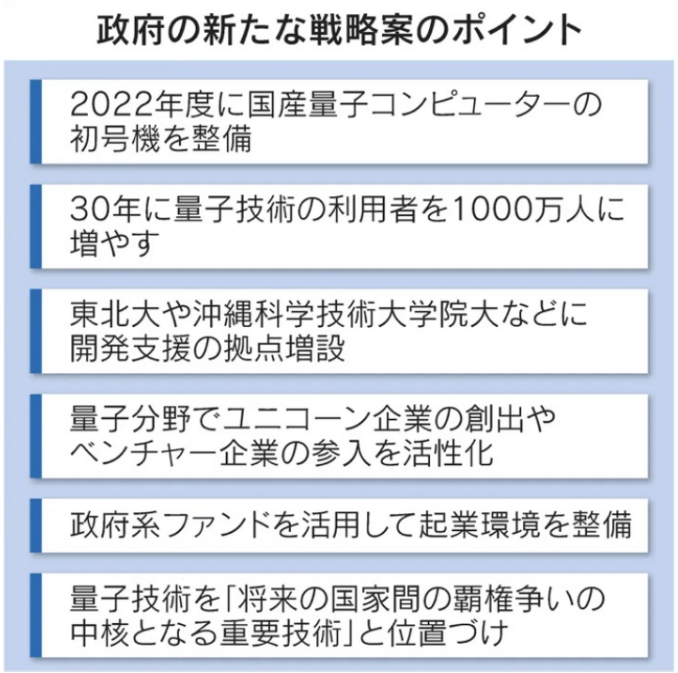
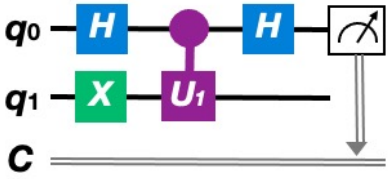
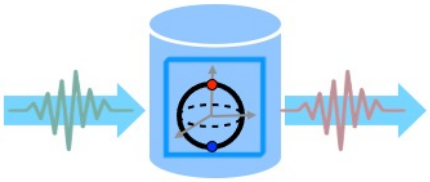
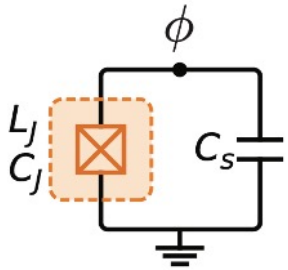
量子コンピューター
ハードウェア



量子AI







Quantum Algorithm

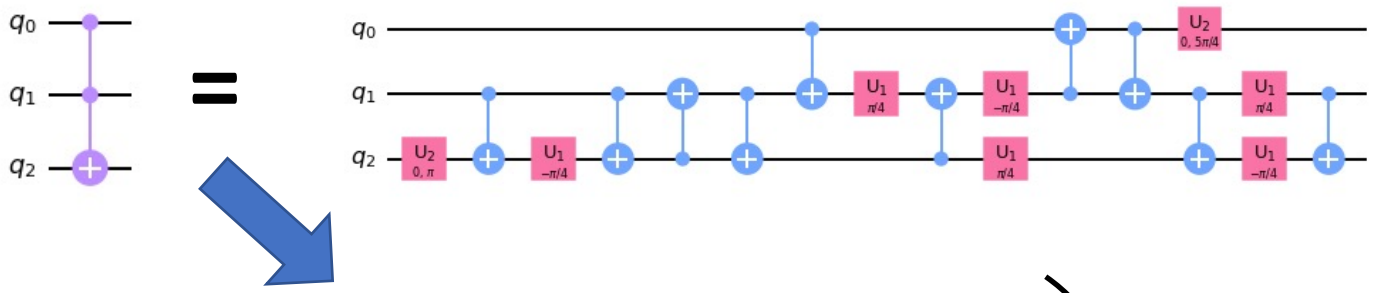
Quantum Software

Control Engineering

Qubit Technology

Qトリット開発の意義

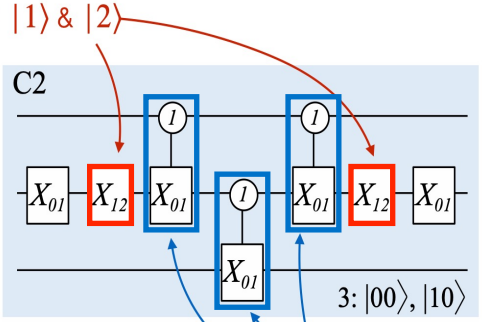
Toffoli and CNOT are widely used in Q circuit;
but too deep and too many gates are required in general.



With Qutrit
Circuit can be simple

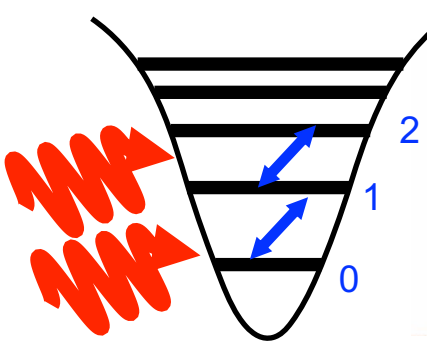
Single gate Qutrit

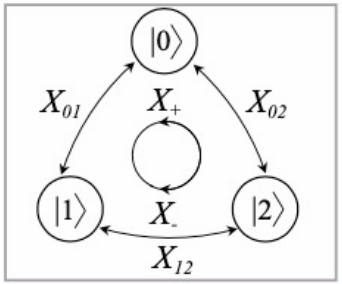
2Q gate Qutrit



$(|0\rangle\langle 0| + |2\rangle\langle 2|) \otimes I + |1\rangle\langle 1| \otimes X_{01}$
"Generalized CNOT"

Qutrit





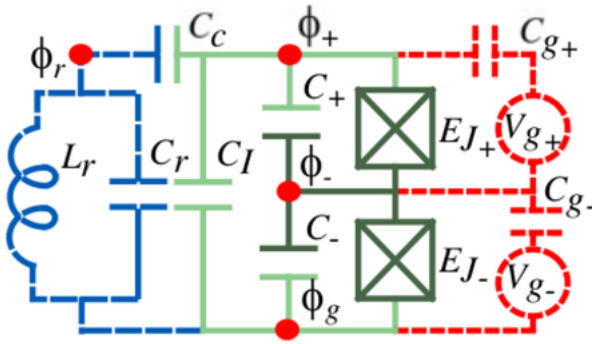
3 states are used

|0>, |1>, |2>

But 1) weak for noise
2) mixing RF
causes wrong operation

Purpose of this Sponsored Researches
is to overcome these problems

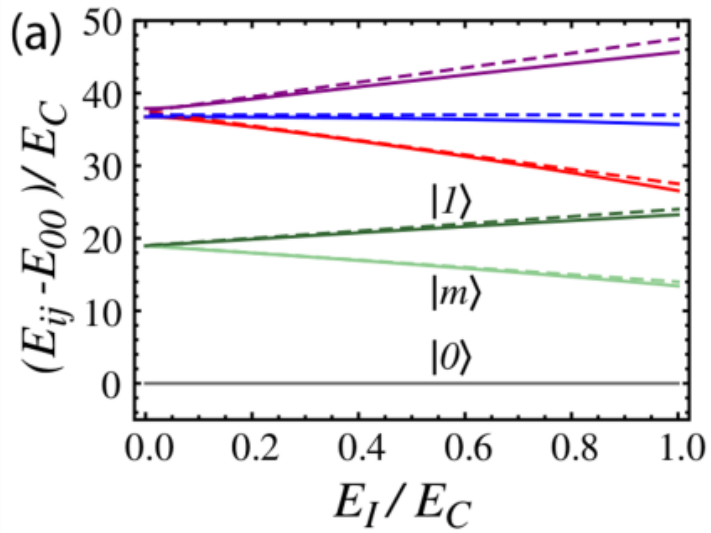
空間対称性によるノイズ抑制型　Qトリット



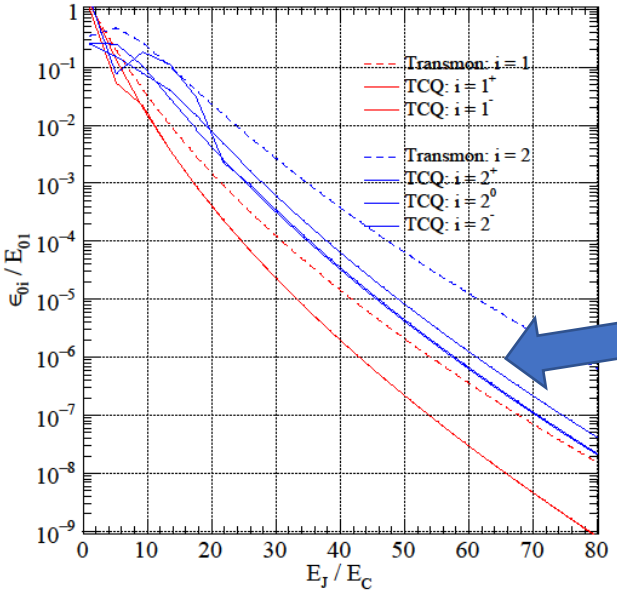
1 Qubit consists with 2 JJs

|2> can be used in TCQ ?

Spatial Symmetry provides
1) Frequency Shift
2) Noise mitigation



Charge dispersion



Can we use here?

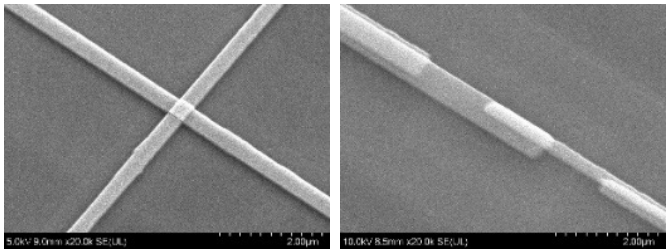
EI=0 -> transmon limit

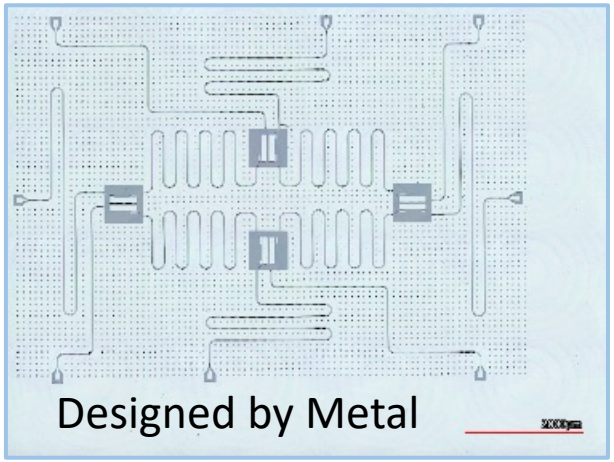
the second excited states are composed of the $|2^{\pm}\rangle$ (= ($|02\rangle \pm |20\rangle$)/√2) modes and the uncoupled zero mode $|2^0\rangle$ (= $|11\rangle$)

- EJ/EC >> 1 -> Noise effect is reduced
- Noise effect is furthermore expected to be reduced by factor ~10 due to symmetry

1）作ってテストする

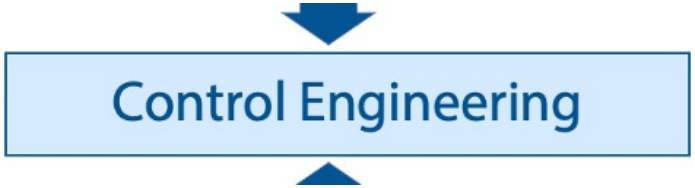
Test JJ we made



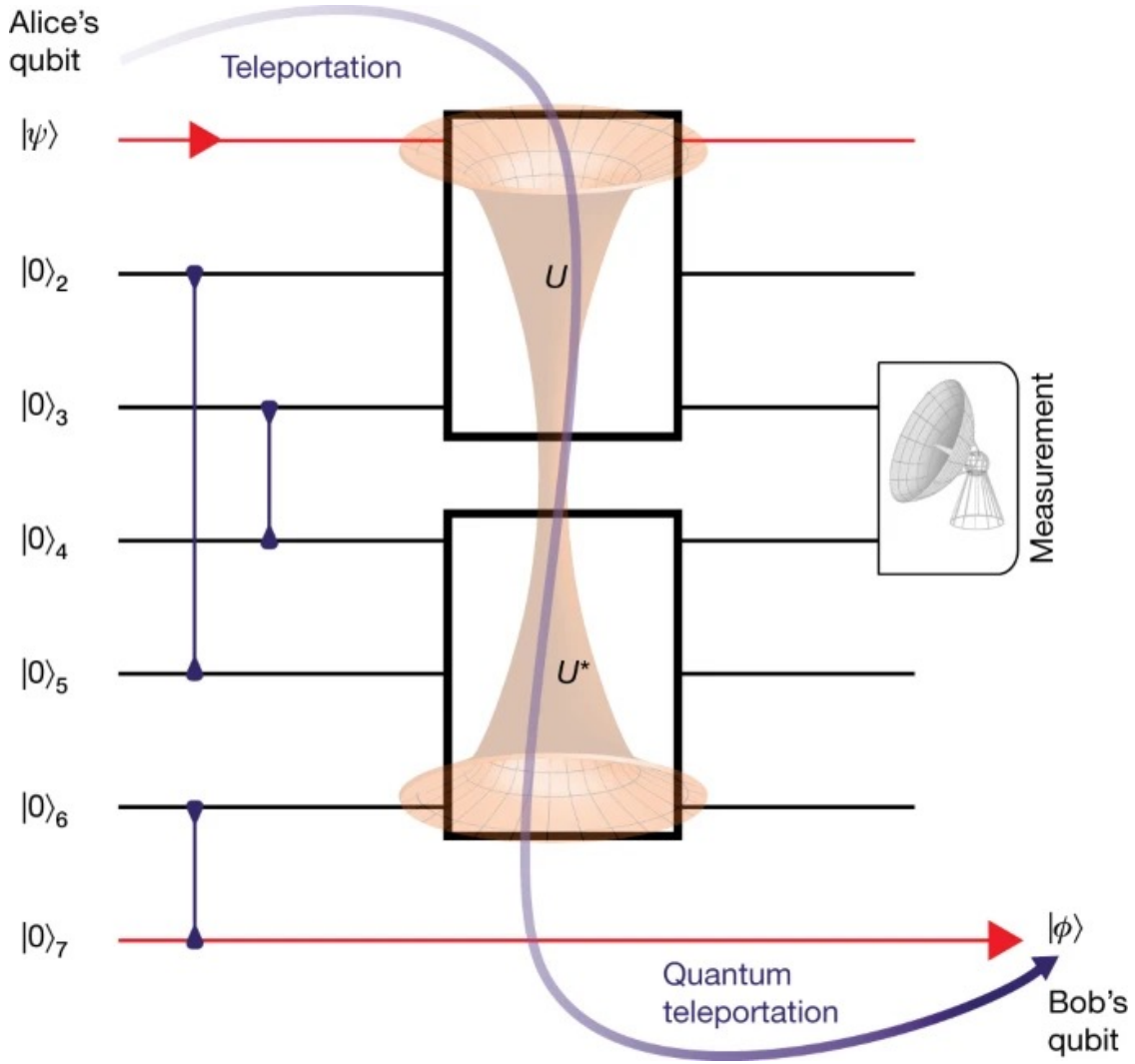


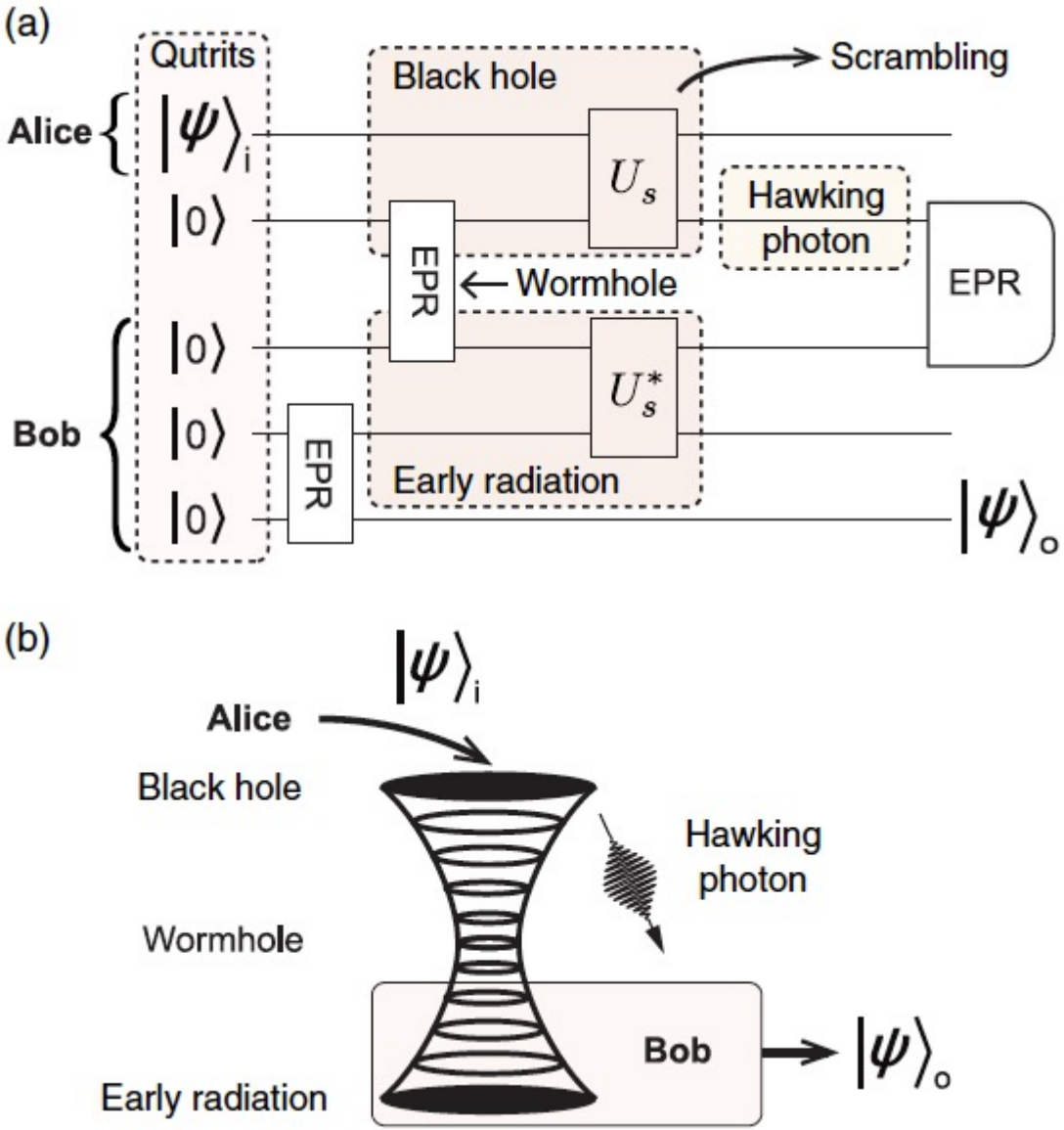
Finally tested
@ IBM QHTC

2）シュミレーターで
制御などをつくる



Qトリットや量子回路をつくって　BHと情報の謎を解く




(a)
Qutrits
Alice
Bob
Black hole
Scrambling
Hawking photon
EPR
Wormhole
Early radiation
(b)
Alice
Black hole
Hawking photon
Wormhole
Bob
Early radiation