DHBW Stuttgart

Wahlfach/Elective
Quantum Computing – Opportunities & Challenges

Stuttgart March 10, 2025

Prof.in Dr. Carmen Winter

Overview

- Introduction (lecturers & students)

- Structure

- Requirements and exam

- Planning

- Introduction to quantum physics (Clara Roth)

- Introduction (future) laboratory (Bernd Hänsch-Rosenberger)

- Choice of project topics and team

Introduction of the instructors

- Prof. Dr. Carmen Winter, Professor Computer Science, Partner in New Study, DHBW Stuttgart

- Bernd Hänsch-Rosenberger, Instructor DHBW Stuttgart

- Prof. Dr. Gerhard Hellstern, Professor of Economics, DHBW Stuttgart

- Dr. Jan-Rainer Lahmann, IBM Distinguished Engineer, Instructor DHBW Stuttgart

- Clara Roth, Instructor DHBW Stuttgart

August 2023: https://www.dhbw-stuttgart.de/artikel/dhbw-der-initiative-quantumbw-beigetreten/

https://www.quantumbw.de/en/the-laend-of-quantum-technology-home/partners/

Any questions by Mail to: Carmen.Winter@dhbw-stuttgart.de

Introduction of the Students

- Name and course (maybe location where you live)

- Your perspective and interest in the topic "Quantum Computing"

- Any prior knowledge?

- What do you want to learn? ... expect from this course?

Learning Goals

- Brief introduction to quantum technology

- Collaborative approach to a topic within the field

- Work on your own perspective regarding quantum technology

- Support to move students toward „Quantum-Readiness"

Structure

- Theoretical and practical background from the expert-instructors

- Collaborative and research-oriented leaning in student-teams (4-5 persons)

  1. presentation

  2. documentation in the overall course „eBooks"

Structur and Exam

Exam*	Description	Evaluation	Due Date	Comment
Presentation with Abstract In a group 4-5 persons (mix teams)	Presentation 20 min. Abstract: 100-200 Words ... Upload in Moodle (general & Stuttgart)	PASS (FAIL) ✓Content ✓Methods ✓Presentation ✓Literature	Friday <u>before</u> the Presentation	40 % overall points
Contribution in the „course-eBook"	2-4 pages in the seminar paper of the group	Evaluation of Academic papers DHBW	May 9, 2025	60 % overall points

* Exams: Reminder, if you are absent, we need a notice (e.g. doctor)

Plan

Due Day
eBook
May 9, 2025

Date 13:00 -15:45	Topic	Team
March 10, 2025 at the DHBW in class Room A4.07	• Introduction • Laboratory • Topics and Groups	Clara Roth Bernd Hänsch-Rosenberger Carmen Winter
March 17, 2025	(Lab.-)Topics *Discussion oft the project plan*	Carmen Winter Bernd Hänsch-Rosenberger
March 24, 2025	QC and Optimization/AI *Final project plan approval*	Gerhard Hellstern Carmen Winter
March 31, 2025	Introduction to QC and hands-on-experience with Qiskit	Carmen Winter Jan Lahmann
April 7, 2025	Project work	Questions via mails to instructors (copy C. Winter)
April 14, 2025	Projekt work	Questions via mails to instructors (copy C. Winter)
April 28, 2025	Project presentations	Carmen Winter
May 5, 2025	Project presentations	Carmen Winter
May 12, 2025	Backup for presentations Beginning and End QC eBooks Wrap-up	Carmen Winter
May 19, 2025	Backup	Carmen Winter

*Englisch Language

Topics (mixed groups of 4-5 persons)

1. Current publications in Quantum Technology (literature project)

2. Qiskit: tasks/projects

3. Quantum Computing programming languages
   (e.g. general overview or one specific programming Language)

4. Quantum Computing and machine learning

5. Quantum Computing optimization

6. *Topic from Bernd?*

7. Your own topic in Quantum Technology

Summary … and last questions for today

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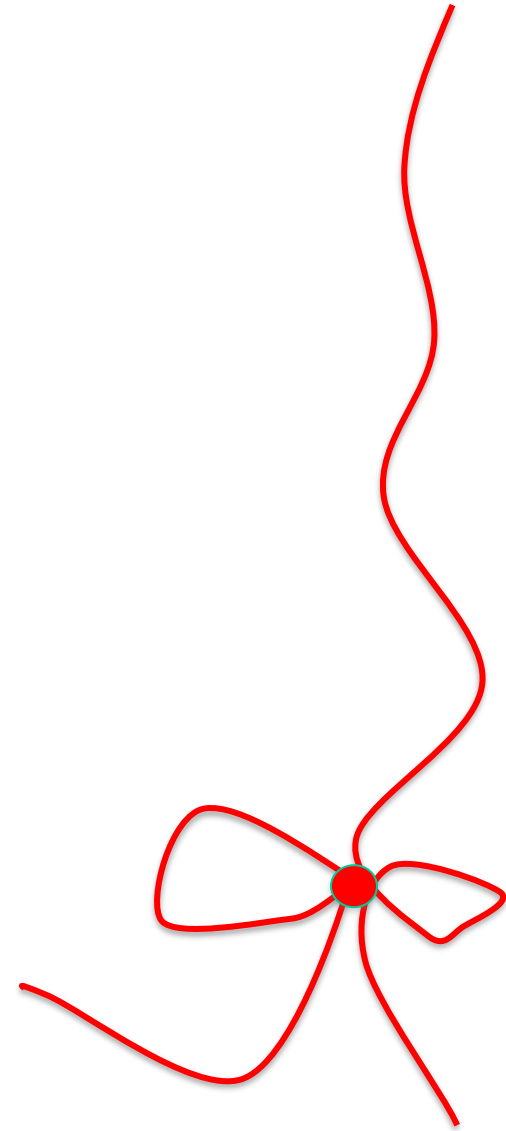
Literature

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Greinert F., Müller , R. (2023). Quantentechnologien für Ingenieure, Springer Verlag. https://ebookcentral.proquest.com/lib/dhbw-stuttgart/detail.action?docID=30375959

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https://newatlas.com/physics/new-type-quantum-entanglement-particles/