

Antoine Amy

PhD Student (SUBATECH / UMass Amherst)

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Education

PhD in Subatomic Physics

2023–pres, 18/18 mo

SUBATECH (Nantes, FR) / UMass Amherst (Amherst, MA, USA)

Thesis: Rare Event Searches in Liquid Xenon with the future nEXO experiment.

Advisors: Julien Masbou (Nantes Université), Andrea Pocar (UMass Amherst).

Master of Science in Subatomic Physics

2021–2023

Nantes Université, Nantes, France

High honors; focus on astroparticle physics, instrumentation, and analysis.

Plas@Par Summer School

Aug 2021

Sorbonne Université, Roscoff, France

Simulations, mathematical modeling, and experimental plasma physics.

GraSPA Summer School

Aug 2021

LAPP, Annecy, France

Courses in particle and astroparticle physics.

Bachelor of Science in Fundamental Physics (Licence)

2018–2021

Nantes Université, Nantes, France

Includes **CUPGE** (selective honors preparatory year) with advanced chemistry, computer science, mathematics, and physics.

High honors.

Research Experience

nEXO

2023–present

SUBATECH (Nantes, FR) / UMass Amherst (Amherst, MA, USA)

▪ Electronegative impurities

- Built purification and outgassing models for electronegative impurities in ultra-high vacuum (UHV) systems and liquid xenon.
- Established mitigation practices (throughput/RGA measurements, bake/clean cycles, purges) and contributed targets for impurity budgets.
- Data analysis of electron lifetimes in liquid xenon (ongoing work).

▪ Radioactive background mitigation

- Performed Monte Carlo simulations of radioactive decays and evaluated shielding efficiency.
- Developed automated pipelines for terabyte-scale radioactive-background simulations

and data reconstruction.

- Modeled γ -attenuation in shielding; defined analytic calculations compared with large-scale MC/reconstruction and extracted attenuation coefficients.
- Worked on statistical treatment of the collaboration background budget using truncated-Gaussian mean/spread.
- **Cryogenic liquid recirculation**
 - Designed and tested a HFE recirculation system.
 - Designed an LN₂ heat exchanger.
 - Implemented instrumentation and DAQ (thermocouples, pressure sensors, flow meters) and slow controls (Arduino-based 10-channel thermocouple readout); developed a control/monitoring web UI.
 - Designed PCBs and integrated power, relay, and valve-control electronics.
 - Mentored two undergraduate students (engineering/physics).
- Authored collaboration-wide notes and presented results in collaboration seminars.

Virgo (Advanced Virgo)

2023

LAPP (Annecy, France)

- Mode-cleaner cavity R&D: optical bench assembly, Python/MATLAB simulations, alignment.

XENON/DARWIN

2022

Università dell'Aquila / LNGS-INFN (L'Aquila, Italy)

- ABALONE hybrid photosensor characterization; Geant4 optical modeling; DAQ noise measurements and analysis.

KM3NeT

2021

SUBATECH (Nantes, France)

- Geant4 simulation of Cherenkov signals; ROOT/C++ analysis of radiation-matter interactions.

Teaching

- IMT Atlantique: C++ and Geant4/ROOT, lectures and computer labs, 2024–2025 (~55h).
- IMT Atlantique, CODEVSI: Nuclear power plant modeling, 2023–2024 (practical project supervision, ~55h).
- Nantes Université: Reviewed and graded physics internship reports and oral presentations; jury member, 2023–2024 (~5h).

Publications

- nEXO Collaboration (incl. A. Amy), *Supernova electron-neutrino interactions with xenon in the nEXO detector*, Phys. Rev. D 110, 093002 (2024); arXiv:2405.19419.
- nEXO Collaboration (incl. A. Amy), *Imaging of single barium atoms in a second matrix site in solid xenon for barium tagging in a ¹³⁶Xe double beta decay experiment*, Phys. Rev.

Research 6, 043193 (2024); arXiv:2407.00285.

- nEXO Collaboration (incl. A. Amy), *Sensitivity of nEXO to ^{136}Xe Charged-Current Interactions: Background-free Searches for Solar Neutrinos and Fermionic Dark Matter*, Submitted, arXiv:2506.22586 (2025).
- nEXO Collaboration (incl. A. Amy), *Ultra-pure Nickel for Structural Components of Low-Radioactivity Instruments*, Submitted, arXiv:2508.08230 (2025).

Presentations & Outreach

- Poster: “Impurities & Radioactivity Control in the nEXO $0\nu\beta\beta$ Detector,” JED Angers (June 2024).
- Talk: “Impact of Nickel Cryostats in the nEXO Detector,” Collaboration Meeting (July 2024).
- Talk: “Impact of Nickel Cryostats in the nEXO Detector,” GDR DUPhy, Lyon France (October 2024).
- Talk: “Impact of Nickel Cryostats in the nEXO Detector,” JRJC 2024, Saint-Jacut-de-la-Mer France (November 2024).
- Talk: “Impact of Nickel Cryostats in the nEXO Detector,” Heures thésardes SUBAT-ECH/IMT Atlantique, Nantes France (February 2025).
- Outreach talk: *Comment est-on arrivé là ?* (“How Did We Get Here?”) — life as a PhD student and pathways to a PhD, SUBATECH, Nantes France (June 2024; December 2024).
- Demonstrations: Science Festival (*Fête de la Science*), Nantes (October 2024).

Languages & Skills

- Languages: French (native); English (fluent, C1).
- Operating systems: Linux/Unix, macOS, Windows.
- Programming languages: C++, Python.
- Scientific/MC: Geant4, ROOT, MCNP, MATLAB, Mathematica.
- Python ecosystem: NumPy, SciPy, pandas, Matplotlib, strax.
- Scripting & shell: Bash, csh, HTML.
- Data & HPC: SLURM, workflow automation, reproducible data pipelines.
- Electronics & instrumentation: Arduino; PCB design; soldering; DIN-rail power/relays/valves; sensor integration (thermocouples, pressure, flow).
- Lab operations: Procurement/vendor liaison.
- Documentation: \LaTeX , Markdown.
- Driver’s license (France).