

Open PhD position in Error-Aware Compilation of Quantum Circuits on the Rydberg Atom Platform at the University of Stuttgart

The Institute for Computer Architecture and Computer Engineering (ITI) at the University of Stuttgart seeks applications for a PhD position in the field of quantum computing. Located in one of Europe's main economic hubs, the Institute offers you an inspiring working atmosphere in a successful international team. The project is part of the DFG Priority Program 2514 "Quantum Software, Algorithms and Systems", providing opportunities for interdisciplinary research with top scientists in Germany and beyond.

We invite candidates to be part of cutting-edge research on quantum algorithm compilation for the Rydberg platform. Compilation takes a quantum algorithm and translates it into instructions that can be executed on a given quantum computer, optimizing parameters such as the duration and/or the fidelity of the execution. The Rydberg platform provides a number of unusual features that can benefit compilation: the availability of n -qubit gates and the option of changing the qubit connectivity on-the-fly by "Rydberg shifts". The goal of this project is to provide an integrated compilation approach that will also incorporate the deep knowledge about the optimal control pulses for the Rydberg platform to optimize entire circuits.

The project is co-supervised by Professor Hans-Peter Büchler and Dr. Sebastian Weber of the Institute for Theoretical Physics III in Stuttgart, who will contribute in-depth knowledge on modeling of errors and error-suppressed gate protocols. One distinguishing feature of this project is the tight integration of detailed error information into (approximate) unitary synthesis, qubit mapping and routing. Further collaborative opportunities are available through the Stuttgart branch of IQST (Center for Integrated Quantum Science and Technology), a multidisciplinary organization for groundbreaking research on quantum computing and quantum technology.

The project has a duration of three years. The remuneration will be a 100% position according to the German public-service salary grade TV-L E13. In addition to research activities, we expect from you occasional contributions to our teaching program, supervision of student theses and participation in administrative duties, such as organization of scientific conferences.

Required qualifications:

- Above-average Master's degree in Computer Science, Mathematics, Electrical Engineering, Physics, or a related discipline.
- Profound knowledge in one of the two areas: (1) electronic design automation and (2) quantum computing, proven by, e.g., lectures taken as part of your study, extracurricular certificates or practical experiences, combined with strong interest in the other area.
- Programming skills in a procedural or object-oriented language (e.g., C++ or Python).
- Openness to collaboration with researchers from physics within the project and from software engineering within the Priority Program.

Preferred qualifications:

- Knowledge in quantum circuit synthesis, optimization or compilation.
- Familiarity with mathematical formalisms for modeling errors on quantum platforms.

- Contributions to open-source projects.
- Background in the Rydberg atom platform.

To apply, please send, by email, your cover letter (explicitly explaining your interest in the topic and specifying your qualifications in quantum computing), CV and scans of your Master's and Bachelor's degree certificates including the transcripts with all grades. You can add, optionally, reference letters, existing publications, or other supplementary materials you consider relevant, or links to such materials. The University is pursuing a gender-equality policy and is therefore particularly encouraging qualified women to apply. Handicapped persons are given priority if they are equally qualified.

Deadline: Send your application to ilia.polian@informatik.uni-stuttgart.de before **April 29, 2025**.

Questions regarding this position can be directed to:

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