

# Jason M Larkin, MS, PhD

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## CAREER OVERVIEW

**I learn quickly and seek complex problems.** 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 and have collaborated in multi-disciplinary teams across the globe. I have delivered the results of my research through publication and public speaking. **I am seeking a position to utilize and increase my knowledge of complex modeling and research.**

## EXPERIENCE

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### SpiralGen, Inc. (2013 - Present) Senior Research Engineer , Software Engineer

- **Spiral:** supported the work of several major research and commercial projects around the Spiral toolchain, creating automatically-optimized / formally-verified kernels for **Cyber-Physical Systems** and **high performance computing (HPC)**.
  - **High-Assurance Cyber Military Systems (HACMS, DARPA)**
    - \* Spiral-generated **kernels**: (PID controller, Kalman filter, Numerical integration, sensor fusion, anomaly detection).
    - \* Spiral code generation plug-in for OSATE and the **Architecture Analysis & Design Language (AADL)**.
    - \* **Physical targets**: Black-i Landshark, American Built Automobile, SMACCM Quadcopter.
    - \* **Large/diverse** collaboration team (HRL, SRI, CMU, MIT, Princeton, UIUC, UPenn).
  - **SpiralFFT for National Center for Supercomputing (NCSA) Blue Waters**
    - \* Improve petascale performance of **Hybrid MPI / OpenMP FFT** over FFTW and P3DFFT.
    - \* Engagement with science teams for analysis of **Pseudo Spectral Methods** for modeling turbulence.
    - \* Development of improved methods for the **NEURON** simulation environment.
  - **DevOps and Cloud: "Full-stack"** of software and hardware (high-performance, embedded, and cloud computing) with a focus on delivering **Agile** solutions in a **Continuous Integration** environment:
    - \* **Software Configuration Management (SCM)**: git, Github, JIRA, Jenkins.
    - \* **Virtual Machines (VMs)** on **Amazon Web Services (AWS)**.
    - \* **WebIDE**: Docker, nginx, nodejs, mongodb.
    - \* Integration of Spiral with: Matlab/Simulink/Mex, Python/Cython, ROS, Webots, KeyMaeraX, Mathematica.
  - **Power Efficiency Revolution for Embedded Computing Technologies (PERFECT, DARPA)**
    - \* Virtualized environment for **Verilog** simulations to support novel HAMLeT architecture.
    - \* Eclipse RCP developed for first commercial release of SpiralFFT.
- **Funding and Resource Proposals:** track record of submitting and being awarded.
  - **DOE Small Business Innovation Research (SBIR)** (co-wrote, Phase 1 awarded, Phase 2 submitted):
  - **CFD Acceleration using Spiral** SBIR (PI, Phase 1 submitted):
  - **NSF NCSA Blue Waters PAID IME Submission** (Co-PI, in progress):
  - **Spiral on PSC Bridges** (PI, submitted)
  - **Optimization of 3-D FFTs for Intel Xeon Phi and NVIDIA Kepler K20 GPUs using Spiral** (PI, submitted, awarded)

### 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 on mathematics, bio-physics, turbulence, statistical and nonlinear phenomena.

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

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

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## 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.
  - **Coursework (8):** statistics · optimization · numerical methods · molecular/electron structure · nanoscale transport
- **University of Pittsburgh** Pittsburgh, PA MS Mechanical Engineering, 2009 GPA: 3.70/4.00

- **Thesis:** Statistics of Particle Concentrations in Free-Surface Turbulence.
- **Coursework (12):** turbulence · chaos and nonlinearity · complexity and information · quantum and statistical physics
- **University of Pittsburgh** Pittsburgh, PA BS Mechanical Engineering, 2007 GPA: 3.20/4.00
  - **Research:** FEM design of model arterial bifurcation.
- **Steel Center AVTS** Jefferson Hills, PA CADD Certification, 2002 GPA: 3.80/4.00
  - **Coursework:** CAD using Autodesk's AutoCAD (15.6) and Inventor (5.3) with CAM.

## SKILLS (DESCENDING ORDER)

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- **Complex Modeling**
  - **Condensed Matter Physics:** **quantum physics** (chemistry, statistical, field), **solid-state physics** (molecular dynamics, nanoscale transport, statistical mechanics).
  - **Engineering:** **fluids** (turbulence, biological), **continuum mechanics** (solid mechanics, kinematics, elasticity).
  - **Complex Systems:** **chaotic and nonlinear systems** (turbulence, many-body systems), **biological fluid dynamics** (arterial flow, viscoelasticity) **robotics** (motion planning, navigation control), **genetics** (sequencing, Markov models).
- **Publication and Public Speaking:** Journal Publication (11), Book Chapter (2), Conference Presentation (18).
- **"Full-Stack" Software Engineering**
  - **Languages (Lines of Code):** Matlab (20000), Python (10000), Perl (1000), JavaScript (4500), Java (1000), C++/C (4500), Fortran (1000). **Misc:** L<sup>A</sup>T<sub>E</sub>X, 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. **Documentation:** Doxygen, JSDoc, lex/flex.
  - **High-Performance Computing:** Linux cluster administration/computing, MPI / OpenMP, SSE/AVX vectorization.
  - **Deployment:** Amazon Web Services EC2, Virtualization (VirtualBox, VMWare), Docker.
  - **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, automation, machining, circuitry, robotics control.
- **Open-Source Development:** Github, GULP, LAMMPS, ROS, arXiv.

## PROJECTS

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- **Advised on 5 projects leading to publication:** K.D. Parrish, S.C. Huberman, A. Jain, S. Stefanus, Nalaka Samaraweera.
- **Research Collaborations**
  - **Nanostructure Thermal Conductivity:** investigator under the AFOSR 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 and Mahesh M. Bandi.
  - **disorder:** comprehensive repository of open-source code and data from PhD thesis.
  - **ntpy:** created open-source effort between NTPL and University of Toronto.
  - **pcm-potentials:** fit hypersurfaces using nonlinear optimization.
  - **pylitrev:** uses Python Natural Language Toolkit (NLP) to provide insight into published work.
  - **Complex Thermostatistics:** **crowd-funded** collaboration with S. Swanson.

## PUBLICATIONS (SELECTED, 11 TOTAL)

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- "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, 18 TOTAL)

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- "SpiralFFT for Blue Waters", **J.M. 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.M. Larkin (speaker)**, M. Bandi, W. Goldberg, 2008 American Physical Society March Meeting New Orleans, LA.