

New Quantum Aspect of Information Flow

@GPPU progress report meeting

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Recent work: Information Flow in Field

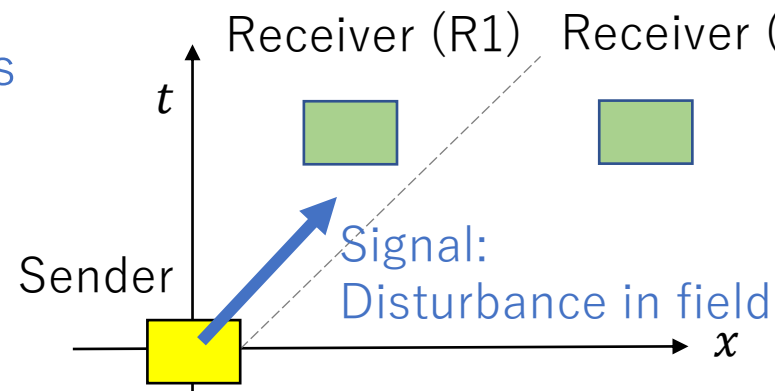
Question: Where does information go in fields? Any quantum effect?

New: It is useful to measure fields before signal arrives in quantum setup.

Wireless communication via **classical fields**

Receivers **cannot enhance** the efficiency if they are spatially separated with senders

(The efficiency is quantified by the so-called channel capacity C)

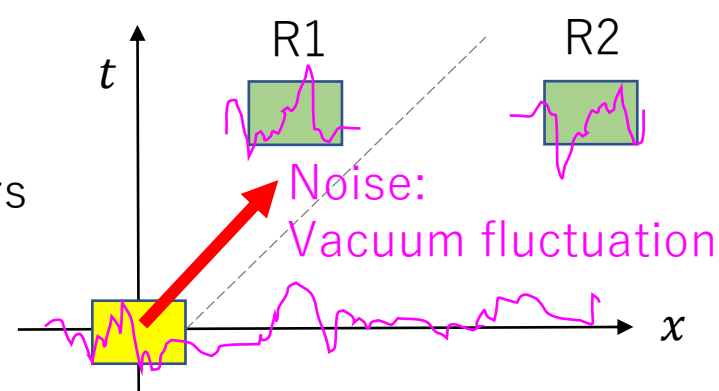


$C_{R1} > 0$: R1 receives sig.
 $C_{R2} = 0$: R2 doesn't.

$$C_{R1+R2} = C_{R1} + C_{R2}$$

Wireless communication via **quantum fields**

Receivers **enhance** the efficiency even if they are spatially separated with senders



$C_{R1} > 0$: R1 receives sig.
 $C_{R2} = 0$: R2 doesn't.

$$C_{R1+R2} > C_{R1} + C_{R2}$$

R2 plays a role of a **noise** detector.

[KY, A. Ahmadzadegan, P. Simidzija, A. Kempf and E. Martín-Martínez, Phys. Rev. D 101, 105009 (2020)]

[For a review on a series of studies, see

山口幸司、堀田昌寛、日本物理学会誌2020年5月号]

Research in the past and plans in future

Main interest: Quantum entanglement and information stored in correlations.

Research in the past two years on ...

- the so-called purification partners: 3 papers
 - the so-called quantum information capsule (QIC): 4 papers
 - other topics : 2 papers
- } These papers will be the main contents of the PhD thesis.

Research in future

- Loss of entanglement in the expanding universe
In collaboration with Y. Nambu in Nagoya Univ.
 - Asymptotic symmetry in general relativity (related with a work in my master course)
In collaboration with M. Hotta and T. Tomitsuka
 - Flow of quantum information in curved spacetime
In collaboration with A. Kempf and E. Martín-Martínez in University of Waterloo
- } In GPPU
- } Postdoc?

Overseas research activities in the last academic year

- Visit to Taiwan (2019/5/20 - 2019/6/2)
 - Discussed with a prof. in National Changhua University of Education
 - I came up with a new research project in a conference.
- Visit to University of Waterloo in Canada (2019/9/1 - 2019/11/1)
 - I proposed the above project and worked together with two profs., a postdoc and a student there.
- Visit to Australia (2020/2/12 - 2020/2/21)
 - I gave two seminars at Macquarie University and Royal Melbourne Institute of Technology
 - I gave an oral presentation at a conference.

During the PhD course, I have spent **94 days** in total (**> 3 month**).

Overseas research plans in future

- If possible, I am planning to visit University of Waterloo in Sept. and Oct.
 - Profs. at UW are happy to host me.
- Even if it is impossible to visit there due to COVID-19, I will keep in touch with people at UW via e-mail.
- After finishing Ph.D, I want to be a postdoc at UW:
 - JPSJ overseas research fellow (I have finished the application.)
 - The Banting fellowship in Canada (The application will launch in June.)