# Antoine Amy

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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 $\gamma$-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 $LN_2$ 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 $^{136}$Xe 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 SUBATECH/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).