[AARONSON QUANTUM COMPUTATION NOTES]

Hamiltonians

$|\varphi\rangle \longrightarrow U|\varphi\rangle$

how to get here? TIME!

* Hamiltonians by way of diagonalization

simulated evolution, w/ the passing of time $|\varphi\rangle$ will evolve to $U|\varphi\rangle$

Hamiltonians → energies

Ex: $\begin{bmatrix} \lambda_0 & & & \\ & \lambda_1 & & \\ & & \lambda_2 & \\ & & & \lambda_{n-1} \end{bmatrix}$ ordered least to greatest

for each λ_j there exists a $|v_j\rangle$ such that ↳ basis state

$$H|v_j\rangle = \lambda_j|v_j\rangle$$

$$\begin{bmatrix} \lambda_j & & & \\ & \lambda_{j+1} & & \\ & & \lambda_{j+2} & \\ & & & \lambda_{n-1} \end{bmatrix} \begin{bmatrix} 0 \\ 0 \\ 0 \\ j \end{bmatrix} = \lambda_j \begin{bmatrix} 0 \\ 0 \\ 0 \\ 1 \end{bmatrix}$$

Superposition of energy states

$$|V_j\rangle = \alpha_0|v_0\rangle + \alpha_1|v_1\rangle \cdots \alpha_{n-1}|v_{n-1}\rangle$$

energy → defined as speed at which quantum state picks up phase.

concerning eigenstates $|v_0\rangle$ (lowest energy state) corresponds to ground state. next level is $|v_1\rangle$, etc.

Understand why Hamiltonian addition is NP-HARD

ADIABATIC ALGORITHM

given a system in H_i's ground state, apply H_i to this system.

Suppose you very slowly apply a transformation $H_i \longrightarrow H_f$, then final state of the system would be very close to H_f.