# Léo Bechet

*Curriculum Vitae*

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## Introduction

Passionate about astronomy, optics, and computer science, I hold a Master's degree in Computational Physics and a Bachelor's degree in Fundamental Physics. With research experience at FEMTO-ST and the SYSTEM-7 Lab of the University of Tokyo, I have developed strong technical skills in Python, JavaScript, Fortran and modern neural network training, including exposure to cutting-edge learning techniques. Fluent in English at a Cambridge C1 + level and deeply curious about optics, meteorology, chemistry, and biology, I thrive on complex technical challenges and seek international opportunities where I can contribute to scientific innovation for the advancement of society.

## Education

Sep. 2025 – ongoing **PhD – Energy-efficient algorithmic solutions driven by data-intensive applications**, *Uppsala University, Division of Scientific Computing*, Uppsala, Sweden

Sep. 2024 – Jul. 2025 **Master 2 – Physics & Computational Physics (CompuPhys)**, *University of Bourgogne Franche-Comte*, Besancon, France

Sep. 2023 – Jun. 2024 **Master 1 – Physics & Computational Physics (CompuPhys)**, *University of Bourgogne Franche-Comte*, Besancon, France

Jul. 2021 – Jun. 2023 **Bachelors in Fundamental Physics**, *University of Bourgogne Franche-Comte*, Besancon, France

Jul. 2019 – Jun. 2021 **Higher school preparatory classes - Physics-Chemistry and engineering science, specilization in Physics and chemistry**, *Lycée Follereau*, Belfort, France

## Research Internships

Feb 2025 - Jul 2025 **Hybrid Gradient Propagation via DFA-Seeding for Efficient Parallel Training**, *System 7 lab, Tokyo University*, André RÖHM & Ryoichi HORISAKI

- Development and characterization of a bleeding-edge neural network training technique applied to Physical Neural Networks (PNN). The results are not yet public and are awaiting publication.

June 2024 - August 2024 **Stepper motor based laser sweeping of a viewport.**, *FEMTO-ST, Time and Frequency Department*, Marion DELEHAYE

- Developing an embedded system with Arduino-like boards for laser movement to clean ytterbium deposits. Designing a computer-controlled mirror mount to ensure precise laser trajectory in an optical setup. Emphasizing affordability and precision using standard lab resources. Finalizing a PWM-based control unit for comprehensive laser management. Project nearing completion.

Oct 2023 - June 2024 **3D Extinction Mapping of the Milky Way using Artificial Neural Network**, *University of Bourgogne Franche Comte*, Barnabé Deforet

- Conducted a literature review on extinction estimation techniques and developed an Artificial Neural Network (ANN). The ANN predicts extinction profiles from color-magnitude histograms, optimizing computational efficiency while maintaining high accuracy, expanding on D. Cornu's thesis.

Jan 2024 **Building of a Multidimensional Potential Energy Surface**, *University of Bourgogne Franche Comte*, Ludovic Martin-Gondre

- Developed and validated multidimensional potential energy surfaces (PES) for N/W(100) atom-surface and N2/W(100) molecule-surface interactions. Initiated with a 3D PES using Morse functions and Fourier expansions, enhanced with a Z-dependent alpha parameter. Expanded to a 6D PES using the LEPS potential to simulate gas-surface reactions. Implemented in Fortran with benchmarking against the CRP model for accuracy, building on L. Martin-Gondre's research in advanced scientific applications.

Sep 2023 - Oct 2023 **Space battle around a Black Hole**, *University of Bourgogne Franche Comte*

- Created a sophisticated physics engine for a mini-game, integrating advanced dynamics with first-order relativistic corrections and precise collision detection, including elastic collisions. Developed using Python, the project included a leap-frog algorithm integrator and GPU-based graphical engine for real-time visual feedback, overseen by D. Viennot for proficiency in large-scale project development.

May 2022 - June 2022 **Analysis framework for commercial lightbulbs**, *FEMTO-ST, Energy dpt*

- Developped a python based analysis framework for a commercial entity. Content of the project is under NDA.

## Projects

Oct. 2024 - Dec. 2024 **GPU/CPU optimized N-Body simulation in Fortran**, *University of Bourgogne Franche Comte*

- Created and implemented a N-Body simulation. Optimized the code using different techniques to achieve high performance. Adapted the code to utilize multi-threading using OpenMP, and run on GPU accelrators using OpenACC. Studied accuracy evolution between implementations and speedup.

Jan. 2024 - July 2024 **Stability And Evolution Of Conway's Game Of Life**, *University of Bourgogne Franche Comte*

- Studied the stability of Conway's Game of Life cellular automaton (CA) using hardware-accelerated computation, focusing on grid filling percentages. Found CA stability around 4.1% fill. Explored additional properties, including calculating the Lyapunov exponent with different Tychonov distance definitions.

March 2024 - Ongoing **Strange attractor visualizer**, *Personal project*

- Developed a Python tool with Matplotlib to visualize 2D and 3D strange attractors, featuring a library of famous examples and support for custom definitions. Inspired by Paul Bourke's work, the tool offers interactive exploration of chaotic systems and attractor dynamics.

Feb 2024 **Web implementation of the Marching Cubes algorithm**, *Personal project*

- Created a real-time 3D JavaScript demo with dynamic camera control and optimized chunk management. Implemented the Marching Cubes algorithm on the Mandelbulb function using Web Workers for parallelization, enhancing performance. Features include customizable camera controls, automated chunk generation, and efficient resource management for optimal browser-based performance.

Feb 2024 **Web-Based 3D Raycast Renderer Development**, *Personal project*

- Implemented GPU-accelerated ray marching for voxel-based data in a web browser using ModernGL. Developed a custom 3D renderer focused on real-time graphics and shader optimization for web-based applications.

## Skills

Computer Related

- Programming: Fortran, OpenMP, OpenACC, Python, Javascript/HTML/CSS and NodeJS, C#, C, Bash, GLSL/HLSL, Jupyter Notebook, MARKDOWN, LaTeX, Tensorflow/PyTorch
- Software: Microsoft Office Suite, Autodesk Fusion 360, Docker and Portainer, Photoshop, Lightroom
- Miscellaneous : Numerical/Physical simulations, Personal server administration, Assembly basics, Embedded system programming.

Languages English (C1+), French (Native), Spanish (A2), Japanese (Early beginner)

Miscellaneous

- Photography and Astro-photography and image processing
- Experience : Electronics and embedded systems, Optical test-benches and high-power equipment, Experimental and theoretical chemistry.

## Extra-Curricular Activities

**Course-En-Cours Regional Winner - 2017 Season**, *Team member in an high-school engineering project*

- Contributed to an award-winning high school team at the National Course-En-Cours championship, achieving regional champions and 12th place nationally. Involved in designing an aerodynamic car meeting strict regulations, optimizing engine performance, and leading public communication efforts.