Sean L. Seyler

COMPUTATIONAL PHYSICS · PROJECT MANAGEMENT · SCIENTIFIC LEADERSHIP

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Education

Arizona State University   *Tempe, AZ*
PH.D. IN PHYSICS   *Aug. 2012 – Dec. 2017*
- Dissertation: Computational approaches to simulation and analysis of large conformational transitions in proteins

Cornell University   *Ithaca, NY*
M.ENG. IN ENGINEERING PHYSICS   *Aug. 2011 – May. 2012*
- M.Eng. project: Modeling dynamic ionization and radiation transport in a numerical magnetohydrodynamic code

Cornell University   *Ithaca, NY*
B.S. IN ENGINEERING PHYSICS   *Aug. 2007 – May. 2011*
- Minor in Applied Mathematics

Experience

ASU Health   *Tempe, AZ*
SENIOR PROJECT MANAGER   *Apr 2025 – current*
- Development of ASU Health Venture Studio concept to accelerate innovation for critical medical technologies
- Facilitating collaborations to enable AI-/ML-powered medicine and medical technologies for education and training

VentSafe Medical   *San Francisco, CA*
CO-FOUNDER AND CHIEF SCIENTIFIC OFFICER   *Nov. 2023 – current*
- Lead scientist developing the next-generation ICU ventilator to treat Acute Respiratory Distress Syndrome (ARDS)
- Currently **funded by NIH Phase I SBIR** – VENTSAFE: Life Saving Ventilation for the Treatment of ARDS
- Responsible for conceptualization, evolution, and supervision of research goals, activities, and grant-writing
- Oversight of multiphysics modeling of fluid-structure interactions (COMSOL) and R&D of engineering prototypes

School of Molecular Sciences, Arizona State University   *Tempe, AZ*
ADJUNCT FACULTY   *Jan 2025 – current*
- Developing stochastic integration methods for dynamical systems with thermal noise
- Developing DEP nanoparticle characterization methods based on the classical scattering problem

CHEMISTRY CLOUD LAB DEVELOPER & CO-INSTRUCTOR   *May 2022 – Jan. 2025*
- Co-instructor for ASU Online CHM 343 (Physical Chemistry Laboratory)
- Software developer for open-source remote-learning tools for ASU Online CHM 343
- Developed familiarity with quantum chemistry software (GAMESS, ORCA, Psi4)
- Developed the MoleCalc web app (molecalc.cloud) for CHM 343 students

RESEARCH LABORATORY MANAGER   *Nov. 2020 – Nov. 2023*
- Co-led development of a SARS-CoV-2 point-of-need (PON) diagnostic device using mechanical and electronic filtration
- Managed, scheduled, and coordinated experimental and computational studies
- Assembled/Maintained computing infrastructure, including lab workstations, networking, and data storage hardware
- Oversaw computational activities of the lab (COMSOL), including troubleshooting and student training
- Oversaw chemistry wet lab operations: safety regulation compliance, inventory/procurement, and implementation of SOPs

INDEPENDENT RESEARCH   *May 2021 – current*
- Developed a new stochastic integration method for generalized Langevin equations
- Developed a new hydrodynamic theory for describing fluid physics and correlations at molecular scales
- Wolfram Community Featured Contributor – Molecular hydrodynamic theory of the velocity autocorrelation function (Staff Picks)
- Developed new DEP characterization method for micro-/nanoparticles based on classical scattering problem

Department of Physics, Arizona State University   *Tempe, AZ*
POSTDOCTORAL RESEARCH SCHOLAR   *Jan. 2018 – Nov. 2020*
- Investigated role of hydrodynamic effects on biological transport processes at subcellular scales
- Developed a state-of-the-art numerical code for generalized Langevin equations (bitbucket.org/sseyler/glsimulator)
- Developed custom particle tracking code based on Trackpy for accurate position/velocity measurements in phase contrast microscopy

Department of Physics, Arizona State University *Tempe, AZ*

Blue Waters Graduate Fellow *Sep. 2016 – Dec. 2017*

- Developed a hybrid atomistic-continuum simulation approach for biomolecular systems
- Developed new fluctuating hydrodynamics (FHD) algorithm and code (bitbucket.org/sseyler/hermeshd)
- Used Blue Waters supercomputer for code development with MPI and domain decomposition

Graduate Research Assistant *Aug. 2012 – Dec. 2017*

- Investigated protein conformational transitions using dimensionality reduction and clustering techniques
- Leveraged HPC and supercomputers to perform molecular dynamics and enhanced-sampling simulations
- Developed (Path Similarity Analysis) method for analyzing conformational transitions of large biomolecules

School of Applied and Engineering Physics, Cornell University *Ithaca, NY*

M.Eng. Student Researcher *Aug. 2011 – Jun. 2016*

- Studied basics of continuum modeling for high-energy density physics (HEDP)
- Developed modular structure for PERSEUS XMHD code (Fortran90); enabled toggling of radiation transport model
- Implemented dynamic ionization and radiation transport models in PERSEUS
- Performed Z-pinch simulations using PERSEUS to study radiation transport effects

Lab of Plasma Studies, Cornell University *Ithaca, NY*

Undergraduate Researcher *Jun. 2010 – Mar. 2012*

- Learned basic principles of parallel computation, GPGPU programming, and CUDA Fortran.
- Modularized the Fortran90 xMHD code PERSEUS for task-parallelization using CUDA Fortran.

Department of Electrical and Computer Engineering, Cornell University *Ithaca, NY*

Undergraduate Researcher *Jun. 2010 – Mar. 2012*

- Sorted and post-processed large data sets containing upper-atmospheric wind measurements.
- Developed working knowledge of Fortran and Mathematica for sorting and visualizing large datasets.

Honors & Awards

International

| 2016 | **Lindau Nobel Laureate Meeting Young Scientist**, 66th Lindau Nobel Laureate Meeting (Physics) | *Lindau, Germany* |

Domestic

2021	**SUN Award**, Arizona State University	*Tempe, AZ*
2020	**Finalist**, GSNP Postdoctoral Speaker Award, APS March Meeting	*Denver, CO*
2017	**CLAS Student Leader**, CLAS Leaders Program, ASU College of Liberal Arts and Sciences	*Tempe, AZ*
2017	**Graduate Excellence Award**, ASU College of Liberal Arts and Sciences	*Tempe, AZ*
2017	**GPSA Outstanding Research Award**, ASU Graduate & Professional Student Association	*Tempe, AZ*
2016	**Blue Waters Graduate Fellowship**, NCSA University of Illinois Urbana-Champaign	*Tempe, AZ*
2016	**CLAS Student Leader**, CLAS Leaders Program, ASU College of Liberal Arts and Sciences	*Tempe, AZ*
2016	**Recipient**, Molecular Imaging Corporation Endowment, ASU Department of Physics	*Tempe, AZ*
2016	**Education Committee Travel Award**, 60th Annual Meeting of the Biophysical Society	*Los Angeles, CA*
2015	**ASU Summer Graduate Fellowship**, ASU Department of Physics	*Tempe, AZ*
2015	**Shirley Chan Student Travel Award**, American Physical Society, Division of Biological Physics	*San Antonio, TX*
2014	**Wally Stoelzel Physics Fellowship**, ASU Department of Physics	*Tempe, AZ*
2012	**David Delano Clark Award**, Cornell University, School of Applied and Engineering Physics	*Ithaca, NY*
2012	**Henri S. Sack Memorial Award**, Cornell University, School of Applied and Engineering Physics	*Ithaca, NY*

Publications

Author order convention in the field: students first, principal investigator(s) last, joint first-authorship may be indicated.
Key: asterisk ("*"): first theorist; dagger ("†"): communicating author.

2025 ***Streaming-particle method for dielectrophoretic characterization***

AKM Fazlul Karim Rasel, EP Ristich, MA Hayes and **SL Seyler**[*][†]

Accepted in Electrophoresis (2025).

Gradient Insulator-based Dielectrophoresis of Gold Nanoparticles

A Ramirez, AKM Fazlul Karim Rasel, P Dawson, **SL Seyler**[*] and MA Hayes[†]

Accepted in Electrophoresis (2025).

Thermodynamically consistent algorithms for generalized Langevin dynamics and temporal coarse-graining

EP Ristich and **SL Seyler**[†]

In preparation (2025).

Fluctuating hydrodynamics formulated as a hyperbolic relaxation system

SL Seyler,[†] CE Seyler and O Beckstein

In preparation (2025).

2024 *Enhanced green fluorescent protein streaming dielectrophoresis in insulator-based microfluidic devices*

J Sheu, **SL Seyler**,[*] AKM Fazlul Karim Rasel and MA Hayes[†]

Accepted in Electrophoresis (2024). doi:10.1002/elps.202400123

2023 *Molecular hydrodynamic theory of the velocity autocorrelation function*

SL Seyler[†] and CE Seyler

The Journal of Chemical Physics. **159**(5), 054108 (2023). doi:[10.1063/5.0153649](10.1063/5.0153649)

A Numerical Study on Microfluidic Devices to Maintain the Concentration and Purity of Dielectrophoresis induced Separated Fractions of Analyte

AKM Fazlul Karim Rasel, **SL Seyler**[*] and MA Hayes[†]

Analytical and Bioanalytical Chemistry **415**, 4861–4873 (2023). doi:[10.1007/s00216-023-04795-4](10.1007/s00216-023-04795-4)

2020 *Surmounting potential barriers: hydrodynamic memory hedges against thermal fluctuations in particle transport*

SL Seyler and S Pressé[†]

The Journal of Chemical Physics. **153**, 041102 (2020). doi:[10.1063/5.0013722](10.1063/5.0013722)

Swimming, fast and slow: strategy and survival of bacterial predators in response to chemical cues

M Carlson, **SL Seyler**[*] and S Pressé[†]

bioarXiv. (2021). doi:[10.1101/2020.11.11.377200v1](10.1101/2020.11.11.377200v1)

2019 *Long-time persistence of hydrodynamic memory boosts microparticle transport*

SL Seyler and S Pressé[†]

Physical Review Research. **1**, 032003(R) (2019). doi:10.1103/PhysRevResearch.1.032003

Hydrodynamic interaction facilitates the unsteady transport of two neighboring vesicles

J Lee, **SL Seyler** and S Pressé[†]

The Journal of Chemical Physics. **151**, 094108 (2019). doi:[10.1063/1.5113880](10.1063/1.5113880)

2017 *Structure of the SLC4 transporter Bor1p in an inward-facing conformation*

N Coudray, **SL Seyler**,[*] R Lasala, Z Zhang, KM Clark, ME Dumont, A Rohou, O Beckstein and DL Stokes[†]

Protein Science. **26**, 130–145 (2017). doi:[10.1002/pro.3061](10.1002/pro.3061)

2016 *MDAnalysis: a Python package for the rapid analysis of molecular dynamics simulations*

RJ Gowers, M Linke, J Barnoud, TJE Reddy, MN Melo, **SL Seyler**, DL Dotson, J Domanski, S Buchoux, IM Kenney, and O Beckstein[†]

Proc of the 15th Python in Science Conf. 102–109 (2016). doi:10.25080/majora-629e541a-00e

datreant: persistent, Pythonic trees for heterogeneous data

DL Dotson, **SL Seyler**, M Linke, and O Beckstein[†]

Proc of the 15th Python in Science Conf. 51–56 (2016). doi:10.25080/Majora-629e541a-007

2015 *Path Similarity Analysis: a Method for Quantifying Macromolecular Pathways*

SL Seyler, A Kumar, MF Thorpe, and O Beckstein[†]

PLoS Computational Biology. **11**, e1004568 (2015). 10.1371/journal.pcbi.1004568

2014 *Sampling large conformational transitions: adenylate kinase as a testing ground*

SL Seyler and O Beckstein[†]

Molecular Simulation. **40**, 10–11, 855-877 (2014). doi:[10.1080/08927022.2014.919497](10.1080/08927022.2014.919497)

Patents

2024 *Improved SpO2 Sensor for Reliable and Rapid Deployment in Critical Care Settings*

D Barker, **SL Seyler**, S Degmetich, A Chatterji

Provisional patent (Application No. 63/697,967) filed April 2024.

Presentations

Talks at some meetings are competitively selected and marked with an asterisk ("*"). Presentations selected for special recognition or an award are marked with a dagger ("†"). Presenting author is listed first. **Invited presentations** are indicated with an underline.

Poster: *Streaming Mode Dielectrophoresis to Characterize Micro and Nanoscale Particles*

AKM F K Rasel, EP Ristich, **SL Seyler** and MA Hayes

SciX 2024, Raleigh Convention Center

Raleigh, NC

Oct. 2024

Poster: *Numerical Investigation on Microfluidic Devices to Maintain Purity and Concentration of Separated Fractions of Bioparticles*

AKM F K Rasel, **SL Seyler** and MA Hayes

SciX 2022, Northern Kentucky Convention Center

Covington, KY

Oct. 2022

Poster: *DC g-iDEP Trapping of Gold Nanoparticles*

A Ramirez, AKM F K Rasel, MA Sauer, **SL Seyler** and MA Hayes

Dielectrophoresis 2020.1, Northern Arizona University

Flagstaff, AZ

Jul. 2021

Poster: *A Numerical Investigation to Extend Quantitation of Gradient-induced Forces within an Insulator-based Sawtooth Design*

AKM F K Rasel, **SL Seyler** and MA Hayes

Dielectrophoresis 2020.1, Northern Arizona University

Flagstaff, AZ

Jul. 2021

Poster: *A Numerical Investigation to Extend Quantitation of Gradient-induced Forces within an Insulator-based Sawtooth Design*

D Charlot, AKM F K Rasel, **SL Seyler** and MA Hayes

SciX 2021, Rhode Island Convention Center

Providence, RI

Sep. 2021

Invited Seminar: *Hydrodynamic Memory Hedges Against Fluctuating Sources of Energy*

SL Seyler

Center for Biological Physics Seminar Series, ASU Department of Physics

Tempe, AZ

Apr. 2020

Talk:* *Hydrodynamic memory and driven microparticle transport: hedging against fluctuating sources of energy*

SL Seyler

APS March Meeting 2021

Denver, CO

Mar. 2021

Poster: *Hydrodynamic Memory and Single-cargo Transport Efficiency in Liquids: Beyond Stokes' Law*

SL Seyler and S Pressé

Nature Conferences: Functional dynamics—visualizing molecules in action

Tempe, AZ

Nov. 2019

Invited Talk: *Hydrodynamics beyond Navier-Stokes: mass and energy transport in nanofluidic flows through the lens of the numerical model*

SL Seyler

NCSA Blue Waters Symposium

Sun River, OR

Jun. 2019

Talk: *Transport of sub-micron particles in liquids: hydrodynamic memory effects can boost efficiency*

SL Seyler and S Pressé

BioPhest Meeting, ASU Center for Biological Physics

Tempe, AZ

Mar. 2019

Talk: *Hydrodynamic Brownian motion and nanoscale transport efficiency in liquids*

SL Seyler and S Pressé

APS March Meeting 2019

Boston, MA

Mar. 2019

Talk: *Fluctuating Hydrodynamics in the 13-moment Approximation for Simulating Biomacromolecular Nanomachines*

SL Seyler, CE Seyler and O Beckstein

APS March Meeting 2018

Loa Angeles, CA

Mar. 2018

Invited Talk: *Developing a Hybrid Atomistic-Continuum Method for Simulating Large-scale Heterogeneous Biomolecular Systems*

SL Seyler, CE Seyler and O Beckstein

2018 NCSA Blue Waters Symposium

Sun River, OR

May 2017

Invited Poster: *Developing a Hybrid Atomistic-Continuum Method for Simulating Large-scale Heterogeneous Biomolecular Systems*

SL Seyler, CE Seyler and O Beckstein

2017 NCSA Blue Waters Symposium

Sun River, OR

May 2017

Talk: *Developing a hybrid atomistic-continuum method for simulating large-scale heterogeneous biomolecular systems*
SL Seyler, CE Seyler and O Beckstein
BioPhest Meeting, ASU Center for Biological Physics

Tempe, AZ

Apr. 2017

Platform Presentation: *Quantifying Macromolecular Transition Paths with Path Similarity Analysis*
SL Seyler, T Colburn, A Kumar, MF Thorpe, and O Beckstein
60th Annual Meeting of the Biophysical Society

Los Angeles, CA

Mar. 2016

Poster: *Path Similarity Analysis: a Method for Quantifying Macromolecular Pathways*
SL Seyler, A Kumar, MF Thorpe, and O Beckstein
APS Four Corners Section (4CS) 2015 Annual Meeting

Tempe, AZ

Oct. 2015

Talk: *Path Similarity Analysis: a method for quantifying macromolecular transition pathways*
SL Seyler, A Kumar, MF Thorpe, and O Beckstein
BioPhest Meeting, ASU Center for Biological Physics

Tempe, AZ

May, 2015

Poster: *Quantifying macromolecular conformational transition pathways*
SL Seyler, A Kumar, MF Thorpe, and O Beckstein
APS March Meeting 2015

San Antonio, TX

Mar. 2015

Talk: *Quantifying conformational transitions: an application to simulations of apo adenylate kinase*
SL Seyler, A Kumar, MF Thorpe, and O Beckstein
BioPhest Meeting, University of Arizona Biological Physics Program

Tucson, AZ

Apr. 2014

<u>Invited Seminar</u>: *Quantifying conformational transitions*
SL Seyler
University of Pittsburgh, Department of Biological Sciences

Pittsburgh, PA

Nov. 2013

Talk:* *An approach to quantifying conformational transitions*
SL Seyler, A Kumar, MF Thorpe, and O Beckstein
APS Four Corners Section (4CS) 2013 Annual Meeting

Denver, CO

Oct. 2013

Talk: *Quantifying conformational transitions*
SL Seyler and O Beckstein
BioPhest Meeting, ASU Center for Biological Physics

Tempe, AZ

Apr. 2013

Mentorship & Service

2014–	**Reviewer (ad hoc)**, Journals: Computer Methods in Biomechanics and Biomedical Engineering (invited), Archives of Biochemistry and Biophysics (invited), Proteins (supervised), Journal of the American Chemical Society (supervised), Proceedings of the National Academy of Sciences (supervised)	*Tempe, AZ*
2023–	**Mentor and Project Advisor**, Mentee – Erin P Ristich (ASU Honors Student in Computer Science). Honors thesis committee member and primary project advisor.	*Tempe, AZ*
2022–	**Mentor**, Mentee – AKM Fazlul Karim Rasel (ASU Chemistry PhD candidate). Developing new methods for (bio)particle characterization and enrichment using dielectrophoresis and microfluidic device design.	*Tempe, AZ*
2020–2023	**Mentor**, Mentee – Michael Sauer (ASU Biochemistry PhD student). Development of a hybrid chemical kinetic model to investigate the Loop-Mediated Isothermal Amplification (LAMP) reaction network.	*Tempe, AZ*
2018–2022	**Mentor**, Mentee – Mikayla Carlson (ASU Biochemistry PhD student). Elucidating the hunting strategy of *Bdellivibrio bacteriovorus*, a predatory bacterium, using physics models; development of LAMP assay for COVID point-of-need diagnostic device.	*Tempe, AZ*
2020–2021	**Mentor**, Mentee – Shep Bryan IV (ASU Physics PhD student). Bayesian prediction of unknown potential energy functions, particularly with realistic models of particle dynamics that include hydrodynamic memory.	*Tempe, AZ*
2015–2019	**Mentor**, Mentee – Taylor Colburn (ASU Physics undergraduate student). Helped develop Dynamic Importance Sampling MD as applied to explicit solvent MD simulations; testing its viability on the Mhp1 membrane transporter protein.	*Tempe, AZ*
2023	**Judge**, ASU Department of Physics Undergraduate Research Symposium	*Phoenix, AZ*

2021	**Judge**, Regeneron International Science and Engineering Fair (ISEF), judge and interviewer for Physics & Astronomy	*Remote*
2021	**Judge**, Arizona Science and Engineering Fair, judge and interviewer for Physics & Astronomy and Computational Biology & Bioinformatics.	*Phoenix, AZ*
2021	**Judge**, Maricopa Institute of Technology Science and Engineering Fair, judge and interviewer	*Phoenix, AZ*

Technical Skills

Programming	Python, Cython, Fortran, C/C**++**, Mathematica, MATLAB, Java, Julia
Scientific Computing	Linux, HPC/Supercomputing, Git, Xarray/Pandas, Inkscape, ImageJ, GIMP, LaTeX
Simulation & Modeling	VMD, NAMD, GROMACS, LAMMPS, CHARMM, OpenMM, GAMESS, Orca, Psi4, RDKit, Chimera, AutoCAD, COMSOL
Web Development	Flask, FastAPI, HTML/CSS, Javascript, SQL, MongoDB, Nginx