2019 references for Quantum Computing and Nuclear Physics (QC & NP)

Notes CP ESNT, V.L June 2019

References and Web sites *(as in June 2019)*

General references on the scientific context

Back to the initial discussions

Richard P. Feynman, *Simulating **Physics** with Computers,* Int. J. Theor. Phys. **21**, 467 (1982).

D. S. Abrams S. Lloyd, *Simulation of many-body Fermi systems on a universal quantum computer,* Phys Rev Letters **79**, 2586 (1997) DOI: *https://doi.org/10.1103/PhysRevLett.79.2586*

Books and lectures

References recommended before the workshop by D. Estève, Quantronics Group, CEA-Saclay

→ see the "Bible" of Quantum Computing by Nielsen and Chuang, and the lecture notes by D. Mermin.
Michael Nielsen and Isaac Chuang, *Quantum Computation and Quantum Information* 10th Anniversary, Edition Cambridge University Press 2011
N. David Mermin, ***Quantum Computer Science,*** Cambridge University Press, August 2007.

N.B. ***(****V.L, last access June 2019)* **Links to read the books**

+ Nielsen and Chuang, Cambridge University Press 2000.
http://michaelnielsen.org/qcqi/QINFO-book-nielsen-and-chuang-toc-and-chapter1-nov00.pdf

+ Web page of N. David Mermin Cornell University, Theory physics *http://www.lassp.cornell.edu/mermin*
Quantum Computer Science , incorporating the lecture notes
http://www.lassp.cornell.edu/mermin/qcomp/CS483.html

Other reference books given by A. Leverrier during his lecture at ESNT:
Quantum Computing: Lecture Notes by Ronald de Wolf *http://homepages.cwi.nl/~rdewolf/qcnotes.pdf*
Lecture notes by John Preskill *http://www.theory.caltech.edu/people/preskill/ph229/*

LINKS and references of laboratories and authors

Quantronics Group (QUANTum physics and electronics) SPEC, CEA-Saclay
http://iramis.cea.fr/spec/Pres/Quantro/static/index.html

Paris center for quantum computing *http://www.pcqc.fr*

Quantum computers
Cf *http://QuantumComputingReport.com*

Cloud access to quantum computers/simulators *rigetti.com*

Links given by D. Estève about personal pages of theorists of quantum computing
Alan Aspuru-Guzik *http://aspuru.chem.harvard.edu*

Ryan Babbush https://research.google.com/pubs/RyanBabbush.html
Iordanis Kerenidis https://www.irif.fr/~jkeren/jkeren/Iordanis_Kerenidis.html
Miklos Santha https://www.irif.fr/~santha

(*Ref. from Jaume Carbonell, Nov 2017*)
Talks given at the French Sciences Academy, Colloquium about the Quantum Computing, 02/04/2013
http://www.academie-sciences.fr/fr/Colloques-conferences-et-debats/calcul-informatique-et-ordinateurs-quantiques.html

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DOI: *https://doi.org/10.1103/RevModPhys.86.153*

Useful reference (and most of the useful references therein)
Pierre-Luc Dallaire-Demers, Jonathan Romero, Libor Veis, Sukin Sim, Alán Aspuru-Guzik,
Low-depth circuit ansatz for preparing correlated fermionic states on a quantum computer
https://arxiv.org/abs/1801.01053 January 2018

QC for nuclear physics
Jakub Visnak, *quantum algorithms for computational nuclear physics*
EPJ Web of Conferences **100**, 01008 (2015). DOI: *10.1051/epjconf/201510001008*

Other references discussed during the workshop

Articles exploring the possibilities of quantum computing

Talk Th. Ayral
Speed comparison Atos QLM vs IBM Qiskit simulator ideal simulation
'Quantum volume' benchmark circuit, IBM POWER8 benchmark data from www.ibm.com/blogs/research/2018/

Talk P.-L.Dellaire-Demers *+cf extra-references (on Slide 42 of the talk)*
P.-L. Dallaire-Demers *et al.*, *Low-depth circuit ansatz for preparing correlated fermionic states on a quantum computer*, ***arXiv:1801.01053*** (2018).
A.Signoracci *et al., Ab initio Bogoliubov coupled cluster theory for open-shell nuclei*,
Phys. Rev. C **91**, 064320 (2015).
Jarrod R. McClean *et al.*, "*Barren plateaus in quantum neural network training landscapes*"
Nature communications **9.1** (2018): 4812.
Sam McArdle, *Variational quantum simulation of imaginary time evolution*, ***arXiv:1804.03023*** (2018).
Wang, Daochen, Oscar Higgott, and Stephen Brierley.
"*Accelerated Variational Quantum Eigensolver*", Phys. Rev. Lett. **122**, 140504 (2019).
Romero *et al.*, *Quantum autoencoders for efficient compression of quantum data*,
Quantum Science and Technology **2.4** (2017) 045001.
Pierre-Luc Dallaire-Demers and Nathan Killoran.
"*Quantum generative adversarial networks*", Phys. Rev. A **98**, 012324 (2018).

Talk A. Grinbaum
Alexei Grinbaum, *Reconstruction of quantum theory, British Journal for the Philosophy of Science, **58**, 2007, pp. 387-408.*

Talk J Eisert.
Hamiltonian quantum simulation architectures

Bermejo-Vega, Hangleiter, Schwarz, Raussendorf, Eisert, Phys Rev X **8**, 021010 (2018).
Hangleiter, Bermejo-Vega, Schwarz, Eisert, Quantum **2**, 65 (2018).
http://www.physik.fu-berlin.de/en/einrichtungen/ag/ag-eisert

Talk G. Hagen
"Certain key regions of the nuclear landscape still require exponential computational complexity"
Ref H. Hergert *et al,* Physics Reports **621**, 165-222 (2016)
cloud QC of an Atomic nucleus, Dumitrescu, McCaskey, Hagen, Jansen, Morris, TP, Pooser, Dean, Lougovski, Phys. Rev. Lett. **120**, 210501 (2018).
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*See Gil Kalai, **arXiv:1605.00992** for a pessimistic view.*
*"Optimistic hypothesis: It is possible to realize universal quantum circuits with a small bounded error level regardless of the number of qubits." See Gil Kalai, **arXiv:1605.00992***

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Hsuan-Hao Lu, Natalie Klco, Joseph M. Lukens, Titus D. Morris, et al, ***arXiv:1810.03959*** (2018).

Lecture A. Leverrier
Many quantum algorithms have been dequantized!
cf Ewin Tang, *A quantum-inspired classical algorithm for recommendation system,* ***arXiv:1807.04271****;* ***arXiv:1811.00414***
A. Gilyen, S. Lloyd, E. Tang, ***arXiv:1811.049909***
("Noisy Intermediate-ScaleQuantum (NISQ) technology, excellent survey addressed to non-specialist by John Preskill") John Preskill, *"Quantum Computing in the NISQ era and beyond"*
https://quantum-journal.org/papers/q-2018-08-06-79

Talk A. Roggero
Roggero & Baroni ***arXiv:1905.08383***

Talk O'Brien
Quantum sim density matrix simulator: https://gitlab.com/quantumsim

Talk A. Tichai
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NB. (V.L, added on June 27th 2019, considering the recent CEA DRF highlights sent in June about new papers)
Additional useful references which we should keep in mind for further discussions

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arXiv:1702.07688v7 [quant-ph] *https://arxiv.org/abs/1702.07688*
Xavier Waintal* **xavier.waintal@cea.fr*, Univ. Grenoble Alpes, CEA, IRIG-Pheliqs, France.
Xavier Waintal, a researcher at IRIG's Quantum Photonics, Electronics and Engineering Laboratory
http://www.pheliqs.fr Laboratoire PHotonique ELectronique et Ingénierie QuantiqueS (PHELIQS)
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Web site *http://www.pheliqs.fr/en/Pages/News/2019_Xavier-Waintal.aspx*
In the Phys. Rev. A 99 (2019) paper, this final remark, acknowledgment "*Warm thanks to M. Sanquer, who pointed out Ref. [2] to us, which triggered the present study.*"

Reference [2] M. I. Dyakonov, *Prospects for quantum computing: Extremely doubtful*,
Intl. J. Modern Phys.: Conf. Series **33**, 1460357 (2013). *https://doi.org/10.1142/S2010194514603573*
Michel.Dyakonov@univ-montp2.fr Université Montpellier II, CNRS, France.

References from CEA web site, general presentations and documents (in French)

Autres références, Infographies et animations sur le site du CEA- ordinateur quantique

http://www.cea.fr/multimedia/Pages/videos/culture-scientifique/technologies/ordinateur-quantique-animation.aspx
http://www.cea.fr/comprendre/Pages/nouvelles-technologies/essentiel-sur-ordinateur-quantique.aspx

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http://www.cea.fr/multimedia/Documents/infographies/defis-du-cea-infographie-processeur-quantique-elementaire214.pdf

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Atos et le CEA lancent une chaire industrielle sur l'informatique quantique, avec le soutien de l'ANR
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