First Semester Report
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Research plan: Deep Learning of Biochemical Properties of Molecules from Quantum Information
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We started this semester with interesting weekly discussion session about the above-mentioned project. We have discussed many different aspects of the project from some new tools in quantum computing to some topics on open quantum systems [1] and we will report possible findings in upcoming months. In these sessions we discussed in particular about possible applications of "Tensor Networks" and "Matrix Product States" approaches [2-3] and on the other side about some possible applications of Landauer–Büttiker approach [4].

I had also two courses in this semester: interesting course of "Statistical physics of polymers and membranes" and also a course on "Classical and quantum optimization". In the first one we had topics on: statistical physics of biopolymer (which includes topic such as: chain conformations in polymers, the ideal and real chain models including: the random walk model, the worm-like chain model, freely jointed chain, freely rotating chain, Gaussian chain, excluded volume and self-avoiding walks, Flory theory of polymer) and physics of biological membranes (includes topic such as: shapes, adhesion and dynamics of bio membranes) and in the second one we had topics on: qubit-based architecture (which includes topic such as: quantum gates and quantum circuits, quantum speedup and complexity, quantum algorithms for optimization including: quantum annealing process, quantum variational algorithms, quantum approximate optimization algorithm, Grover's search algorithm, Shor's algorithm) and optical quantum computing (which includes topic such as: quantum optical elements (beam splitters, phase shifters), quantum algorithms for optical quantum computing, quantum gates and logic in optical quantum computing).

Acknowledgment

References

[1] D. A. Lidar, arXiv:1902.00967.

[2] U. Schollwöck, Ann. Phys., **326 (1)** (2011) 96–192.

[3] R. Orús, Ann. Phys., **349** (2014) 117-158.

[4] G. B. Lesovik, I. A. Sadovskyy, Phys. Usp. **54** (2011) 1007.