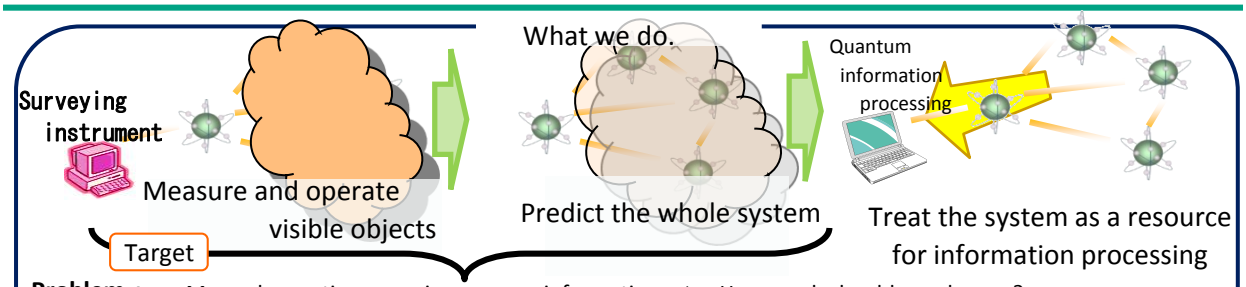
14 Quantum computer using noisy environment

～Identification of untouchable quantum system～

Abstract

In general, behind visible objects there exist hidden objects. And, the visible and hidden objects interact with each other. Therefore, to obtain the information about the whole system, we have to predict information about the hidden objects through their effect on the visible objects. We formalize such a task in quantum systems and investigate such a situation. In previous research, some special structures of systems are supposed. In our research, we only assume that the dimension of the quantum system is finite and give a strategy for obtaining all of the information about the system from the observation of the visible objects. Using this strategy, we can identify even noisy devices rigorously and treat them as a resource for quantum information processing.



Problem : More observation may give us more information. ⇒ How much should we observe?

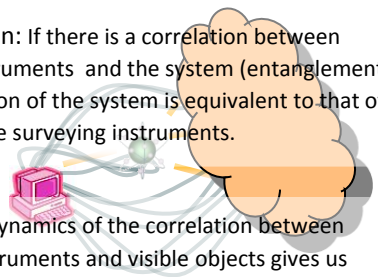
(Previous research: Special assumptions make it easy to know what kind of observation gives us all of the information.)

Theoretical results: Give a compact expression of sufficient observations.

/Give an explicit procedure to predict the whole system.

How to predict？

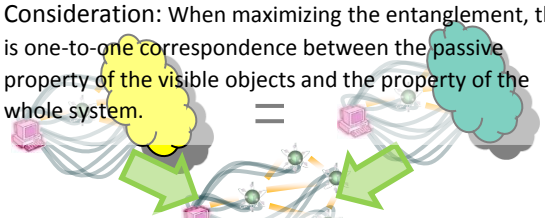
Consideration: If there is a correlation between surveying instruments and the system (entanglement), any modification of the system is equivalent to that of the state of the surveying instruments.



Result: The dynamics of the correlation between surveying instruments and visible objects gives us information about the dynamics of the system.

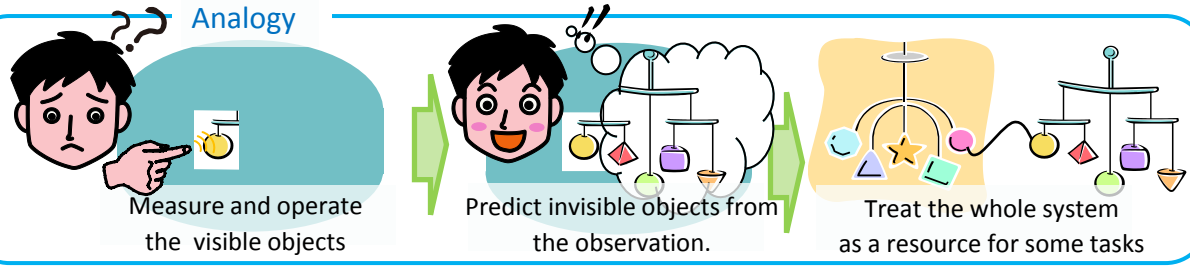
Are observations sufficient？

Consideration: When maximizing the entanglement, there is one-to-one correspondence between the passive property of the visible objects and the property of the whole system.



Result: All of the information is obtained from the passive observation if a certain condition is satisfied.

Analogy



Related works

[1] M. Owari, K. Maruyama, T. Takui, G. Kato, "Probing an untouchable environment for its identification and control," ***Phys. Rev. A,*** **Vol. 9, 012343, 2015.**

Contact

Go Kato Computing Theory Research Group, Media Information Laboratory

E-mail : kato.go(at)lab.ntt.co.jp