Jason M Larkin, MS, PhD, Consultant, Founder

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CAREER OVERVIEW

I learn quickly and seek complex problems.

- I have extensive experience in **research and development** in diverse fields, collaborating in multi-disciplinary teams globally, delivering my research in **publications and presentations**.
- Simultaneously, I am transferring this research and development into **startup companies**.
- I have done the following ”deep dives”:
  - **Quantum Computing and Information Science**
  - **High Performance Cloud Computing and Collaboration**:CMU-SEI QHub,PhdMentors.org,complexityweekend.com
  - **Materials Science**:atomistic/molecular modeling,nanoscale transport
  - **Condensed Matter Physics**:turbulence/microfluidics,nonlinear/visco-elasticity
  - **Knowledge Management Systems**:natural language processing/understanding,”umwelt hacking”

EXPERIENCE

CMU Software Engineering Institute Emerging Technology Center (2017 - Present) ***Senior Research Scientist***

- **PROJECTS**
  - **Quantum Advantage Evaluation Framework**
    - PI (1.6M funding) for research in applications of quantum advantage versus classical state-of-the-art computing
    - Applications in combinatorial optimization, materials science, machine learning, cryptography
    - Created CMU-SEI QHub, supporting 10 researchers, 5 research publications
  - **Software Defined Hardware (SDH, DARPA)**
    - Worked to create the testing infrastructure for SEI via AWS, JupyterHub, and assorted compilation and analysis tools (Intel, PyTorch, Tensorflow, ARM) to establish maximum theoretical and empirical performance for data-intensive workflows (machine learning, graph analytics, optimization) on commodity hardware (CPU, GPU, TPU).
  - **GraphBLAS Test Framework**
    - GraphBLAS Test Framework (Scott McMillan PI): Created a test framework for multiple implementations of GraphBLAS.org, including SEIs GraphBLAS Template Library

PhDMentors (2019 - present) ***Co-Founder***

- **PROJECTS**
  - Fully cloud/virtual research mentoring service, O(10) mentors, O(40) mentees with clear efficacy/market fit.
  - Formulating new business model, partnership with complexityweekend.com

SpiralGen, Inc. (2013 - 2017) ***Senior Research Engineer***

- **PROJECTS**

Supported work of commercial and research projects featuring the code-generation engine **Spiral**.

– **Spiral Code Generation Toolbox for Matlab/Simulink and Advanced Driver Assistance Systems (ADAS)**:Developed toolbox for Spiral code generation of Automotive Adaptive Cruise Control Using FMCW and MFSK Technology.

– **High-Assurance Cyber Military Systems (HACMS, DARPA)**: Automatically-optimized / formally-verified kernels for **Cyber-Physical Systems** using Spiral, plug-in for OSATE and the **Architecture Analysis** & **Design Language (AADL)**, **DARPA Demo Days** ground/air vehicles, virtual/physical environments, **Large/diverse** collaboration team interacting with O(1000K) Lines of Code (LOC).

– **SpiralFFT for National Center for Supercomputing (NCSA) Blue Waters**: Improve petascale performance of **Hybrid MPI** / **OpenMP** FFT and Stencils using Spiral. **Pseudo Spectral Methods** for modeling turbulence and the **NEURON** simulation environment.

– **SpiralGen DevOps and Cloud Infrastructure**: **”Full-stack”** software development for high-performance, embedded, and cloud computing). **Agile** solutions in a **Continuous Integration** using **Software Configuration Management** (SCM). **WebIDE** interface using **Virtual Machines** (VMs) containers on **Amazon Web Services** (AWS). Integration: Matlab/Simulink/Mex, Python/Cython, ROS, Webots, KeyMaeraX, Mathematica.

– **Power Efficiency Revolution for Embedded Computing Technologies (PERFECT, DARPA)**Eclipse RCP **first commerical release** of SpiralFFT.

– **Building Resource Adaptive Sotware Systems (BRASS, DARPA)**:Test harness for Spiral-generated resource adaptive FFT for Synthetic Apeture Radar.

- **FUNDING AND RESOURCE PROPOSALS**
  - **DOD 172-008 SBIR** (co-wrote Phase 1).

- **DOE SG-13808 SBIR** (co-wrote, Phase 1 awarded, Phase 2 submitted, denied).
- **DOD A15-102 SBIR** (PI, Phase 1 submitted).
- **NSF NCSA Blue Waters PAID IME Submission** (Co-PI).
- **Optimization of 3-D FFTs for Intel Xeon Phi and NVIDIA Kepler K20 GPUs using Spiral** (PI, awarded).

Carnegie Mellon University (2010-2012) ***TA-Heat Transfer: lectured on conduction, convection, radiation.***
University of Pittsburgh (2008) ***TA-Fluid Mechanics: viscous, boundary, scale similarity, dimensional analysis.***
University of Pittsburgh (2007-2009) ***Lecturer-Physics: mathematics, turbulence, statistics and nonlinearity.***
Precision Therapeutics (2006-2007) ***Intern-Technology Development: optical microscope automation design.***

EDUCATION

- **Carnegie Mellon University** Pittsburgh, PA PhD Mechanical Engineering, 2013 GPA: 3.9/4.0
  - **Thesis**: Vibrational Mode Properties of Disordered Solids from High-Performance Atomistic Simulations.
  - **Nanostructure Thermal Conductivity:** investigator for AFOSR on the DOD's HPCMP.
  - **GULP: international** collaboration with Julian Gale at the Nanochemistry Research Institute at Curtin University.
- **University of Pittsburgh** Pittsburgh, PA MS Mechanical Engineering, 2009 GPA: 3.7/4.0
  - **Thesis**: Statistics of Particle Concentrations in Free-Surface Turbulence.
  - **Statistics of Free-Surface Turbulence: international** collaboration with Alain Pumir and Mahesh M. Bandi.
- **University of Pittsburgh** Pittsburgh, PA BS Mechanical Engineering, 2007 GPA: 3.2/4.0
  - **Research**: FEM design of model arterial bifurcation.
- **Steel Center AVTS** Jefferson Hills, PA CADD Certification, 2002 GPA: 3.80/4.00

SKILLS/TOOLS

- **Publication and Public Speaking**: google scholar (journal pubs (18), book chapters (2), conference presentations (28).
- **"Full-Stack" Software Engineering (stacks)**:
  - Python/C++/C (PyTorch/Tensforflow/NLTK/scipy/numpy)
  - Matlab-Simulink/C++/C/Fortran
  - **Software Configuration Management**: svn, git, GitHub, Jenkins, JIRA. **Compilers/Compilation**: GNU, Intel, Visual Studio, MinGW, Cray, Cython, Mex, Ant, make, cmake, catkin_make, MSBuild, Maven.
  - **Cloud Computing**: Amazon Web Service (AWS), Docker, VirtualBox/VMWare, Ubuntu, Red Hat, CentOS, CoreOS, Windows (XP, 7, 8, Server). MPI / OpenMP, Vector Intrinsics (SSE/AVX/etc), CoArray Fortran
- **Hardware:** optics/lasers, DI/DO AI/AO interfaces, automation, machining, circuitry, robotics control.

PUBLICATIONS (SELECTED, 27 TOTAL)

- "Quantum Circuit Generation with SPIRAL", S. Mionis, F. Franchetti, J. Larkin, IEEE High Performance Extreme Computing Conference Septemeber 2021.
- Evaluation of Quantum Approximation Optimization Algorithm, J Larkin, et al, arXiv preprint arXiv:2006.04831 (2021)
- Achieving the Quantum Advantage in Software, SEI Blog, (2019)
- Reduced thermal conductivity of Si/Ge random layer nanowires, N Samaraweera, JM Larkin, Journal of App. Physics (2018)
- Thermal conductivity accumulation in amorphous silica and silicon, JM Larkin, et al, Physical Review B 89 (14), 144303 (2014)
- Origins of thermal conductivity changes in strained crystals, KD Parrish, A Jain, JM Larkin, WA Saidi, AJH McGaughey Physical Review B 90 (23), 235201
- Predicting alloy vibrational mode properties using lattice dynamics calculations, molecular dynamics simulations, and the virtual crystal approximation, JM Larkin, AJH McGaughey Journal of Applied Physics 114 (2), 023507
- Disruption of superlattice phonons by interfacial mixing, SC Huberman, JM Larkin, AJH McGaughey, CH Amon Physical Review B 88 (15), 155311
- Power-law distributions of particle concentration in free-surface flows, J Larkin, et al, Physical Review E 80 (6), 066301 (2009)

PRESENTATIONS (SELECTED, 28 TOTAL)

- Effect of noise models on QAOA performance for Max-Cut, R. Majumdar, J. Larkin, G. Guerreschi, S. Susmita, APS March Meeting 2021.
- Evaluation of QAOA, J. Larkin(speaker), Association Quantum, DC Quantum Meetup 2020.
- Quantum Circuit Optimization with SPIRAL, S. Mionis, J. Larkin, et al, Supercomputing 2020 (best presentation noimnee).
- Assesing Objective Functions for Quantum Variational Optimization, M. Jonsson, J. Larkin et al, IEEE Quantum Week 2020.
- Projecting NISQ-era quantum advantage with QAOA GG Guerreschi, J Larkin, et al American Physical Society 65 2020.

- SpiralFFT for Blue Waters, **J.M. Larkin (speaker)**, NCSA Symposium for Petascale 2015.
- Predicting Vibrational Mean Free Paths in Disordered Systems, J.M. Larkin, A.J.H. McGuaghey, presented at 2013 ASME Summer Heat Transfer Conference Minneapolis, MN.
- Effect of Interspecies Mixing on Phonon Mean Free Paths in Superlattices, S.C. Huberman, J.M. Larkin, A.J.H. McGaughey, C.H. Amon, presented at 2013 ASME Summer Heat Transfer Conference Minneapolis, MN.
- Origin of Thermal Conductivity Changes in Strained Systems, K. Parrish, J.M. Larkin, A.J.H. McGaughey, presented at 2013 ASME Summer Heat Transfer Conference Minneapolis, MN.
- Virtual Crystal Approximation, **J.M. Larkin (speaker)**, 2013 MRS Spring Meeting San Francisco, CA.
- Ordered and Disordered Contributions to Lattice Thermal Conductivity, J.M. Larkin (speaker), A.J.H. McGaughey, presented at 2012 PHONONS Conference Ann Arbor, MI.
- Predicting Phonon Properties of Silicon from First-Principles Calculations, J.M. Larkin, A.J.H. McGaughey (speaker), W.A. Al-Saidi, presented at 2012 ASME Summer Heat Transfer Conference Puerto Rico, USA.
- Generalized Fractal Dimensions...Turbulence, **J.M. Larkin (speaker)**, 2008 American Physical Society March Meeting.
- Flow Chamber to Explore the Development of Cerebral Aneurysms, J. Larkin, et al, 2007 Biomedical Engineering Society.