Nathan **Touroux**

PhD Student - Computational fluid dynamics

Contact

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Technical Skills

- Rust | Haskell
- git | awk | sed | bash | vim | helix
- ArchLinux | MacOS
- Parallel programming (CPU and GPU)
- Encryption (TLS, WebSockets)
- Relativistic hydrodynamics
- Stochastic simulations
- Numerical integration

Soft Skills

- Creative Problem Solving
- Scientific Communication
- Improvisation
- Rigor

Languages

French — Native

English — Fluent

Japanese — Begginer

Hobbies & Interests

- Japanese Language
- Programming
- Numerical analysis
- Fantasy novels/comics/cartoon
- Board games

About me

PhD student in theoretical physics pasionate about programming and simulations. Tried numerous programming languages, yet stayed true to Rust and Haskell. Driven by programming challenges, especially involving optimization and type level programming.

Professional Experience

2024 – 2025 **Full stack Rust developper**

LetScan — Nantes, France

Technical leader of a team of 3 developpers dedicated to efficient signal processing.

- Developpement of a CPU and GPU backend for efficient signal processing.
- Creation and implementation of a compute server, a web client, and a native app connected by encrypted connections to analyse and synthesise signals.
- Creation of a mobile app dedicated to the classification of baby emotions. For this purpose, an AI model was trained on the output of the signal analysis method developped by the company.

Education

2020 - now **PhD in Physicst: numerical fluid dynamics**

IMT Atlantique, Subatech, Osaka University, YITP — Nantes, France and Osaka, Japan

Double degree program PhD between France and Japan. Granted the MEXT scholarship from the Japanese governement.

Courses: Heavy-ion Collisions, Relativistic Hydrodynamics, Non-equilibrium Physics, Anti-matter, Integrity and Ethics.

Dissertation: *"Efficient solver for relativistic hydrodynamics with implicit Runge-Kutta method"*

- Creation and implementation in Rust of a general implicit integration method applied to relativistic hydrodynamics.
- Emphasis on improved accuracy and efficiency compared to existing methods.

2018 - 2020 **Master in Particle physics**

Nantes University — Nantes, France

Courses: Quantum Field Theory, Perturbation Theory, N-body Problem, Solid State Physics, Atomic Physics, Group Theory, Signal Theory, Monte Carlo Simulations, Statistics, Numerical Analysis.

Thesis: *"Impact of the dimensions in the dynamics of fluctuations in heavy-ion collisions"*

- Creation and implementation in Rust of a Partial Differential Equation (PDE) solver on GPU.
- Focus on efficiency with GPU parallel programming required by the time-consuming nature of schochastic simulations.
- Developpement of a PDE compiler for GPU to study various equations.

Publications

2025 N. Attieh, **N. Touroux**, M. Bluhm, M. Kitazawa, T. Sami, and M. Nahrgang, "Renormalized critical dynamics and fluctuations in model A in the Hohenberg-Halperin classification", *Phys. Rev. C 111(2):24906*, 2025, doi: *10.1103/PhysRevC.111.024906*.

2024 **N. Touroux**, M. Kitazawa, K. Murase, and M. Nahrgang, "Efficient Solver of Relativistic Hydrodynamics with an Implicit Runge–Kutta Method", *PTEP 2024(6):63*, 2024, doi: *10.1093/ptep/ptae058*.

Projects

BoxArray

https://crates.io/crates/boxarray

BoxArray is an open-source Rust library dedicated to safely allocate fixed-size arrays on the heap. Especially, it uses unsafe Rust code for efficiency while guaranteeing correct usage through type level programming.