Ben Czaja

Education

Ph.D., Computational Science — Amsterdam, the Netherlands
University of Amsterdam — *Jan. 2017 – Dec 2020*

Master of Science, Astronomy and Astrophysics — Innsbruck, Austria
University of Innsbruck – University of Padua – University of Göttingen — *Aug. 2014 – Sep. 2016*

Bachelor of Science, Physics — Salt Lake City, U.S.A.
University of Utah — *Aug. 2007 – Dec. 2012*

Experience

Ph.D. Research — Jan. 2017 – Dec. 2020
University of Amsterdam

- Core developer for HemoCell, which is two open-source cell resolved blood flow solvers. Both models are developed for deployment on high performance distributed computing facilities. Numerical methods include the combined Immersed boundary-lattice Boltzmann method for computational fluid dynamics, fluid structure interaction, and multi-scale modelling.
- Wrote annual funding proposals for computing time on the Dutch national supercomputer Cartesius.
- Pursued and organized collaboration with two external experimental groups (one in U.S.A. and the other in Canada).
- Lead author on three peer reviewed scientific journal articles and co-author on three additional articles.

Visiting Scholar — March 2019 – June 2019
University of Michigan - College of Chemical Engineering

- Designed/conducted in-vitro blood flow experiments using the HemoCell software. Lead author on the resulting publication in PLOS computational biology.
- Designed cover image of the research project using Blender, which was selected for the March 2020 issue cover.

Workshop Instructor - High Performance Computing — Sep. 2018 & Feb. 2020
Partnership for advanced computing in Europe (PRACE) training event
Barcelona Super Computing Center

- Instructor in multiple workshops for Ph.D. level researchers to get hands on experience with compiling, deploying, and visualizing output from parallel software on a HPC machine.
- Developed HPC course in collaboration with members from the visualization and cluster computing groups at SURF.

Master Thesis Supervisor — Sep. 2018 – Aug. 2020
University of Amsterdam

- Conceived, organized, and was the daily supervisor on two computational science master student thesis projects. Both students graduated on time, and both projects resulted in submissions to peer reviewed journals.
- Co-daily supervisor on a third master thesis project, which resulted in publication in the international journal for uncertainty quantification.

Teaching Assistant - Intro to Computational Science (Master Level) — Sep. 2017 – Dec. 2019
University of Amsterdam

- Conducted/Taught lab sessions for the master level Introduction to Computational Science course.
- Developed and graded two month long assignments. Assignments focused on discrete, stochastic, and lattice based simulations to model and analyze the spread of infectious diseases.

Master Thesis Research - Computational Astrophysics — Jan. 2016 - Sep. 2016
University of Padua - National Institute of Astrophysics

- Developed and performed N-body smoothed particle hydrodynamic simulations of star formation from colliding molecular clouds. Ref. Michela Mapelli
- Developed star identifying algorithm to analyze 10^6 simulation particles.

Research Assistant - Computational Astrophysics 2012 – 2014

University of Utah - Department of Physics and Astronomy

- Modelled the measurable effect that the mass of the Milky Way has on observations of the Cosmic Microwave Background. Research published in the Physical Review. Ref. Prof. Benjamin Bromley
- Performed numerical stellar orbit determinations to search for minor merger events in Milky Way galaxy. Ref. Prof. Inese Ivans

Projects

HemoCell | *C/C++, Python, Fortran, HDF5, Slurm, HTML, CSS, MPI, Singularity* Jan. 2017 – Dec. 2020

- Core developer for HPC framework and applications focused on solving physiological blood flow problems.
- Maintained Git repository for open-source release as well as designed/created HemoCell2D website using HTML/CSS (www.hemocell.eu).
- Wrote proposals and acquired annual NWO funding for computing time on the Cartesius cluster.

Heterogeneous Multiscale Model for blood flow | *C/C++, Python, HDF5, Slurm, MPI* Jan. 2019 – Dec. 2020

- Conceived and lead developer for a multiscale model for blood flow using the heterogeneous multiscale method. Model is built upon Palabos and is a coupling between lattice based advection diffusion solvers and cell resolved blood flow solver HemoCell.

ChaNGa (Charm N-body GrAvity solver) | *C/C++, Charm++, Python, PBS* Jan. 2015 – Oct. 2015

- Acquired AstroMundus Category A scholarship to fund Master programme and thesis project.
- Developed star formation algorithm to identify formed stars in large scale simulation output (approximately 10^6 simulation particles). Deployed simulations on the GALILEO cluster at CINCEA.

GalgRav | *C/C++, Python, MPI, Perl* 2012 – 2014

- Lead developer for N-body integrator to study massless body dynamics in galactic gravitational potentials.
- Acquired UROP scholarship to fund and initiate project and resulting research. Applied numerical code in two Astrophysics research groups. Deployed simulations on NASA's Discover cluster.

Technical Skills

Languages: Python, C/C++, Fortran, HTML/CSS, Bash, Go
Frameworks/Libraries: HemoCell, Palabos, NumPy, pandas, HDF5, OpenCV, OpenMP, MPI, Bootstrap, Hugo
Tools: Git, Blender, Paraview, Slurm, PBS, Docker, Singularity

Languages

Native: English
Intermediate: Dutch (B1)
Basic: German (A2), Italian (A2)

Publications

Lead Author

Czaja, B., Závodszky, G., & Hoekstra, A. (2020, June). A Heterogeneous Multi-scale Model for Blood Flow. International Conference on Computational Science (pp. 403-409). Springer, Cham.

Czaja, B., Gutierrez, M., Závodszky, G., de Kanter, D., Hoekstra, A., & Eniola-Adefeso, O. (2020). The influence of red blood cell deformability on hematocrit profiles and platelet margination. PLOS Computational Biology, 16(3), e1007716.

Czaja, B., Závodszky, G., Azizi Tarksalooyeh, V., & Hoekstra, A. G. (2018). Cell-resolved blood flow simulations of saccular aneurysms: effects of pulsatility and aspect ratio. Journal of The Royal Society Interface, 15(146), 20180485.

Czaja, B., & Bromley, B. C. (2014). Distortion of the cosmic microwave background by the Milky Way. Physical Review D, 90(4), 047302.