



Research Assistant (HiWi) — Analytical Quantum Certification

Institute for Complex Quantum Systems, University of Ulm

At the Institute for Complex Quantum Systems of the University of Ulm, a position as a Research Assistant is available as part of the CeQuaDe project, a project to **certify the correctness of quantum devices**. The project focuses on analytical foundations of certifying time-dependent quantum processes. The goal is to establish rigorous bounds on the time evolution of quantum systems by studying the algebraic structure of the underlying dynamics.

Scope of Duties

The scope of duties includes participation in scientific research on the certification of quantum devices through rigorous mathematical bounds. Duties include in particular:

- Study of closed dynamic Lie algebras and their role in time evolution
- Selection and analysis of physically relevant Hamiltonians suitable for certification and implementable on current quantum hardware
- Investigation of initial state characteristics that allow for efficient and tight bounds on the time evolution
- Collaboration with a second student assistant on the joint implementation of certification bounds

Requirements

- Completed bachelor's degree in physics, mathematics, computer science, or a comparable field
- Strong interest in quantum physics and quantum information
- Basic programming skills in Python
- Background or strong interest in quantum mechanics, quantum information, or mathematical physics
- Experience or coursework in Lie algebras, group theory, or related mathematical structures is an advantage (optional)
- Analytical mindset with interest in rigorous mathematical formulations
- Excellent command of English and/or German, both written and spoken

We offer

- An exciting work environment at the interface of quantum many-body physics and quantum information
- Insights into current research in theoretical physics and quantum technologies
- Access to courses on tensor networks and computational methods for quantum information
- Flexible working hours and a dedicated team

Start date: 1st of October 2026

Duration: 9 months (until 30th of June 2027)

Workload: up to 32 hours per month

If you are interested, please send a short application (motivation letter, CV) to:

Patrick Emonts (patrick.emonts@uni-ulm.de)

Please indicate the name of the position in the application.

Research Assistant (HiWi) — Numerical Quantum Certification

Institute for Complex Quantum Systems, University of Ulm

At the Institute for Complex Quantum Systems of the University of Ulm, a position as a Research Assistant is available as part of the CeQuaDe project, a project to **certify the correctness of quantum devices**. The project focuses on the numerical implementation of certifying time-dependent quantum processes. The goal is to establish rigorous bounds on the time evolution of quantum systems by using semi-definite programs and modern variational methods.

Scope of Duties

The scope of duties includes participation in scientific research on the certification of quantum devices through rigorous mathematical bounds. Duties include in particular:

- Acquiring necessary background in tensor networks (TN), semi-definite programming (SDP), and neural-network quantum states (NNQS)
- Implementation of upper bounds on time evolution based on existing TN or NNQS code for systems
- Implementation of lower bounds using SDPs and propagation of bounds through time
- Collaboration with the WP1 student assistant on the joint certification framework

Requirements

- Completed bachelor's degree in physics, mathematics, computer science, or a comparable field
- Strong interest in quantum physics and quantum information
- Basic programming skills in Python
- Background or strong interest in computational physics, numerical methods, or quantum simulation
- Experience with scientific Python libraries (NumPy, SciPy, or similar) is an advantage
- Familiarity with tensor network methods or optimization is a plus
- Excellent command of English and/or German, both written and spoken

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