JASON M LARKIN

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CAREER OVERVIEW

I learn quickly. I specialize in multi-scale / physics modeling and prediction with varying levels of complexity (i.e., "back of the envelope" versus computationally-intensive simulation). I have extensive experience performing research and development in diverse fields, collaborating in large and multi-disciplinary teams across the globe. The software development has covered the "full-stack", was produced using Agile methods, and has resulted in scalable and sustainable research. I have delivered the results of this research and development through publication and public speaking. **I seek complex problems**.

EXPERIENCE

SpiralGen, Inc. (2015 - , 2013 - 2015) ***Senior Research Engineer , Software Engineer***

Spiral: toolchain creates automatically-optimized and formally-verified kernels for Cyber-Physical Systems. My work involved research and development across the "full-stack" of software and hardware that supported the Spiral toolchain for projects ranging from applications in high-performance, embedded, and cloud computing, with a focus on devlivering Agile solutions in a Continuous Integration environment using (see **Skills** section for more):

- Software Configuration Management (SCM): git, Github, JIRA, Jenkins.
- Virtual Machines (VMs) on Amazon Web Services (AWS): nginx, Docker, nodejs, mongodb
- Web-based Integrated Development Environment (WebIDE): Matlab/Simulink/Mex, Python/Cython, ROS, Webots, KeyMaeraX, Mathematica.

Projects

- **High-Assurance Cyber Military Systems (HACMS, DARPA)**: technology for high-assurance cyber-physical systems.
  - Helped develop Spiral-generated HCOL kernels for motion planning (Kalman filter, Euler integration), navigation control (PID controller), sensor fusion, and spoof/anomaly detection.
  - Integrated and tested on physical targets: Black-i Landshark, American Built Automobile, SMACCM Quadcopter.
  - Large/diverse collaboration team (HRL, SRI, CMU, MIT, Princeton, UIUC, UPenn).
- **Department of Energy (DOE) Small Business Innovation Research (SBIR)**
  - Co-wrote SBIR DOE Grant proposal.
  - Provided consultation on thermal, fluid and nuclear physics for Phase 1 demo of Nuclear Feedwater System.
- **SpiralFFT for National Center for Supercomputing (NCSA) Blue Waters**
  - Improve the petascale performance of Hybrid MPI / OpenMP FFT over existing packages such as FFTW and P3DFFT.
  - Engagement and consulting with the science and engineering teams.
  - Analysis of Pseudo Spectral Methods for modeling turbulence.
- **Power Efficiency Revolution for Embedded Computing Technologies (PERFECT, DARPA)**
  - Began development of virtualized environment for Verilog simulations to support the novel HAMLeT architecture.

Carnegie Mellon University (2010-2012) ***Teaching Assistant-Heat Transfer***

- Topics in conduction, convection, and radiation. Supervised recitations and substituted for lectures.

University of Pittsburgh (2008) ***Teaching Assistant-Advanced Fluid Mechanics***

- Topics in viscous flow, boundary layer theory, and scale similarity.

University of Pittsburgh (2007-2009) ***Lecturer-Physics***

- Lectured to students and faculty on mathematics, bio-physics, turbulence, statistical and nonlinear phenomena.

Precision Therapeutics (2006-2007) ***Intern-Technology Development***

- Worked with team of software developers and laboratory equipment specialists.
- Used CAD to design and fabricate components of optical microscopes and laboratory automation controls.

EDUCATION

- **Carnegie Mellon University** Pittsburgh, PA PhD Mechanical Engineering, 2013 GPA: 3.85/4.00
  - **Thesis**: Vibrational Mode Properties of Disordered Solids from High-Performance Atomistic Simulations and Calculations. Numerically investigated thermal properties of crystal alloys, glasses, and organic materials using classical and *ab initio*-based atomistic techniques.
  - **Coursework**: statistical analysis · nonlinear optimization · numerical methods · molecular/electron structure · nanoscale transport phenomena
- **University of Pittsburgh** Pittsburgh, PA MS Mechanical Engineering, 2009 GPA: 3.70/4.00
  - **Thesis**: Statistics of Particle Concentrations in Free-Surface Turbulence. Performed experiments using novel 2D and 3D flow configurations to study turbulence as a nonlinear dynamical system.
  - **Coursework**: turbulence · chaos and nonlinear phenomena · complexity and information theory · quantum and statistical physics
- **University of Pittsburgh** Pittsburgh, PA BS Mechanical Engineering, 2007 GPA: 3.20/4.00
  - **Research**: Used FEM to design a model arterial bifurcation for *in vivo* study.
- **Steel Center AVTS** Jefferson Hills, PA CADD Certification, 2002 GPA: 3.80/4.00
  - **Coursework**: Trained in CAD using Autodesk's AutoCAD (15.6) and Inventor (5.3) to produce CAM and human machining.

SKILLS (DESCENDING ORDER)

- **Complex Modeling**
  - **Condensed Matter Physics**: Molecular Dynamics, quantum physics (chemistry, field), solid-state physics, thermal physics, nanoscale transport.
  - **Complex Systems**: chaos, nonlinear phenomena, statistical and nonlinear analysis, statistical physics.
  - **Engineering**: fluid dynamics (turbulence, microfluidics, biological), Continuum Mechanics (solid mechanics, kinematics, elasticity)

  - **Robotics**: (motion planning, navigation, sensor fusion, sensor spoofing and detection)
- **Publication and Public Speaking**
  - **Publication**: Journal Publication (11), Book Chapter (2)
  - **Public Speaking**: Conference Presentation (20), Invited Presentation (10)
- **Computation**:
  - **Languages (Lines of Code):** Matlab (20000), Python (10000), Perl (1000), JavaScript (4500), Java (1000), C++/C (4500), Shell (?), Fortran (1000). **Misc**: LaTeX, Markdown, HTML, XML, JSON, CSS
  - **Development:** SCM (svn, git, Jenkins). **Compilers/Compilation**: GNU, Intel C/C++, Visual Studio, MinGW, Cython, Mex, Ant.make,cmake, catkin_make,MSBuild,Maven, Mex, Cython. **Integrated Environments**: Visual Studio, Eclipse, Matlab/Simulink, ROS (roscore, rospy, etc.). **Documentation**: Doxygen, docco, lex/flex
  - **High-Performance Computing:** Linux/Unix cluster administration/computing, parallel computation (MPI, OpenMP), SSE/AVX vectorization.
  - **Deployment:** Amazon Web Services EC2, Virtualization (VirtualBox, VMWare), Debian, NSIS
  - **Operating Systems**: Linux/Unix: (Ubuntu, Red Hat, CentOS, Mac), Windows XP,7,8,Server
  - **General Computing:** Microsoft Office, Libre/Open Office, GIMP.
- **Hardware:** optics/lasers, DI/DO AI/AO interfaces, simple automation, machining, circuitry, simple robotics control.
- **Open-Source Development:** Github, GULP, LAMMPS, ROS, arXiv.

PROJECTS

- **Quantum Mechanics-Driven Prediction of Nanostructure Thermal Conductivity:** served as investigator under the AFOSR with collaborators at Carnegie Mellon and University of Pittsburgh, performing calculations on the DOD's HPCMP.
- **GULP:** international collaboration with Julian Gale at the Nanochemistry Research Institute at Curtin University.
- **Statistics of Free-Surface Turbulence:** international collaboration with Alain Pumir at ENS Lyon, France and Mahesh M. Bandi at OIST.
- **disorder:** a comprehensive repository of open-source code and data from my PhD thesis.
- **Projects Advised On**
  - **ntpy:** created this open-source collaborative effort between members of NTPL and University of Toronto.
  - **Effective energy density and thermal diffusivity of Ioffe-Regel confined vibrations in amorphous silica**: supplied C. S. Gorham with source code and expertise.
  - **Origins of thermal conductivity changes in strained crystals**: supplied K. D. Parrish (Malen Lab, NTPL) with source code and expertise.
  - **Phonon Properties in Superlattices**: supplied Samuel Huberman (University of Toronto, NanoEngineering Group MIT) with source code and expertise.
  - **A Search for Conformal Invariance in Compressible Two Dimensional Turbulence**: provided S. Stefanus with datasets and expertise.
  - **Phonon Transport in Periodic Materials with Feature Sizes of 1 nm to 1 μm**: provided A. Jain with expertise.
- **Phase Change Materials MD potentials**: fit to quantum mechanically-derived energy hypersurfaces using Nonlinear optimization, simulated annealing, and genetic algorithms.
- **pylitrev**: uses Python Natural Language Toolkit (NLP) to provide insight into published writing.

PUBLICATIONS (SELECTED, 11 TOTAL)

- "Origin of the Exceptionally Low Thermal Conductivity of Fullerene Derivative PCBM Films", (in progress).
- "Decorrelating a Compressible Turbulent Flow: an Experiment", Physical Review E 82, 016301 (2010).

PRESENTATIONS (SELECTED, 15 TOTAL)

- "SpiralFFT for Blue Waters", J. Larkin (speaker), T. Popovici, M. Franusich, F. Franchetti, NCSA Blue Waters Symposium for Petascale Science and Beyond May 10-13, 2015
- "Evaluation of the Virtual Crystal Approximation for Predicting Thermal Conductivity", J.M. Larkin (speaker), A.J.H. McGaughey, 2013 MRS Spring Meeting San Francisco, CA.
- "The Generalized Fractal Dimensions of a 2-D Compressible Turbulence", J. Larkin (speaker), M. Bandi, W. Goldburg, 2008 American Physical Society March Meeting New Orleans, LA.

HONORS

- 2012 ASME MHNMT International Summer Heat Transfer Conference Top 5 Technical Paper
- 2011 Bennett Conference Best Presentation
- 2011 ICES Northrop-Gruman Fellow
- 2007-2009 NSF Graduate Student Research Grant University of Pittsburgh Department of Physics.

MEMBERSHIPS

- American Physical Society · American Society of Mechanical Engineers · Materials Research Society · Society of Industrial and Applied Mathematics · DOD High Performance Computing Modernization Program · NCSA Blue Waters PAID IME