ELEC-C9440 - Quantum Information, Lecture, 24.4.2023-8.6.2023

Schedule and materials

Study materials

Abbreviations used for textbooks (e.g., NCX = Xth chapter of Nielsen, Chuang):

- NC = Nielsen, Chuang, *Quantum Computation and Quantum Information: 10th Anniversary Edition*, Cambridge University Press.
- QS = Qiskit community, *Learn Quantum Computation using Qiskit*. (link)
- QO = Fox, *Quantum Optics, An Introduction*, Oxford University Press.
- Endo = Endo et al., *Hybrid quantum-classical algorithms and quantum error mitigation*, J. Phys. Soc. Jpn. 90, 032001 (2021), arXiv:2011.01382 [quant-ph].
- Cerezo = Cerezo et al., *Variational Quantum Algorithms*, arxiv:2012.09265 [quant-ph]
- MW = Mandel, L., & Wolf, E. (1995). *Optical Coherence and Quantum Optics*. Cambridge: Cambridge University Press. doi:10.1017/CBO9781139644105.016 . Chapter 15 - Interaction between light and a two-level atom.
- QMart = [W. Tittel, M. Afzelius, T. Chaneliere, R.L. Cone, S. Kroell, S.A. Moiseev, M. Sellars, "Photon-echo quantum memory in solid state systems""// Laser & Photonics Reviews 4 (2), 244–267 (2010); DOI 10.1002/lpor.200810056 .] and [L. Ma, O. Slattery, X. Tang, "Optical Quantum Memory and its Applications in Quantum Communication Systems" // Journal of Research of the National Institute of Standards and Technology 125, 125002 (2020); DOI: 10.6028/jres.125.002 .]

The lecture videos and slides will be published on this page weekly. The schedule may be subject to some changes as the course progresses.

Schedule, topics of lectures and materials

	WEEK 1	
24.4.	Organization of the course, quantum bits	slides, notes, NC2
26.4.	Quantum gates and circuits, Qiskit	Qiskit intro notebook
	WEEK 2	
1.5.	Density operator, mixed states, reduced states **HOLIDAY! Watch this video instead: link to video.**	slides, notes, NC2, NC11.2-11.3, NC9.1-9.2
3.5.	Entanglement, entanglement entropy, distance measures for states	
	WEEK 3	
8.5.	Examples of quantum algorithms (QFT, Shor, Grover,...)	slides, notes, NC1.4, NC5, NC6
10.5.	Continued	Deutch demo notebook
	WEEK 4	
15.5.	Quantum channels, noise	slides, notes, NC8.1-8.3, NC10.1-10.3, NC10.5
17.5.	Quantum error correction	
	WEEK 5	
22.5.	Noisy intermediate-scale quantum computing, error mitigation, quantum simulation	slides, notes, NC4.7, Endo error mitigation demo
24.5.	Variational quantum algorithms	slides, Cerezo
	WEEK 6	
29.5.	Quantum key distribution, quantum communication networks	slides, NC12.6, MW15 BB84 demo notebook
31.5.	Quantum memory, quantum optical applications	slides, QMart

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Course home
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Assignments

Completion Progress

NOW

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Latest announcements

Matti Raasakka 5 Jun, 10:36
Cheat sheet for the exam

Matti Raasakka 2 Jun, 15:52
Exam instructions and bonus exercise set

Matti Raasakka 27 Apr, 15:32
First of May

Matti Raasakka 24 Apr, 15:10
Course Telegram group

Older topics ...

Upcoming events

KT
Thursday, 8 June, 09:00 » 12:00

Bonus exercise is due
Sunday, 11 June, 23:59

MyCourses maintenance, service out of use
Monday, 12 June, 10:00 » 17:00

Go to calendar...