

The Quantum Physics Department at the Nicolaus Copernicus University in Toruń, Poland offers a **PhD position** for research at the interface of **theoretical nanophotonics, solid-state physics and quantum optics**.

Benefits:

Remuneration type: stipend

Number of offers: 1

Remuneration: 60.000 PLN per year

Maximum period of hiring: 48 months

Earliest position start: 01.04.2025

We offer:

- work in a state-of-the-art group specialised in quantum nano-optics theory
- international collaboration with excellent partners
- good remuneration
- international internships

Project scope: *Nanophotonic architectures inspired by 2D materials*

Project description: Artificial photonic architectures provide a versatile arena for exploring fundamental physics within simple optical settings. These structures are intentionally crafted arrays of photonic components such as waveguides, microcavities, or nanoparticles arranged in layouts inspired by the geometrical patterns of 2D materials. There, individual photonic components play the role of “atoms” forming the lattice. In consequence, photonic lattices serve as platforms where light emulates electron-like physics, enabling phenomena such as the photonic quantum Hall effect, topological protection, and light localization on defects. However, photonic platforms offer far more flexibility than conventional materials due to their tunability at the level of individual components. Among the variety of applications that stem from this tunability is the realisation of non-Hermitian physics, topological lasing or spin-momentum locking in light propagation across the lattice.

These phenomena arise due to the new capabilities sustained by photonic architectures that may reach far beyond what is possible with the materials that inspired them. The goal of this project is to harness the potential of photonic architectures to host physics in new regimes for fundamental insights and novel applications.

Institution: Nicolaus Copernicus University in Toruń, Poland (NCU)
Faculty of Physics, Astronomy and Informatics
Institute of Physics

Project PI: Dr hab. Karolina Słowik, associate professor at NCU

Partner group leaders:

- Carsten Rockstuhl, Karlsruhe Institute of Technology
- Andres Ayuela, Donostia International Physics Center
- Garnett W. Bryant, National Institute of Standards and Technology, Maryland

Methods and tools:

quantum master equation approach or alternative light-matter interaction modelling techniques

tight-binding model

electromagnetic simulations using finite element method or alternatives

Python codes developed and available within the group cover the optical properties of selected 2D materials, and will need to be adjusted to account for physics of light in nanophotonic materials. The group has access to selected commercial software (such as Matlab, Mathematica, COMSOL Multiphysics, and CST Studio Suite).

Key responsibilities include:

1. Depending on the candidate's background: theory development/software development / numerical simulations,
2. active collaboration with partners,
3. preparation of articles and presentation of research results at seminars and conferences.

Profile of candidates/requirements:

1. Master's. degree in physics or related (or declaration of obtaining such a degree before the start of the position)
2. Basic experience in at least one of the following disciplines
 - quantum optics,
 - quantum solid-state theory,
 - atomic/molecular physics,
 - classical electrodynamics,
3. experience in numerical simulations or programming,
4. strong oral and written communication skills in English.

Selection process

Required documents:

1. CV,
2. motivation letter (optional),
3. contact details to at least one academic referee.

Please submit the documents to: karolina@fizyka.umk.pl

(scanned or pdf versions will be accepted; in case of a successful application original documents will need to be provided). For more details please contact the project leader by email: karolina@fizyka.umk.pl

Application deadline:

The call is open until suitable candidates are identified with the final closing date of 30.10.2025. We reserve the right not to select any candidates or to prolong the call.

Please include in your offer: "I hereby give consent for my personal data included in my application to be processed for the purposes of the recruitment process under the Personal Data Protection Act as of 10 May 2018 (consolidated text: Journal of Laws 2019, item 1781) and pursuant to art. 6§1a GDPR (General Data Protection Regulation - EU2016/279)."