Dissipative quantum electrodynamics in nanophotonics

We are seeking a highly motivated PhD candidate in nanophotonics and quantum technologies to join a dynamic and collaborative research environment. The project will explore coherent and dissipative light–matter interactions in nanophotonic systems, at the crossroads of quantum optics, open quantum systems, and photonic resonators.

Keywords: nanophotonics, quantum optics, quantum emitters, dissipative coupling, quasinormal modes.

About us

The PhD will be carried out at the FEMTO-ST Institute, a leading research laboratory gathering more than 700 staff members and providing access to world-class facilities and technology platforms. The institute is currently strengthening its activities in quantum science and nanophotonics, notably through the creation of a transverse axis in Quantum Science & Technologies in 2025. The PhD will take place within the Optics Department and the Nano-Optics group, whose research focuses on light–matter interactions below the wavelength scale.

Research project

This thesis aims to develop new theoretical and computational tools to model light–matter interactions in nanophotonic systems while fully accounting for dissipation, which is unavoidable in real devices but remains difficult to describe in conventional quantum approaches. It will rely on a non-Hermitian formalism based on quasinormal mode theory to investigate resonant interactions between photonic or plasmonic resonators and quantum emitters. The goal is to provide a more realistic and physically transparent framework for the design of future nanophotonic and quantum technologies, including single-photon sources, quantum sensors, and strongly coupled light–matter systems.

Related publications

- Varguet, Rousseaux, et al., Journal of Physics B, 52(5), 055404 (2019).
- Rousseaux et al., Physical Review Research, 2(3), 033056 (2020).
- Kuisma, Rousseaux, et al., ACS photonics, 9(3), 1065-1077 (2022).

Candidate profile

- Master’s degree in Physics, Applied Physics, Engineering Physics, Nanotechnology, Photonics, or a related field.
- Strong motivation for theoretical research in a collaborative environment.
- Strong written and verbal communication skills in English.

Highly recommended experience:

- Quantum optics, quantum physics and nanophotonics.
- Strong background in theoretical physics and electromagnetic modeling.
- Programming skills in Matlab and/or Python. Experience with COMSOL Multiphysics is a plus.

What you will do

- Develop theoretical models and numerical tools for quantum nanophotonic systems.
- Interact with ongoing experimental activities within the group and with collaborators.
- Receive training in the theoretical and numerical techniques relevant to the project.
- Take advanced courses (100 hours total) within the SPIM doctoral school.
- Present and publish your research results through scientific papers, conferences, and seminars.
- Optionally contribute to undergraduate and master-level teaching, up to 64 hours per year.

Terms and conditions

- Fully funded PhD position with fixed-term appointment of 3 years.
- Salary of approximately €2300/month, additional compensation for teaching activities.
- International candidates are welcome; a valid residence permit must be obtained before the start date.

We are committed to diversity, inclusion, and gender equality. If French is not your native language, the SPIM doctoral school offers 30 hours of French courses to help you settle in.

Application procedure

Applications should be submitted to benjamin.rousseaux@femto-st.fr, in English as PDF files and include:

- CV.
- Motivation letter describing your background and interest in the position.
- Bachelor's and Master's transcripts.
- Master's thesis, if available.

For further information, please contact:

Benjamin Rousseaux, Assistant Professor and coordinator of the Quantum Science & Technologies axis

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