

Doctoral Researcher in solid-state quantum optics and
optomechanics
Aalto University

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Posted Jun. 11, 2025, set to expire Dec. 31, 2025

Job Title Doctoral Researcher in solid-state quantum optics and
optomechanics

Department T304 Dept. Applied Physics

Institution Aalto University
, , Finland

Date Posted Jun. 11, 2025

Application Deadline Open until filled

Position Start Date Available immediately

Job Categories Graduate Student

Academic Field(s) Physics - General

Job Website https://aalto.wd3.myworkdayjobs.com/aalto/job/Otaniemi-Espoo-Finland/Doctoral-Researcher-in-solid-state-quantum-optics-and-optomechanics_R43512

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Job Description

Aalto University is where science and art meet technology and business. We shape a sustainable future by making research breakthroughs in and across our disciplines, sparking the game changers of tomorrow and creating novel solutions to major global challenges. Our community is made up of 13 000 students, 400 professors and close to 4 500 other faculty and staff working on our dynamic campus in Espoo, Greater Helsinki, Finland. Diversity is part of who we are, and we actively work to ensure our community's diversity and inclusiveness. This is why we warmly encourage qualified candidates from all backgrounds to join our community.

At the Department of Applied Physics, our pioneering research in physical sciences creates important industrial applications that hold great technological potential. Our research focuses on Materials physics, Quantum technology, Soft & living matter, and Advanced energy solutions. Topics extend

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from fundamental research to important applications. We educate future generations of research and development professionals, data specialists, technology experts, inventors, and scientists for industry and society.

The [\[url=https://www.aalto.fi/en/departments-of-applied-physics/macroscopic-quantum-optics-mqo\]](https://www.aalto.fi/en/departments-of-applied-physics/macroscopic-quantum-optics-mqo)Macroscopic Quantum Optics (MQO) Group at the Department of Applied Physics, is seeking for candidates for the position of

Doctoral Researcher (PhD position) in solid-state quantum optics and optomechanics.

Position overview:

The successful candidate will join a Tandem Industry-Academy funded project [\[url=https://www.vaikuttavuussaatio.fi/en/funded-projects/tandem-industry-academia-tia-seed-2024/\]](https://www.vaikuttavuussaatio.fi/en/funded-projects/tandem-industry-academia-tia-seed-2024/)<https://www.vaikuttavuussaatio.fi/en/funded-projects/tandem-industry-academia-tia-seed-2024/> developing next-generation optical computing technologies for ultra-fast, low-energy optical interconnects in collaboration with Microsoft and two Finnish SMEs. The project focuses on development new optomechanical control methods for macroscopic quantum states of light-matter Bose-Einstein condensates (BEC) using optical signals in the telecom and infrared (IR) spectral ranges.

Project background:

The control methods are enabled by strong exciton-photon and exciton-phonon interactions, which together form tri-partite coupling that gives rise to effective optomechanical interaction between collective excitonic states (optical) and vibrational modes (mechanical). This mechanism allows for the room-temperature control over polariton condensation [\[url=https://doi.org/10.1038/s41566-019-0392-8\]](https://doi.org/10.1038/s41566-019-0392-8)Nature Photonics 13 378 (2019), enabling nonlinear optical switching at extremely low optical signals - down to the single-photon level [\[url=https://doi.org/10.1038/s41586-021-03866-9\]](https://doi.org/10.1038/s41586-021-03866-9)Nature 597, 493 (2021). However, current devices require precise resonant signals in the visible range, limiting practical use. Our approach overcomes this by using optomechanical coupling to vibrational/phonon modes [\[url=https://doi.org/10.1103/PhysRevB.110.134321\]](https://doi.org/10.1103/PhysRevB.110.134321)Phys. Rev. B 110, 134321 (2024), accessible in the IR and telecom ranges, to achieve ultrafast optical logic operations at industry-relevant signals.

Your role and goals * Designing and building a new experimental setup to generate and control polariton BEC using near-IR/telecom excitation and Raman-based techniques; * Investigating high-energy vibrational (phonon) modes and their coupling to excitonic states in solid-state optical cavities; * Exploring new methods for controlling the density and phase of the BEC, with the goal of realizing telecom-compatible optical logic operations; * Collaborating with theorists and industry partners to benchmark switching speed and energy performance in integrated optical platforms; * Preparing

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research manuscripts for submission in top-tier journals.

Your experience and ambitions * A Master's degree (or equivalent) in physics: photonics, AMO physics, quantum optics, or a related discipline; * Excellent communication skills (fluency in English) and strong collaboration abilities; * Finnish language is not required * Strong interest and motivation to conduct high-impact research at the interface of quantum science and photonic technology; * Prior experience in an optics lab (e.g. laser alignment, spectroscopy, photon counting, data acquisition/automation) is advantageous but not required; * Alignment with our core values

What we offer

The MQO group is young but yet very ambitious research team exploring quantum phenomena in large scale and complex systems, from high-temperature Bose-Einstein condensates to trapped solid-state particles in ultra-high vacuum. We combine advanced quantum optics methods in both discrete and continuous variables with cutting-edge solid-state systems aimed at pushing the limits of fundamental research and applications such as optical computing and quantum sensing.

We are part of Finland's major national quantum initiatives, including the [\[url=https://instituteq.fi/\]](https://instituteq.fi/)InstituteQ and the [\[url=https://instituteq.fi/fqf/\]](https://instituteq.fi/fqf/)Finnish Quantum Flagship (FQF), and benefit from access to world-class experimental infrastructure at Aalto's Otaniemi campus - home to [\[url=https://www.aalto.fi/en/otanano\]](https://www.aalto.fi/en/otanano)OtaNano, the largest cleanroom facility in the Nordics.

The PhD position is full-time. The contract period is initially for 2 years, with an extension possibility.

We value a healthy work-life balance and actively support personal and professional development. You will have opportunities to collaborate with leading academic and industry partners (IBM, Microsoft, the Vienna Center for Quantum Science and Technology etc) and contribute to exciting national and international research initiatives in photonics, quantum science and technology.

Join us!

Please submit your application including the attachments mentioned below as one single PDF document in English through our online recruitment system by using the link on Aalto University's web page (click the "Apply Now" button).

- (1) Letter of motivation
- (2) CV including list of publications
- (3) Contact details of at least two referees

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Please note: Aalto University's employees should apply for the position via our internal HR system Workday (Internal Jobs) by using their existing Workday user account (not via the external webpage for open positions). If you are a student or visitor at Aalto University, please apply with your personal email address (not aalto.fi) via [\[url=https://www.aalto.fi/en/careers-at-aalto\]](https://www.aalto.fi/en/careers-at-aalto)Aalto University open positions

The deadline for applications is June 30, 2025. We will go through applications, and we may invite suitable candidates to interview already during the application period. The positions will be filled as soon as suitable candidates are identified.

For additional information, contact Prof. Anton Zasedatelev, anton.zasedatelev@aalto.fi.

Aalto University reserves the right for justified reasons to leave the position open, to extend the application period, reopen the application process, and to consider candidates who have not submitted applications during the application period.

Want to know more about us and your future colleagues? You can watch these videos:

[\[url=https://www.youtube.com/watch?v=i8zawpNMVG8\]](https://www.youtube.com/watch?v=i8zawpNMVG8)This is Aalto University!

[\[url=https://www.youtube.com/watch?v=5k_og_6zUJQ\]](https://www.youtube.com/watch?v=5k_og_6zUJQ)Aalto University - Towards a better world
and [\[url=https://www.youtube.com/watch?v=ZK6pDWm1_CE\]](https://www.youtube.com/watch?v=ZK6pDWm1_CE)Shaping a Sustainable Future.

Read more about working at Aalto: [\[url=https://www.aalto.fi/en/careers-at-aalto\]](https://www.aalto.fi/en/careers-at-aalto)<https://www.aalto.fi/en/careers-at-aalto>

Check out our new virtual campus experience: [\[url=https://virtualtour.aalto.fi/\]](https://virtualtour.aalto.fi/)<https://virtualtour.aalto.fi>

About Finland

Finland is a great place for living with or without family - it is a safe, politically stable and well-organized Nordic society. Finland is consistently ranked high in quality of life and was listed again as the happiest country in the world: [\[url=https://worldhappiness.report/news/world-happiness-report-2025-people-are-much-kinder-than-we-expect-research-shows/\]](https://worldhappiness.report/news/world-happiness-report-2025-people-are-much-kinder-than-we-expect-research-shows/)World Happiness Report 2025

For more information about living in Finland: [\[url=https://www.aalto.fi/en/careers-at-aalto/for-international-staff\]](https://www.aalto.fi/en/careers-at-aalto/for-international-staff)Aalto Careers for International Staff.

Contact Information

Please reference Academickeys in your cover letter when applying for or inquiring about this job announcement.

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