Measurement.

Composite system

→ Combinatorial problems

→ Iterative solution.

→ Scaling →

Classical Ising Model :→

$$E(\{s\}) = -J \sum_{\langle ij \rangle} s_i s_j \qquad s \in [-1, 1]$$

$$Z = \sum_{\{s\}} \exp\left[- \frac{E[s]}{k_B T} \right]$$

Computational Basis :→

$$|0\rangle = \begin{pmatrix} 1 \\ 0 \end{pmatrix} \qquad |1\rangle = \begin{pmatrix} 0 \\ 1 \end{pmatrix}$$

$$|q\rangle = e^{i\gamma}\left[\cos\frac{\theta}{2}|0\rangle + e^{i\phi}\sin\frac{\theta}{2}|1\rangle\right]$$

global phase

$\Rightarrow$

$|q\rangle = |0\rangle$ $\qquad$ $|q\rangle = |1\rangle$

$|q\rangle = \alpha|0\rangle + \beta|1\rangle$

$\Rightarrow$ $U^{\dagger}U = I$

2×2 unitary Matrix.

σ_0

σ_1

σ_2

σ_3

Pauli X gate $|0\rangle \longrightarrow |1\rangle$

Hadamard

Pauli X

Pauli Y

Pauli Z

Phase

$\pi/8$

R_x

R_y

R_z

$$U = e^{i\alpha} R_z(\beta)\, R_y(\gamma)\, R_z(\delta)$$

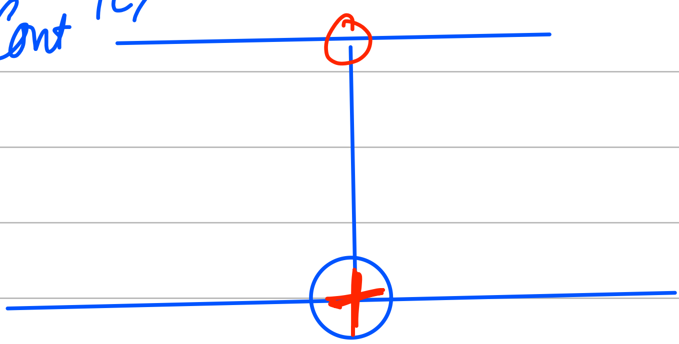
→ Eigenvalues & Eigenvectors

$$A|v\rangle = v|v\rangle$$

$$A^{\dagger}A = AA^{\dagger}$$

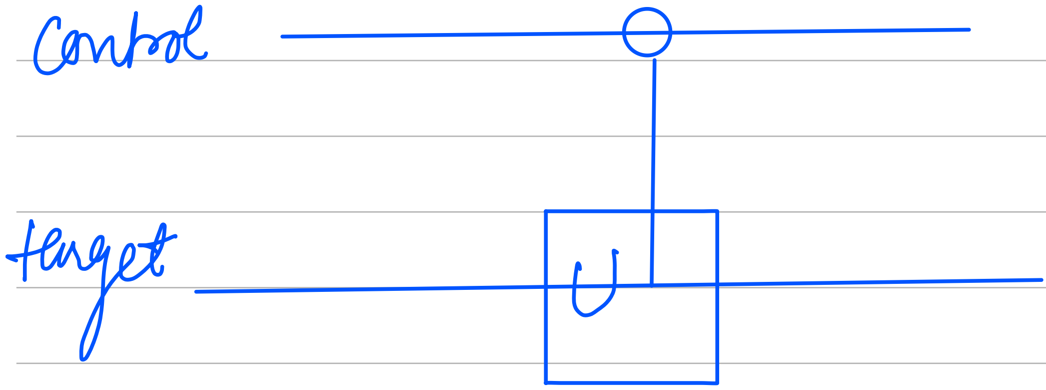
Spectral decomposition.

Control → Cont $|c\rangle$



$|t\rangle$

$$|c\rangle|t\rangle \rightarrow |c\rangle|c \oplus t\rangle$$



$|c\rangle |t\rangle \longrightarrow |c\rangle U^c |t\rangle$

Single qubit gates & CNOT gates are universal.

Fusion dynamics:-

Fusion reaction.

→ fission reaction.

1. Non Capture breakup. – Elastic
2. Non Capture breakup – Inelastic.
3. t - Capture
4. α - Capture

(5) Direct complete fusion.

(6) Sequential complete fusion.

→ rp process

→ νp process

→ ν process.

→ p(γ) process

→ s process

→ CNO cycle

→ Stellar fusion

→ e^- capture

→ r-process

→ fusion

→ pp chain.

Big Bang Nucleosynthesis

↓

classically not possible

$$\frac{d}{dt}|\psi(t)\rangle = -iH|\psi(t)\rangle$$

$$|\psi(t)\rangle = \exp(-iHt)\,|\psi(0)\rangle$$

↓

Classically

$$|\psi(t+\Delta t)\rangle = \{1 - iH\Delta t + \ldots\}|\psi(t)\rangle$$

$$H|\psi_n\rangle = E_n|\psi_n\rangle$$

$$|\psi(0)\rangle = \sum c_n |E_n\rangle$$

$$|\psi(t)\rangle = \sum_n c_n e^{-iE_nt}|E_n\rangle.$$

→ Eucleadian time evolution when we get rid of (i)

$$\frac{d}{d\tau}|\psi(\tau)\rangle = -H|\psi(\tau)\rangle$$

In Eucledian time evolution we get

$$|\psi(\tau)\rangle = \exp(-Ht)\,|\psi(0)\rangle$$

$$|\psi(\tau)\rangle = \sum_n c_n\, e^{-E_n \tau}\,|E_n\rangle$$

The Eucledian time evolution is dominated by low energy states.

Eucledian time → is an operator

↳ we don't take the time evolution