, and integrating it into the existing datacenter automation tooling.
- Delivered network service goals for brand and marketing sites for the Bronco and Mach-E product launches.
- Helped lead real-time troubleshooting efforts during major product launches.
- Developed and supported DNS migration automation for thousands of campaign-based URLs, eliminating tens of hours per migration.
- Helped define and automate statistics collection for team's service goals using Grafana and Prometheus, and currently working to create self-service statistics reporting for internal application customers.
- Developed and maintained the CI/CD stack for NSG's APIs and web applications, using Docker, node.js express middleware, BASH, and Quay.io, freeing up days of time per application deployment.
- Established and maintained environment and configuration standards for NSG linux systems and containers, and developed BASH programs to automate operations and node maintenance across cloud architecture, reducing the time to reconfigure cluster applications from about 1 day to about 30 minutes.
- Developed APIs that automate advisories and Webex messaging, and load-balanced service discovery. This allowed customers to define automated service alerts that generate application-level advisories and team-based Webex alerts, removing significant human resources from the advisory process.
- Documented network services and network service APIs for Ford's app owners and cloud and fulfillment teams, operational software for our development team, and developed and led training to teach new developers to replicate our micro-services stack.

**Present -
2012** Independent Research and Projects
Researcher and Developer

- Engineered the Adamocomp, a bash and node-based RPA that uses a fuzzy data search over complex and unclean data to perform operations such as the installation of software and containers, or the modification and propagation of configuration – reliably, consistently, and quickly – across any number of clustered hosts.
- Maintain Adamonet cluster using ESXi virtualization, FreeBSD file servers, docker, middleware (Node.js), data storage (ZFS, mdadm, mhdfs), and standard network and server stacks.
- Contributed to development of a thermodynamics-based approach to statistical learning based on energy-decay networks.
- Developed a simple statistical program using Jupyter Notebook to demonstrate the physical behavior of quantum entanglement. (2018)
- Developed, using R and Bash, a machine learning algorithm to classify pulsar candidates which produced a 97% accuracy rate across more than 15,000 data samples. (2017)
- Developed *TAAP*, a physics engine simulating particle interactions under gravitational and electromagnetic forces, in C++. (2014)
- Developed text-based network games using C and graphical network games using the java.net.Socket, java.awt.Graphics, and javax.swing.JFrame classes.

**Present -
2017** Mjolnir Software
Science Officer, Developer

- Maintain database server, data delivery services, and middleware solutions.
- Research and present physical models intended as possible game engine elements.
- Review all scientific information before it is applied in development.
- Research, design, develop, and document game engine elements for *Galaxy In Flames*, the company's major game product, primarily using C#.
- Develop mathematics, operators, and data geometry for our galaxy-to-meter-scale coordinate tracking system.

**2019 -
2018** Department of Physics and Astronomy, University of Kentucky
Computational Researcher under Gary Ferland

- Developed extended quantum mechanical models by correlating sparse datasets from NIST and recently-published works, to ultimately provide better predictions.
- Automated data functions using BASH, Perl, and Python scripting to cleanly resolve collisions and inconsistencies between large sets of atomic data across 29 atomic species, saving hours of manual work per dataset.
- To assess quality of results before deployment, used *Cloudy* to simulate diagnostic emission measurements relevant to observational astronomers.

- 2018 - 2016** Department of Physics and Astronomy, Wayne State University
Computational Researcher under Professor Ed Cackett
- Using Jupyter (python) and frequency-domain techniques developed in C++, characterized the reverberation of NGC 5548 emissions by the power spectral densities in the optical and UV lightcurves and their frequency-dependent time lags.
 - Solved the problem of gappy data in the lightcurves by using a statistical frequency-domain approach developed by Dr. Abdu Zoghbi, University of Michigan, provided as the *psdlag* code. Wrote MPI routines to run these analyses in parallel on our computing cluster, saving hours of time per dataset.
 - Recovered the transfer functions for each set of wavelengths by optimizing test functions in the frequency domain across all datasets, then compared against current accretion disk model predictions.
- 2017 - 2015** Department of Physics, Western Michigan University
Computational Researcher under Professor Kirk Korista
- Developed tools using Bash, Python, and several Linux-based plotting programs to manage and visualize data hypercubes from and operate *Cloudy* to compute predictions of emission line strengths across a parameter space including incident Hydrogen-ionizing flux, number density, and column density, with thousands of resolute points.
 - Developed, using C++, a spectral continuum model of the source radiation in NGC 5548, adapting it as knowledge of active galactic nuclei grew, providing more accurate spectral data input compared to available models.
 - Work credited on the paper Constraints on the Broad Line Region Properties and Extinction in Local Seyferts., wherein predicted hydrogen emission line strengths are used to aid in the comparison of the broad H-I line ratios, providing a possible avenue toward a new classification schedule of Seyfert galaxies.
- 2014** Materials Simulation Laboratory, University of South Florida, Department of Applied Physics
Computational Researcher under Professor Ivan Oleynik
- Designed molecular dynamics simulations using *LAMMPS*, and the Carbon-Carbon screened environment-dependent reactive empirical bond order potential function devised by the Materials Simulation Laboratory, to test the mechanical properties, i.e. tensile strengths and stress-strain curves, of misoriented graphene bicrystals.
 - Automated bicrystal generation, molecular dynamics tests, and statistical analyses, and ran them across our two available computing clusters to reduce the need for human input to once per day.
- 2014** Tandem Van de Graaff Accelerator Laboratory, Department of Physics, Western Michigan University
Electronics Lab Assistant to Accelerator Engineer Allan Kern
- Designed, printed, and constructed rack-mounted power source that allows polarity switching of the particle accelerator's high-current inflection magnet.
 - Designed power source to allow sufficient current for inflection electromagnetic to steer gold ions. This necessitated the use of 12 synchronized latching relays and timing circuits.

2013 Business and Technology Department, Washtenaw Community College
Software and System Developer

- Created Hadoop-based data analytics, with MapReduce algorithms coded in Java, to predict efficient bus routes for the Ann Arbor Transit Authority.
- Designed, built, and maintained virtual server environment for deployment of department and research applications using ESXi.
- Created interactive web apps for coordination between technicians, faculty, and staff using RESTful API and Django.
- Deployed technical and training documentation using MediaWiki, and created and conducted the lab technician training program.

Associated Computing Clusters

- *Ford Global Network* - A global network including 8 major data centers and regional hubs. Our team at Ford built the Network Services automation software used for provisioning services in the next-gen data centers.
- *Cloud 9* - Used by the *Cloudy* group to develop plasma spectroscopy codes in a processor grid format.
- *Thor* - Used to run simulations for AGN reverberation mapping research. Provides standard and CUDA nodes.
- *MSL Cluster* - Used to run *LAMMPS* molecular dynamics simulations on graphene bicrystals.
- *Circe* - Used for material verification and to run *LAMMPS* simulations.
- *WCCnet Hadoop Cluster* - Used by the Ann Arbor Transit Authority traffic analytics project, providing a Hadoop cluster with MapReduce on the ESXi hypervisor, designed and maintained by me as part of that project.
- *AdamoNet* - My cluster of physical and virtual systems, using ESXi hosting and docker containers, providing ZFS and RAID storage, database services, remote backups, and an array of additional services.

Letters

- D. Lawther, M.R. Goad, K.T. Korista, **O. Ulrich**, M. Vestergaard, "Quantifying the Diffuse Continuum Contribution of BLR Clouds to AGN Continuum Inter-band Delays," 2018, MNRAS, 481, 533-554
- Anna Stephens, **Otho Ulrich**, Mariia Kravtsova, "Machine Learning to Classify Pulsar Candidates," 2017, Western Michigan University, N.P.
- David Schuster and **Otho Ulrich**, Abstract: "An Objectives-Mastery Credit Accumulation Course System," 2017, Michigan Academician, XLV 1, 67.
- Allan Schnorr-Müller, R.I. Davies, K.T. Korista, L. Burtscher, D. Rosario, T. Storchi-Bergmann, A. Contursi, R. Genzel, J. Graciá-Carpio, E.K.S. Hicks, A. Janssen, M. Koss, M.-Y. Lin, D. Lutz, W. Maciejewski, F. Müller-Sánchez, G. Orban de Xivry, R. Riffel, R.A. Riffel, M. Schartmann, A. Sternberg, E. Sturm, L. Tacconi, S. Veilleux, **O. A. Ulrich**, "Constraints on the Broad Line Region Properties and Extinction in Local Seyferts," 2016, MNRAS, 462, 3570-3590.
- **Otho A. Ulrich**, Edward M. Cackett, "Optical/UV Band Reverberation Mapping of NGC 5548 with Frequency-Resolved Techniques," 2016, Wayne State University College of Arts and Sciences.
- David Schuster and **Otho Ulrich**, Abstract: "A Very Different Way of Running Your Course and Assessments: An Objectives-Mastery Modular System," 2016, Michigan Academician, XLIV 2, 126-127.

Invited Talks

- **O. Ulrich**, “Quantifying the Diffuse Continuum Contribution of BLR Clouds to AGN Continuum Inter-band Delays,” Astrophysics Seminar Series, Dept. of Physics & Astronomy, University of Kentucky, August 30, 2018.
- **O. Ulrich**, “Emission Line Equivalent Widths for AGN Modeling,” Walking the Line, Arizona State University, Spring 2018.
- M. Goad, D. Lawther, K. Korista, **O. Ulrich**, M. Vestergaard, “Quantifying the diffuse continuum contribution from BLR gas: a modeling approach,” Atlanta meeting of the Space Telescope Optical Reverberation Mapping (STORM) group, Fall 2017.
- Anna Stephens, **Otho Ulrich**, Mariia Kravtsova, “Is this a Pulsar?” Spring Senior Seminar Series, Department of Computer Science, Western Michigan University, 2017.
- D. Schuster, **O. Ulrich**, “An Objectives-Mastery Credit Accumulation Course System,” March meeting of the Michigan Academy of Science, Arts, and Letters, 2017.
- **O. Ulrich**, “Experiences in Research of an Undergraduate Physics Major,” Colloquium Series, Department of Physics, Western Michigan University, Feb. 2017.
- **O. Ulrich**, “Undergraduate Research,” October meeting of the Physics Club at Western Michigan University, 2016.
- **O. Ulrich**, D. Schuster, “Objectives-Mastery Modular Course Operating System,” March meeting of the Michigan Academy of Science, Arts, and Letters, 2016.
- **O. Ulrich**, J. Gonzalez, K.N. Cong, I. Oleynik, “Atomic Structure of Grain Boundaries in Graphene,” March meeting of the American Physical Society, 2015.

Peer Review

- *The Particle Accelerator Simulation Code PyORBIT*, Shishlo, Andrei, et al., reviewed as submission for the Large Scale Computational Physics Workshop at the International Conference on Computational Science, 2015.

Teaching Experience

2019 - 2017 PHY 231: University Physics I, Department of Physics and Astronomy, University of Kentucky
Teaching Assistant

- Provided auxiliary classroom instruction for calculus-based mechanics courses and 100-level astronomy courses.
- Facilitated group work sessions, a scientifically-validated alternative to traditional lecture for learning introductory physics.
- For mechanics courses, developed lesson plans each week to aid students in their solution of a weekly problem set.
- For astronomy courses, assisted in running observational experiments during lecture, and provided guidance on student research projects.
- Provided supplemental instruction during office hours and other special sessions.
- Graded papers and proctored exams.

- 2017 - 2015** PHY 3520: Waves and Optics, Department of Physics, Western Michigan University
Learning Assistant to Professor David Schuster
- Developed while applying a mastery assessment-based approach to course evaluations
 - Presented continuing developments in this method to the Michigan Academy of Science, Arts, and Letters in 2016 and 2017.
 - Designed two lessons: one on the speed of sound, involving a marching band problem; another on harmonics using a brass instrument problem and a brass instrument demonstration.
 - Graded assignments and exams.
 - Provided supplemental instruction.
- 2017 - 2015** PHY 2050 & 2070: University Physics I & II, Department of Physics, Western Michigan University
Learning Assistant
- Provided a helpful presence under a "reversed-class" paradigm, where the in-class time is primarily used for group problem solving, and students are expected to study the lecture material outside of class. This typically means guiding students' inquiries as they attempt to synthesize physical reasoning to solve the assigned problems.
 - Conducted thrice-weekly review sessions mirroring material provided by the lecture, with an emphasis on understanding how general principles simplify under proper assumptions.
 - Solved problems designed by the professor as a test case before introducing them in group problem-solving settings.
 - Created training on critical thinking and scientific philosophy for learning assistant team members, then conducted the training.
- 2016** PHY 3250: Introduction to Astrophysics, Department of Physics, Western Michigan University
Grader
- Graded homework assignments, providing student developmental feedback as needed.
- 2017 - 2014** Student Success Services, College of Arts and Sciences, Western Michigan University
Peer Academic Coach
- Supported student learning as a tutor in physics, chemistry, mathematics, philosophy, computer science, and general learning.
- 2013 - 2009** Emerson School
Music Tutor
- Conducted individual lessons with students of brass and piano performance.
- 2013 - 2012** Business and Technology Department, Washtenaw Community College
Lab Assistant
- Assisted in various computer science courses, running review sessions, labs, tutoring, and providing general course help.
 - Developed computer-based applications used by the professors and administration for keeping track of coursework, lab setup, and faculty requests.

Awards

- GAANN Fellowship, U.S. Department of Education & Department of Physics and Astronomy, University of Kentucky.
- Research Fellowship, Department of Physics and Astronomy, University of Kentucky.
- Paul Rood Physics Scholarship, Department of Physics, Western Michigan University.
- Thomas Dickinson Award, Department of Physics, Western Michigan University.
- Dean's List, College of Arts and Science, Western Michigan University.

Professional Associations

- American Physical Society
- American Astronomical Society
- Society of Physics Students
- Michigan Academy of Science, Arts, and Letters

Appointments

- Communications Officer, Free Software Society, University of Kentucky.
- Inclusive Pedagogies Graduate Learning Community, College of Arts & Sciences, University of Kentucky.
- Academic Integrity Committee, Western Michigan University.
- Gateways to Completion Steering Committee, Western Michigan University.
- Librarian, Physics Club, Western Michigan University.

Relevant Interests

- Strong interest in the theory and application of science education, especially as to education of the public.
- Advocate of critical thinking and scientific skepticism, with interest in bringing those topics to the public on a larger scale.
- Active member of the Free Software Society at University of Kentucky, and Physics Club, Computer Club, and the Advanced Computing Society at Western Michigan University.
- Coded simulations for fun since childhood. A favorite pastime has been to create network-based space simulations in which friends can dogfight, and other internet-connected simulated worlds, going back to the early days of the internet.
- Play improv piano almost every day.