# Jonas Lippuner

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**Fluent languages:** English, German

## Summary

I am a postdoc in computational astrophysics at Caltech. I enjoy analyzing and solving challenging problems and building systems to automate repetitive tasks. I can quickly learn and apply new methods and concepts to help achieve specific goals. I am well-versed in numerous numerical, mathematical, statistical, and basic machine learning techniques, and I have substantial experience with writing and optimizing parallel code for GPUs.

| Physics interests | Coding interests | Finance interests |
|---|---|---|
| computational & nuclear astrophysics, core-collapse supernovae, nucleosynthesis, radiation transport | programming for GPUs and FPGAs, large-scale parallel simulations, machine learning, automation | quantitative trading algorithms, automated trading systems, Monte Carlo methods, Bayesian networks |

## Education

**California Institute of Technology** **Pasadena, CA, USA** **Oct 2012 – Jun 2017**
*Ph.D. in Physics*
- Investigating where in the universe heavy elements like gold, lead, and uranium were created
- Developing an open source, highly modular software package to adaptively evolve a network of 140,000 nuclear reactions, also includes code to make a movie of the results, and an easy-to-use Python interface; my code is actively being used by several other researchers
- Running parallel scientific codes on national supercomputers (e.g. NCSA Blue Waters, TACC Stampede)
- Served as president of a student club, served as both chair and member of different organizing committees (for local lecture events and an international scientific conference)

**University of Manitoba** **Winnipeg, MB, Canada** **Sep 2008 – May 2012**
*B.Sc. (Hons.) in Mathematics and Physics*
- Graduated with the highest GPA (4.48/4.50, 99.6%) among all undergraduate students (about 2500)
- Received numerous merit-based awards and scholarships, see http://jonaslippuner.com/awards

**Kantonsschule am Burggraben** **St. Gallen, SG, Switzerland** **Jul 2007**
*Schweizerische Maturität (Swiss federal university entrance diploma, equivalent to A-Level certificate)*
- Graduating GPA: 5.3/6.0, 88.3%, senior thesis got published in a highly selective book series
- Special subject: Physics and Applied Mathematics, complementary subject: Chemistry
- Implemented a 3D graphical simulation of the solar system for senior thesis

## Skills and Abilities

**Communication skills:** scientific writing, collaborative writing, data visualization and animation, making high quality graphs and figures, oral and poster presentations (won awards for some of my presentations)

**Research skills:** finding and understanding relevant literature, formulating and testing hypotheses, asking relevant questions, analyzing and understanding complex processes

**Coding skills:** parallelizing and optimizing existing code, collaborative development on big coding projects

**Algorithms and Techniques**
- Optimization and root-finding techniques (e.g. gradient descent, genetic algorithm, Newton–Raphson)
- Various numerical methods (e.g. differentiation, integration, smooth interpolation, Monte Carlo)
- Discretizing and solving partial differential equations (finite difference/element, spectral, discontinuous Galerkin)
- Basic signal processing (e.g. Fourier analysis, wavelet analysis, fast folding, template matching)
- Basic machine learning (neural network basics, convolutional neural networks, deep learning, autoencoder basics)

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## Programming Languages and Technologies

| Highly Proficient | Substantial Experience | Working Knowledge |
|---|---|---|
| C/C++, NVIDIA CUDA, C#, Python, LaTeX, Linux / Unix, git, Eclipse, Microsoft Windows | MATLAB, Mathematica, Intel MKL, CMake, Bash, Visual Studio, regex, SWIG, SQL, HTML, CSS, ASP.NET | MPI, OpenMP, Fortran, Java, HDF5, Perl, OpenGL, JavaScript, Go, PHP, MySQL, XML, XSLT |

## Experience

**Postdoctoral Scholar** **California Institute of Technology (USA)** **Jul 2017 – present**
*Division of Physics, Mathematics, and Astronomy*
- Coupling a nuclear reaction network to a 1D core-collapse supernova simulation

**JPL Graduate Fellow** **Jet Propulsion Laboratory (USA)** **Jun 2016 – Sep 2016**
*Deep Space Tracking Systems*
- Implemented and accelerated algorithms for pulsar searches and radio astronomy time series analysis with GPUs
- Debugged and improved existing single radio pulse detection pipeline

**Intern** **NVIDIA Corporation (USA)** **Jun 2015 – Sep 2015**
*CUDA DevTech*
- Implemented a prototype library for efficient MPI-style collective communication between multiple GPUs

**Volunteer Bookkeeper** **Small non-profit organization (USA)** **Apr 2013 – Jun 2014**
*Accounting and tax compliance*
- Responsible for all business accounting, financial reports, recording donations, issuing donation receipts, payroll, filing tax documents, and making sure operations comply with requirements for tax exempt status
- Automated recording of donations, generating donation statements, and generating financial reports
- Introduced secure digital record keeping system and monthly wage statements for employees

**Research Student** **University of Manitoba (Canada)** **Summer 2011 & 2012**
*Department of Mathematics*
- Implemented a finite element method with MATLAB to numerically solve partial differential equations

**Research Student** **CancerCare Manitoba (Canada)** **Summer 2009 & 2010**
*Medical Physics Department*
- Developed an open source extension to an existing software package to simulate medical x-ray imaging
- Implemented a parallel Monte Carlo radiation transport for GPUs achieving speedups of 20 – 40 times

**Software Engineer, Web Developer** **Local Government (Switzerland)** **Oct 2007 – Aug 2008: Intern**
*City Clerk's Office* **Sep 2008 – Sep 2009: Contractor**
- Developed database back end and front end of City Parliament website showing sessions, business items, documents, members, committees, and interactive seating map (website still active!)
- Developed various small GUI programs to interface with existing software and databases
- Automated or drastically simplified various common repetitive, tedious tasks in the City Clerk's Office

## Honors and Prizes (selected, see http://jonaslippuner.com/honors)

- **Best Talk** (Theoretical Astrophysics in Southern California Meeting, University of California, San Diego, 2014)
- **Governor General's Silver Medal** (for highest standing at the undergraduate level, University of Manitoba, 2012)
- **University Gold Medal in Science** (for highest standing in undergraduate Science, University of Manitoba, 2012)
- **Allen Medal in Physics** (for highest standing in the final two years of Honours Physics or Honours Physics and Mathematics, University of Manitoba, 2012)
- **Best Entry in Physics and Astronomy** (Faculty of Science Poster Competition, University of Manitoba, 2011)
- **Best Presentation** (Summer Student Symposium, CancerCare Manitoba, 2010)