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a) Quantum Hamiltonian Complexity 1 - Quantum NP hardness
The past two decades have seen remarkable developments in the study of the computational complexity of Hamiltonian related problem.
Perhaps the single most important result for this development is Kitaev's insightful proof that the local Hamiltonian problem (the problem of estimating the ground energy of a given local Hamiltonian) is
complete for the class QMA - the quantum analog of NP. I will explain the above notions, define quantum NP and the local Hamiltonian problem, and explain why it is related to the most important problem
in theory of computer science, namely, the local constraint satisfaction problem.

b) Quantum Hamiltonian complexity 2: The circuit to Hamiltonian construction.

I will sketch Kitaev's beautiful and influential proof of QMA hardness of the local Hamiltonian problem,
and explain the main idea in it (hint: entanglement). If time permits I will explain how the result was improved
in the past couple of decades to more and more restricted families of Hamiltonians, providing deep insights into the
hardness of finding the groundstate and ground energy of various classes of Hamiltonians, as well as to the hardness of
other physically related tasks.

c) Quantum Hamiltonian Complexity 3 - the evolving complexity map of Hamiltonians
Research in the past two decades has led to tremendous developments in our understanding of the computational complexity of Hamiltonians, branching out in different directions
from the first result of Kitaev. We now have a pretty good understanding of which Hamiltonians are QMA-hard, which Hamiltonians can simulate each other (i.e. are universal),
how and when we can use Hamiltonians for adiabatic and other types of computational university; and how all these problems are related to hardness of physical questions
such as deciding whether a Hamiltonian is gapped or not, in the thermodynamical limit. There are many more questions which are still open though...
I will try to highlight the most important insights and understandings on our way towards completing the rich map of computational complexity of Hamiltonians.