# Amaury Baret

*Doctoral Researcher & Teaching Assistant — Materials Physics — Percolation, Transport & Optics of Stochastic Media*

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## RESEARCH INTERESTS

- Transport, percolation, and non-equilibrium phenomena in stochastic and disordered metallic nanowire networks
- Optical response of metallic nanowire networks: Mie scattering, transfer-matrix modelling, effective-medium theory
- Thermochromic and low-emissivity stacks (VO2, silver nanowires) for autonomous thermal regulation and passive radiative cooling
- High-performance numerical simulation of charge transport and percolation using graph theory
- Integration of functional oxides with transparent conducting materials by RF magnetron sputtering

## EDUCATION

**Ph.D. in Physics — Doctoral Researcher & Teaching Assistant** *2023 — present (expected defense mid-2027)*

*University of Liège, Department of Physics, SPIN Laboratory · Liège, Belgium*

Dissertation (in progress) — Metallic nanowire networks as active transparent electrodes for thermochromic devices. Transport, percolation, and optical response of disordered metallic nanowire networks, with applications to smart-window, low-emissivity, and VO2-based thermochromic stacks.

*Supervisor: Prof. Ngoc Duy Nguyen.*

**M.Sc. in Materials Physics** — *summa cum laude* *2020 — 2022*

*University of Liège, Department of Physics · Liège, Belgium*

Master's thesis — Numerical investigation of low-density metallic nanowire networks as a cure for defective transparent conducting materials. Computational study of sparse silver-nanowire overlays restoring electrical percolation through damaged transparent conductors; precursor to the Nanoscale paper on bridge percolation.

**B.Sc. in Physics** — *magna cum laude* *2017 — 2020*

*University of Liège, Faculty of Sciences · Liège, Belgium*

Core physics curriculum.

## ADDITIONAL TRAINING & CERTIFICATIONS

**High-performance & GPU computing — CÉCI Scientific Computing Training** *2025*

*Consortium des Équipements de Calcul Intensif (CÉCI) · Belgian Tier-1 / Tier-2 clusters*

Training on parallel and accelerated scientific computing — CUDA, MPI, OpenMP, performance profiling, and large-scale code optimisation on SLURM-scheduled HPC infrastructure.

**Higher-education pedagogy — IFRES, University of Liège** *2024*

*Institut de Formation et de Recherche en Enseignement Supérieur*

Certified training programme (10 ECTS) in university-level pedagogy — course design, active-learning methods, assessment, and reflective evaluation of teaching practice for early-career teaching assistants and academics.

**ISMES IX Summer School — University of Catania, Italy** *2022*

*International School on Materials for Energy and Sustainability*

State-of-the-art and future perspectives on critical materials issues for the production and storage of renewable and sustainable energy. Lectures and workshops by leading experts in materials physics, chemistry, and engineering, with a focus on energy applications.

## INTERNATIONAL COLLABORATIONS & RESEARCH STAYS

**M-ERA.NET — INSTEAD** *2023 — present*

*LMGP (Université Grenoble Alpes, FR) · ICMCB (Université de Bordeaux, FR) · Ankara University (TR)*

European partnership on silver-nanowire-based transparent conductors and their integration with functional oxides. Led several work-package contributions on optical characterisation and device integration. Carried out experimental research stays in Grenoble (LMGP) and Bordeaux (ICMCB) for fabrication and characterisation campaigns.

## PUBLICATIONS & PREPRINTS

*Peer-reviewed articles and preprints, reverse chronological. Selected publications marked ★. Underlined author indicates the candidate. A full list is maintained on ORCID and Google Scholar.*

[P1] A. Baret, A. Khan, S. Akin, L. Teulé-Gay, D. Bellet, A. Rougier, N. D. Nguyen (2026). *Challenges and mitigation pathways in coating silver nanowire networks with metallic oxides by RF magnetron sputtering*. *arXiv preprint*, 2604.09372 [PREPRINT]. doi:10.48550/arXiv.2604.09372

[P2] A. Baret, J. Baumgarten, F. Balty, F. Rabecki, J. Brisbois, B. Zheng, D. Bellet, N. D. Nguyen (2025). *The refractive index of silver nanowire networks: a heuristic approach to the foundations of the optical constants, from experiment to theory*. *Discover Nano*, 20, 131. doi:10.1186/s11671-025-04312-9

[P3] T. Ratz, E. Fourneau, N. Sliti, C. Malherbe, A. Baret, B. Vertruyen, A. Silhanek, N. D. Nguyen (2025). *Correlation between material properties, crystalline transitions, and point defects in RF sputtered (N,Mg)-doped copper oxide thin films*. *ACS Applied Electronic Materials*, 7(2). doi:10.1021/acsaelm.4c01396

[P4] ★ A. Baret (2025). *Reconnecting the Fractured: Nanowire Networks and the Physics of Bridge Percolation*. *Bulletin de la Société Royale des Sciences de Liège*, 94(1), 80–101. doi:10.25518/0037-9565.12531

> Sole-author pedagogical paper; basis for the 2025 Prize of the Royal Society of Sciences of Liège.

[P5] ★ A. Baret, A. Khan, A. Rougier, D. Bellet, N. D. Nguyen (2025). *Low-emissivity fine-tuning of efficient VO2-based thermochromic stacks with silver nanowire networks*. *RSC Applied Interfaces*, 2(1), 94–103. doi:10.1039/d4lf00234b

[P6] F. Balty, A. Baret, A. Silhanek, N. D. Nguyen (2024). *Insight into the morphological instability of metallic nanowires under thermal stress*. *Journal of Colloid and Interface Science*. doi:10.1016/j.jcis.2024.06.074

[P7] ★ A. Baret, L. Bardet, D. Oser, D. Langley, F. Balty, D. Bellet, N. D. Nguyen (2024). *Bridge percolation: electrical connectivity of discontinued conducting slabs by metallic nanowires*. *Nanoscale*, 16, 8361–8368. doi:10.1039/d3nr05850f

*Thesis*

[P1] A. Baret (2022). *Numerical investigation of low-density metallic nanowire networks as a cure for defective transparent conducting materials*. *M.Sc. Thesis — University of Liège*, *summa cum laude*. matheo.uliege.be/handle/2268.2/14793

## CONFERENCE TALKS & POSTERS

*May 2026* — CONTRIBUTED TALK + POSTER (FORTHCOMING)
*"E-MRS Spring Meeting 2026, Symposium W"*
Strasbourg, France

*Oct 2025* — CONTRIBUTED TALK
*"Heuristic approach to the fundamental optical constants of silver nanowire networks: experiments and theory".*
*TCM-TOEO 2025* — Rethymno, Greece

*Oct 2025* — POSTER
*"Thermal emissivity of silver nanowire networks: a characterization tool for instability studies".*
*TCM-TOEO 2025* — Rethymno, Greece

*Oct 2025* — POSTER (CO-AUTHOR)
*"Crystalline transitions and point defects in (N, Mg)-doped copper oxide thin films deposited by radiofrequency magnetron sputtering".*
*TCM-TOEO 2025* — Rethymno, Greece

*Sep 2025* — POSTER
*"Crystalline phase transitions and point defects in N- and Mg-doped copper oxide thin films deposited by magnetron sputtering".*
*Belgian Crystallography Symposium — 13* — Leuven, Belgium

*Jun 2025* — CONTRIBUTED TALK
*"Optical constants of silver nanowire networks: theory and experiments".*
*Materials Today Conference 2025* — Sitges, Spain

*Jun 2025* — POSTER
*"On the thermal emissivity of highly efficient VO2-based thermochromic stacks coated with silver nanowire networks".*
*Materials Today Conference 2025* — Sitges, Spain

*May 2025* — CONTRIBUTED TALK
*"Optical constants of silver nanowire networks: theory and experiments".*
*E-MRS Spring Meeting 2025, Symposium F* — Strasbourg, France

*May 2024* — CONTRIBUTED TALK
*"Low-emissivity fine-tuning of efficient VO2-based thermochromic stacks via silver nanowire networks".*
*E-MRS Spring Meeting 2024, Symposium A* — Strasbourg, France

*Jun 2023* — POSTER
*"Bridge percolation: electrical connectivity of discontinued conducting slabs by metallic nanowires".*
*E-MRS Spring Meeting 2023* — Strasbourg, France

*Oct 2022* — POSTER
*"Composite transparent conducting material using metallic nanowire networks on a flexible substrate".*
*TCM-TOEO 2022* — Hersonissos, Greece

## AWARDS, HONOURS & DISTINCTIONS

*Research & academic*

*2025* — **Prix annuel de la Société Royale des Sciences de Liège**
Annual prize of the Royal Society of Sciences of Liège, recognising broadly accessible scientific writing (sole-author paper on bridge percolation in nanowire networks).

*2025* **Best Poster Award — Materials Today Conference 2025**
Sitges, Spain. For work on the thermal emissivity of VO2-based thermochromic stacks coated with silver nanowire networks.

*2025* **Best Oral Presentation Award — ULiège Ph.D. Day 2025**
University of Liège annual doctoral symposium, across all disciplines.

*Additional distinctions*

*2025* **BNP Paribas Fortis & UCM Startup Prizes — Athena**
Co-founder of Athena, a startup applying optimisation algorithms to medical scheduling; recognised by BNP Paribas Fortis and the UCM for the computational approach and entrepreneurial execution.

*2024* **2nd place — Odoo Hackathon 2024**
Web-development and rapid-prototyping competition hosted by Odoo.

*2024* **Nominee & Best Presentation — Japan–Belgium Royal Mission Game Jam**
Team 16, Verdant. Recognised for communication of design intent under time pressure.

*2023* **Grand Prize & Best Presentation — Citizens of Wallonia Hackathon**
Largest hackathon in Wallonia. Drone-mapping tool for risk-aware inter-hospital organ transport, built on Proximus API data with graph-theoretic routing.

## TEACHING & SUPERVISION

*Courses (University of Liège)*

**Electricity and Electromagnetism** (PHYS-1986) *2023 — present*
*Teaching Assistant · First-year undergraduate (Physics)*

Weekly tutorial and exercise sessions.

**Modern Physics & Quantum Mechanics** (PHYS-2026) *2023 — present*
*Teaching Assistant · Second-year undergraduate (Engineering)*

Tutorials in special relativity, early quantum theory, and introductory quantum mechanics.

**Analog and digital electronics** (PHYS-0092) *2023 — present*
*Lab Instructor · Third-year undergraduate (Physics)*

Laboratory supervision and tutoring on analog and digital electronics and experimental methodology.

*Supervision*

**Co-supervisor** — 4 M.Sc. theses *2023 — present*

Three theses on transport in metallic nanowire networks; one on thermochromic materials.

**Supervisor** — 16 undergraduate interns *2023 — present*

Physics and engineering students on experimental projects; Seven have since begun a Ph.D.

## TECHNICAL SKILLS

*Experimental*

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|---|---|
| *Deposition & Fabrication* | RF magnetron sputtering, spray & spin-coating, sol-gel methods, 3D printing |
| *Structural characterisation* | SEM, XRD, profilometry, optical microscopy |
| *Optical & electrical metrology* | UV–Vis–NIR & IR spectrophotometry, emissivity measurement, sheet-resistance characterisation |

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|---|---|
| *Computational* | |
| *Languages* | Python (advanced, including scientific libraries), C / C++, Java, SQL, Mathematica, MATLAB, C#, Web-based languages |
| *High-performance computing* | MPI, OpenMP, SLURM-scheduled clusters |
| *Simulation & modelling* | COMSOL Multiphysics (FEM), Mie scattering, transfer-matrix method, percolation & graph-theory solvers (custom) |
| *Scientific workflow* | Git, LaTeX, Linux, numerical analysis, data visualisation, Microsoft Office, Blender |

## LANGUAGES

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| *French* | Native |
| *English* | Fluent (C2) |
| *Dutch* | Intermediate (B1) |

## REFERENCES

Available upon request.