Walter Landry Ph.D.
California Institute of Technology
MC 314-6
1200 E. California Blvd
Pasadena, CA 91126
858-699-8286
wlandry@caltech.edu
http://wlandry.net

Experience Summary

Developed high performance programs on a wide variety of serial and parallel Linux, Mac, and Windows machines. Extensive experience with C++ and numerical methods. Moderate experience with Python, parsers, multithreaded programming, SQL, and databases. Some experience with Lisp, computer algebra, Java, D, C#, and distributed computing. Publications and teaching experience in C++ programming, astronomy, geology, and physics.

Open Source Projects

Gamra A parallel, finite difference, adaptive mesh refinement C++ code for modeling deformation during an earthquake. 15,000 lines. http://www.wlandry.net/Projects/Gamra

Gale A parallel, finite element C++ code for modeling mountain building, rifting, and subduction. 290,000 lines. http://geodynamics.org/cig/software/gale

FTensor A C++ library to simplify development of codes that use tensors while retaining the performance of hand-crafted code. FTensor was used as part of the release criteria for GCC 3.1-3.4. 45,000 lines. http://www.wlandry.net/Projects/FTensor

SuGrSonic A highly optimized C++ library that uses Intel intrinsics (SSE2, SSE3, SSSE3) to model sound on a grid. Designed for games, it completes 100 iterations on a 200x200 grid in 5.5 ms on an Intel I7-3520M, requiring only 5 cycles per grid point per iteration. 259 lines. https://bitbucket.org/wlandry/sugrsonic

libhires A C++ image processeing library for converting observed data from the Planck spacecraft into high resolution astronomical images. Libhires leverages mlpack and a variety of statistical methods (simple binning, Elastic Net, Maximum Correlation Method) to reconstruct images with resolution better than the underlying instruments. 527 lines. https://github.com/Caltech-IPAC/libhires

tablator A C++ library for translating between different table formats in astronomy: HDF5, FITS, VOTable, JSON, CSV, HTML, plain text. 3,400 lines. https://github.com/Caltech-IPAC/tablator

libtinyhtm A C library with C++ interfaces for efficient storage and lookup of datasets with billions of stars. https://github.com/Caltech-IPAC/libtinyhtm

libADQL A C++ library which uses Boost:Spirit to parse the Astronomical Data Query Language, a variant of SQL 92 with extensions for geometric queries on the sky. 2,800 lines. https://github.com/Caltech-IPAC/libadql

ArX A distributed version control system written in C++. 33,000 lines. http://arx.nongnu.org/

json5_parser A friendly fork of the C++ library JSON Spirit, modified to parse JSON5. https://bitbucket.org/wlandry/json5_parser

Journey to the Pit A simple adventure game with prototypes written in D, C#, and C++. 2,000 lines. http://www.wlandry.net/Projects/Journey_to_the_Pit

The Computer Language Benchmarks Game Improved the performance of the C++ implementation of the n-body benchmark at The Computer Language Benchmarks Game, making it as fast as any implementation in any language at the time. http://benchmarksgame.alioth.debian.org/u32/program.php?test=nbody&lang=gpp&id=7

Boost Contributed improvements to the Boost filesystem library. http://boost.org

Work Experience

2012-Date: Lead Software Engineer, NASA/IPAC Infrared Science Archive, Caltech

- Wrote Tablator, a universal table translator library for converting between different table formats used in astronomy: HDF5, FITS, VOTable, JSON, CSV, HTML, plain text.
- Created a complete parser for the Astronomical Data Query Language (ADQL), a variant of SQL 92 with extensions for astronomy.
- Along with my team, implemented a highly optimized, low latency TAP (Table Access Protocol) service to enable more of a direct database access to large astronomy datasets. `https://irsa.ipac.caltech.edu/docs/program_interface/TAP.html`
- Created a web backend to dynamically generate images from single pixel Planck observations using both simple binning and more sophisticated statistical algorithms. `https://irsa.ipac.caltech.edu/applications/planck/`
- Migrated version control systems from Accurev to git. This involved writing a fast, multi-threaded exporter from Accurev to the git fast-export format.

2005-2012: Lead Software Engineer, CIG, Caltech

- Created Gamra, a 2D and 3D parallel, finite difference, adaptive mesh refinement C++ code for modeling deformation during an earthquake.
- In collaboration with groups at the Victorian Partnership for Advanced Computing (VPAC) and Monash University in Melbourne, we significantly enhanced Gale, an existing parallel finite element and particle-in-cell C code that models mountain building, rifting, and subduction in the Earth's crust. This included
  - Multiple improvements to the numerical techniques and physics. This required reading papers, meeting with colleagues, and experimenting with new methods.
  - Creating, running, and documenting numerous benchmarks and then presenting the results at international conferences (AGU Fall Meeting, Geomod).
  - Adding an equation parser based on muParserX, allowing users to input equations like "x*x + y" rather than having to modify and recompile the software.
  - Running training sessions at national conferences (Earthscope, GSA).
  - Writing and maintaining a thorough 100+ page manual.
- Provided support for many codes developed by the Computational Infrastructure for Geodynamics (CIG). This included

  - Implementing Python configure and build systems in SCons, Petsc's Buildsystem, and Waf.
  - Creating binary packages for Linux, Mac, and Windows.
  - Email support for national and international users on public mailing lists, as well as occasional direct support for users at Caltech.

- Set up and maintained Mac, Linux, and Windows machines to handle backups, mail, web, CMS, bug tracker, version control, and continuous integration.

2003-2005: Onsite lead for Integrated Modelling and Test Environments
Senior Systems Developer, Ohio Supercomputer Center
Assistant Professor, Mississippi State University

- Managed a project to create a converter for multibody dynamics programs. This involved writing a parser in C++ and adding functionality to an existing large C++ project.

2001-2003: Postdoctoral Researcher for George Fuller
University of California San Diego

- Collaborated with the Terascale Supernova Initiative in creating a program to realistically simulate supernovae in 3D.
- Created a small (~1000 line) program to track the evolution of neutrinos as they travel through a supernova.

1999-2001: Postdoctoral Researcher for Richard Price and Ben Bromley
University of Utah

- Extensively modified the existing C++ code to apply it to other problems in astrophysics (black hole initial data, accretion disks around black holes).

1993-1999: Graduate Research Assistant for Saul Teukolsky
Center for Radiophysics and Space Research
Cornell University

- Designed, implemented, and tested 10,000 lines of C++ code to perform fully relativistic simulations of coalescing neutron star binaries.

Education

Ph.D. in Astronomy, Cornell University, Ithaca, NY, 1999
B.S. in Astronomy, California Institute of Technology, Pasadena, CA, 1993

Publications

- Processing Images from the Zwicky Transient Facility
  R. R. Laher et al.
  Astronophysical Journal, submitted

- Gamra: Simple meshing for complex earthquakes
  W. Landry and S. Barbot
  Computers & Geosciences **90**, 49-63 (2016):

- Instantaneous Archives
  W. Landry, S. Monkewitz
  Astronomical Data Analysis Software and Systems XXVI
  Ed. F. Pasian, Astronomical Society of the Pacific Conference Series, in press

- Providing comprehensive and consistent access to astronomical observatory archive data: the NASA archive model
  T. McGlynn et. al.
  Observatory Operations: Strategies, Processes, and Systems VI
  Ed. A. B. Peck, R. L. Seaman, C. R. Benn,Proc. of SPIE Vol. 9910, 2016
  doi:10.1117/12.2231438

- Learning from FITS: Limitations in use in modern astronomical research
  B. Thomas et. al.
  Astronomy and Computing **12**, 133-145 (2015)

- Development, verification, and maintenance of computational software in geodynamics
  M. Gurnis, W. Landry, E. Tan, L. Armendariz, L. Strand, and M. Aivazis
  Geoinformatics: Cyberinfrastructure for the Solid Earth Sciences
  Ed. R. Keller and C. Baru, Cambridge U. Press, 2011

- Implementing a High Performance Tensor Library
  W. Landry
  Scientific Programming **11**, 273-290 (2003)

- Radiation-balanced simulations for binary inspiral
  J. T. Whelan, C. Beetle, W. Landry, R. H. Price
  Classical and Quantum Gravity **19**, 1285 (2001)

- An Efficient Method for Fully Relativistic Simulations of Coalescing Binary Neutron Stars
  W. Landry & S. Teukolsky
  gr-qc/9912004

- Stable characteristic evolution of generic 3-dimensional single-black-hole spacetimes
  Binary Black Hole Grand Challenge Alliance: Abrahams et al.
  Physical Review Letters **80**, 3915-3918 (1998)

- Boosted three-dimensional black-hole evolutions with singularity excision
  Binary Black Hole Grand Challenge Alliance: Abrahams et al.
  Physical Review Letters **80**, 2512-2516 (1998)

- Gravitational wave extraction and outer boundary conditions by perturbative matching
  Binary Black Hole Grand Challenge Alliance: Abrahams et al.
  Physical Review Letters **80**, 1812-1815 (1998)

- Growth of perturbations in homogeneous collisionless collapse: discs versus spheres
  W. Landry, S. Shapiro, and S. Teukolsky
  Monthly Notices of the Royal Astronomical Society **276**, 847-858 (1995)

- Computer Simulations of self-organized wind ripple patterns
  W. Landry and B. Werner
  Physica D **77**, 238-260 (1994)

Selected Presentations

- Converting ADQL's Grammar from BNF to PEG
  Shanghai, China
  IVOA Northern Spring Interop 2017

- Instantaneous Archives
  Trieste, Italy
  Astronomical Data Analysis Software & Systems 2016

- Tables in HDF5
  Sydney, Australia
  Astronomical Data Analysis Software & Systems 2015

- Challenges when Implementing the Planck Virtual Image Service with SIA 2
  Banff, Canada
  IVOA Interop 2014

- Gamra: Simple Meshes for Complex Earth Models
  Singapore
  Nanyang Technical University 2013

- Correct Finite Difference Solutions to Variable Viscosity Stokes Flow with Sharp Interfaces
  San Francisco, CA
  AGU Fall Meeting 2011

- **Invited** Gamr: A Free, Parallel Adaptive Tectonics and Mantle Convection Code
  Long Beach, CA
  SIAM Conference on Mathematical and Computational Issues in the Geosciences 2011

- Scalable Methods for Incompressible Stokes Flow with Yielding Rheologies
  San Francisco, CA
  AGU Fall Meeting 2009

- **Invited** How to Give Away Scientific Software
  Stanford, Palo Alto, CA
  InSAR Processing Workshop 2008

- **Invited** Gale
  Golden, CO
  Workshop on Numerical Modeling of Crustal Deformation and Earthquake Faulting 2008

- ArX: Distributed Version Control
  San Francisco, CA
  Codecon 2005

- Adapting Parallel Multibody Dynamics Software
  Williamsburg, VA
  HPCMP User's Group Conference 2004

- Implementing a High Performance Tensor Library (Library Design)
  Tampa Bay, FL
  Second Workshop on C++ Template Programming, OOPSLA 2001

- Periodic Initial Data for Binary Black Holes
  Pasadena, CA
  Theoretical Astrophysics in Southern California Meeting 2001

- Fully Relativistic 3D Simulations of Accretion onto Rotating Black Holes
  Santa Barbara, CA
  Pacific Coast Gravity Meeting 2001

- An Efficient Method for Fully Relativistic Simulations of Binary Neutron Star Coalescence
  Los Alamos, NM
  Los Alamos National Lab 2001

References

Available on request