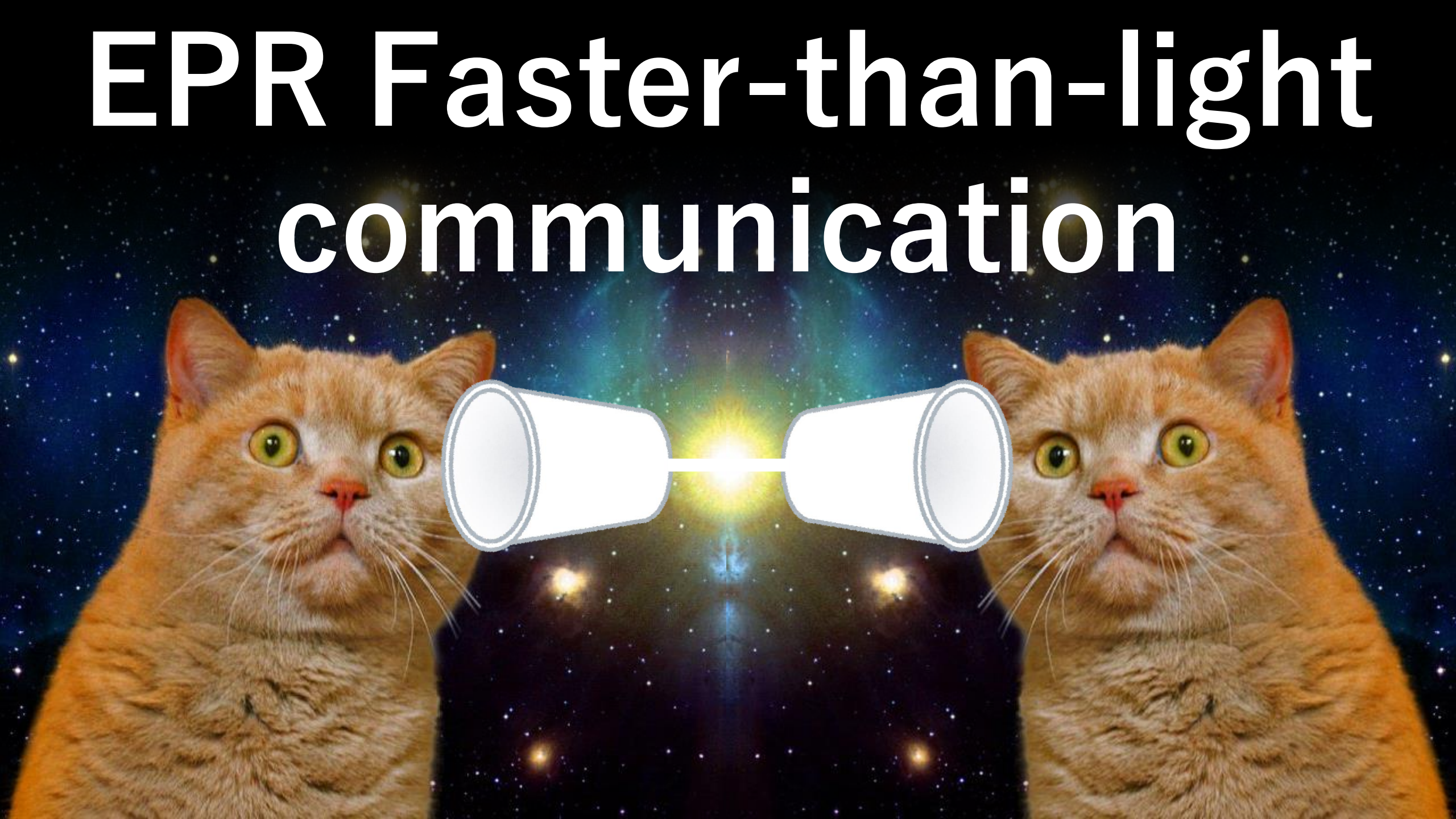
EPR Faster-than-light communication

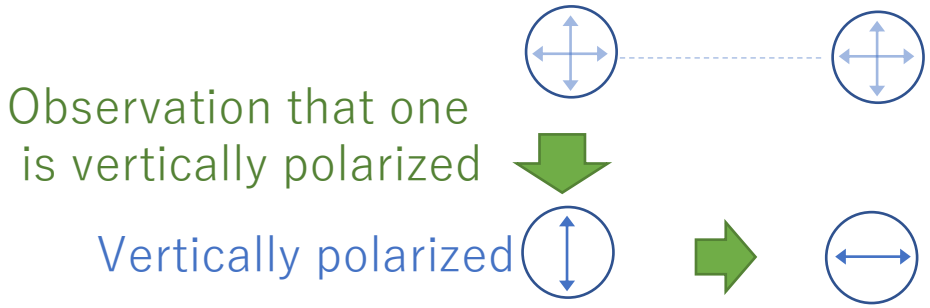


EPR Faster-than-light communication

Entanglement

Two entangled photons

One is vertically polarized, the other is horizontally polarized.



Instantly, the possibility of the other being vertically polarized becomes zero.

If the waves were not transmitted instantaneously, they could both be perpendicularly polarized when observed simultaneously, but this is not the case.

There was a theory that it was determined from the beginning by a hidden variable, but this was disproved by the violation of Bell's inequality.

A great detective explains how quantum entanglement in the EPR paradox can be used to achieve faster-than-light communication.
It uses two entangled photons.
If one is vertically polarized, the other is horizontally polarized.
If one is observed as vertically polarized, the possibility of the other being vertically polarized instantly becomes zero.
If the transmission is not instantaneous, there is a possibility that both will be vertically polarized when observed simultaneously.
However, in reality, both will never be the same polarization.
It was called the EPR paradox because it seemed strange that something could travel faster than the speed of light.
There was a theory that it was determined from the beginning by a hidden variable, but this was disproved by the violation of Bell's inequality.
There is no longer any doubt that nonlocality, whereby photons behave as a single quantity even when far apart, is a concept that cannot be understood.

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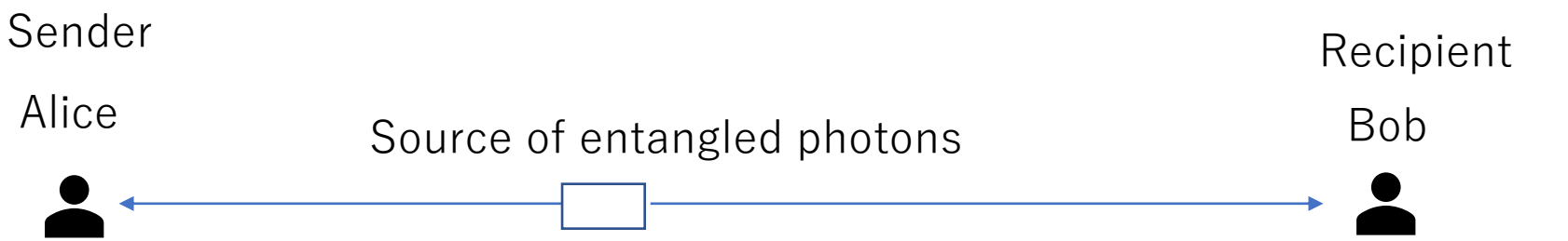
Faster-than-light communication

Transmit meaningful information from Alice to Bob faster than the speed of light.



After Alice decides whether to observe or not,
Bob checks the entanglement.

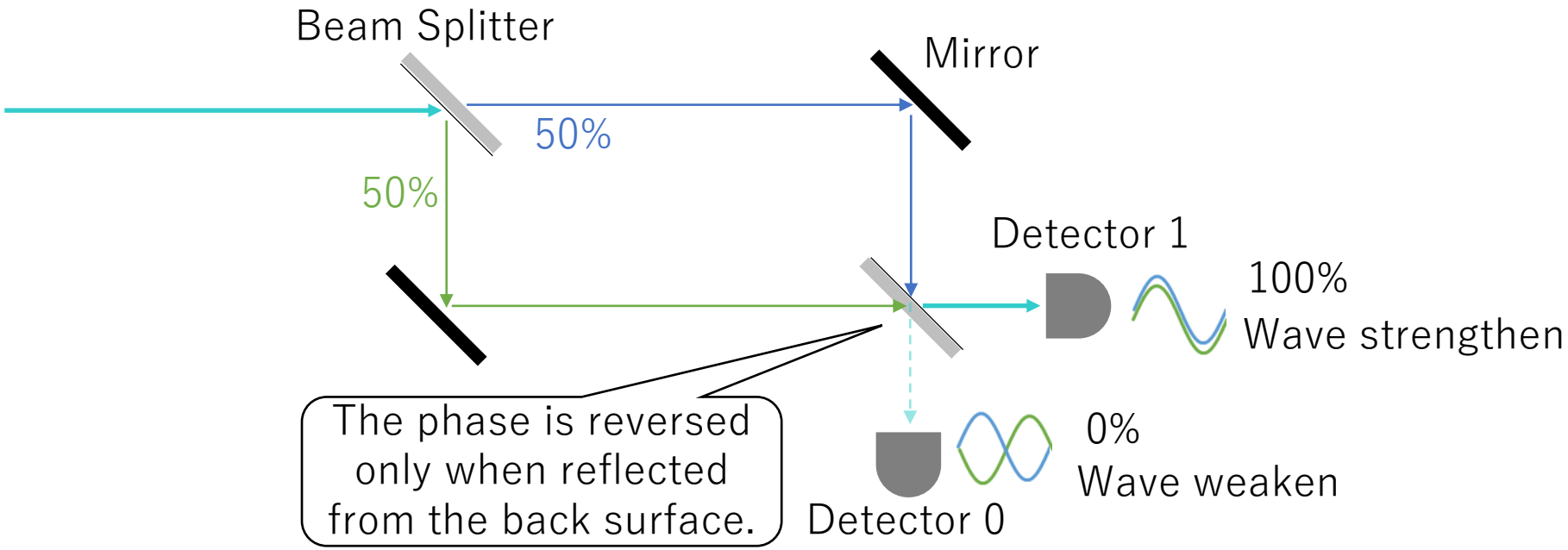
"1" ⇒ Do not observe
"0" ⇒ Do observe
(Entanglement disappears)

Entangled ⇒ "1"
Not Entangled ⇒ "0"

Let's think about how to transmit meaningful information from Alice to Bob faster than the speed of light.
A pair of entangled photons is sent to Alice and Bob.
If Alice wants to communicate "1", she doesn't observe the polarization direction.
If Alice wants to communicate "0", she observes the polarization direction.
Once observed, the quantum entanglement is resolved.
Bob is farther away from the source of the photon than Alice.
After Alice decides whether to observe or not, Bob checks whether the photon is entangled.
If the photon is entangled, Bob receives a "1".
If the photon is not entangled, Bob receives a "0".

EPR Faster-than-light communication

Mach-Zehnder interferometer

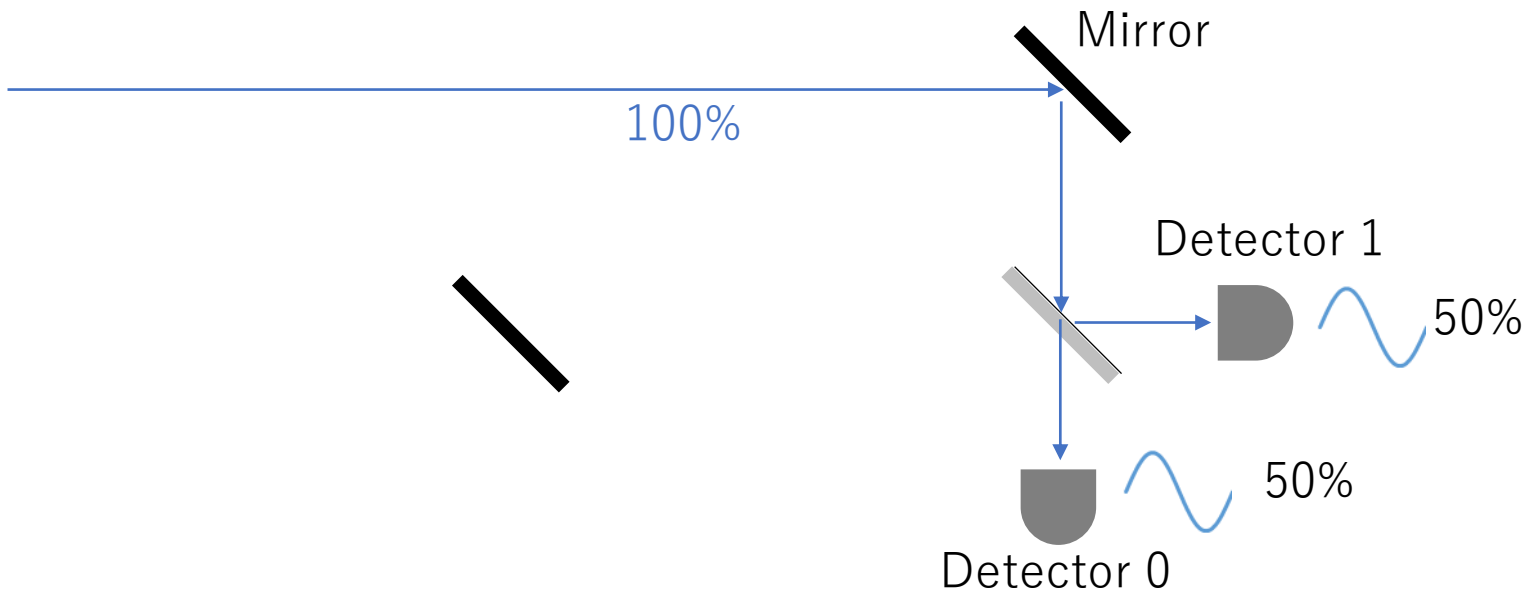


Even a single photon will travel through both paths,
interfering and being detected 100% by detector 1.

A Mach-Zehnder interferometer is used to test for entanglement.
First, let's explain a standard Mach-Zehnder interferometer.
Light splits at the first beam splitter and recombines at the second.
The beam splitter is a half mirror that reflects or transmits light with a 50% probability.
It is designed so that the light is shifted by half a wavelength only when it is reflected off the back side of the beam splitter.
The waves constructively interact in the direction of detector 1 and destructively interact in the direction of detector 0.
Even a single photon will travel along both paths.
They interfere and are detected 100% by detector 1.

EPR Faster-than-light communication

Mach-Zehnder interferometer

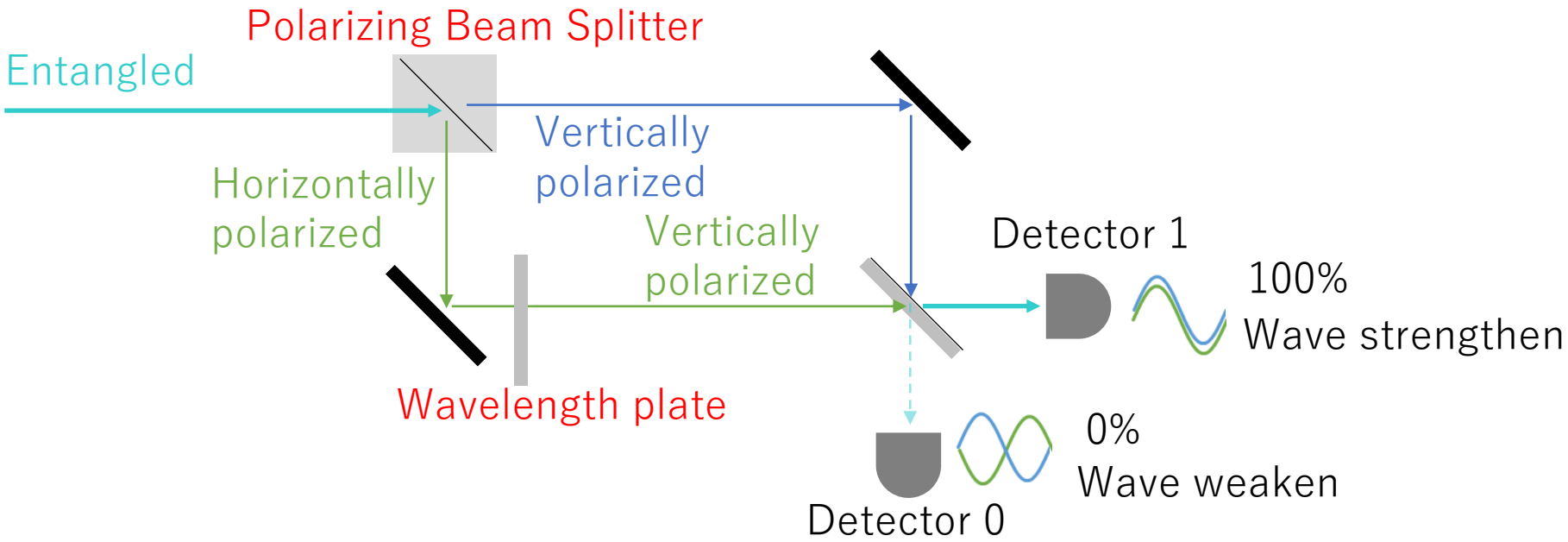


If it travels only one path, there will be no interference
and detectors 1 and 0 each detect 50%.

Let's consider the case where the first beam splitter is removed.
Since the light only travels through one path, there is no interference.
Detectors 1 and 0 each detect 50%.

EPR Faster-than-light communication

Entanglement Detector



If the photon remains entangled, it will be a mixture of
vertically and horizontally polarized light and will travel both paths.
Because of interference, 100% of the photon will be detected by detector 1.

We will modify the Mach-Zehnder interferometer to turn it into an entanglement detector.
The first beam splitter is changed to a polarizing beam splitter.
Vertically polarized light is transmitted 100%, and horizontally polarized light is reflected 100%.
Since different polarization directions do not interfere, a wave plate is inserted to align the polarization directions.
If the photons remain entangled, they will be mixed with vertically and horizontally polarized light and will pass through both paths.
Because they interfere, 100% will be detected by detector 1.

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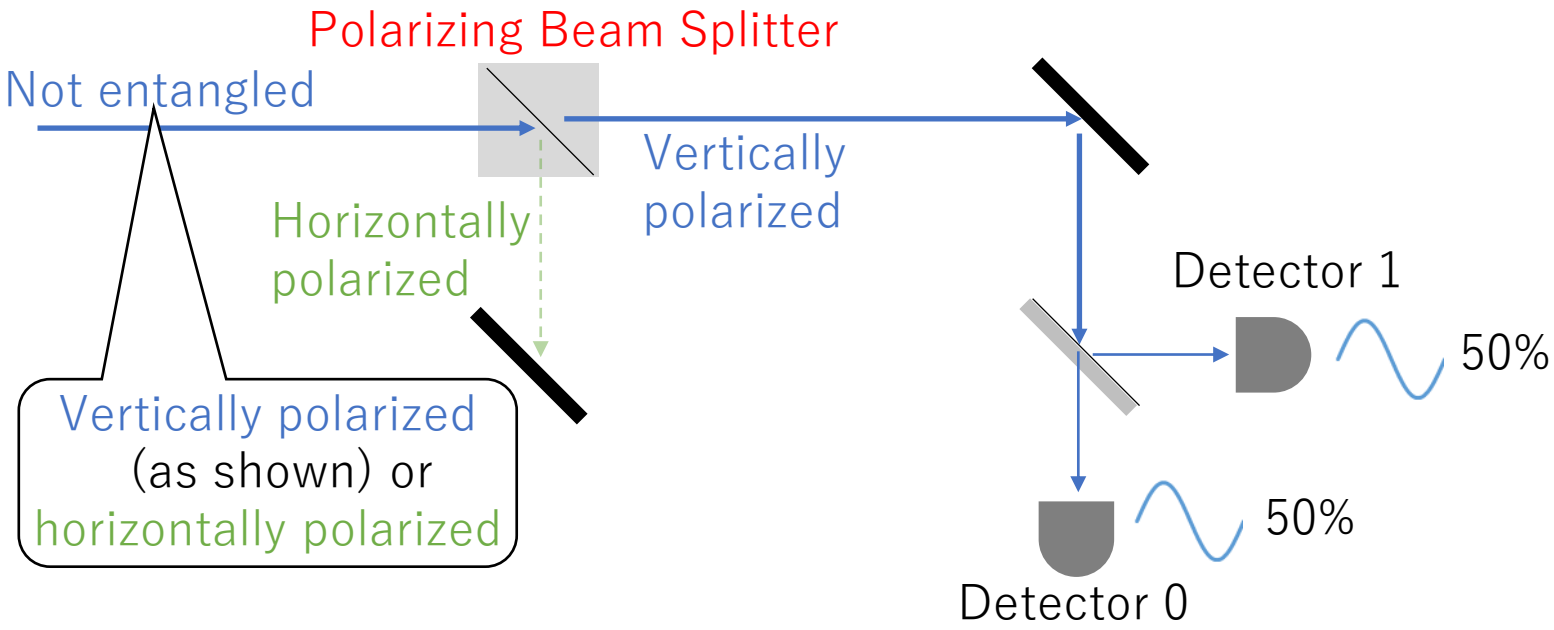
Entanglement Detector



Since it only travels one path, there is no interference,
and detectors 1 and 0 each detect 50%.

Let's consider the case of disentangled photons.
They are definitively either vertically or horizontally polarized and do not mix.
They do not interfere because they only travel one path.
Detectors 1 and 0 detect 50% each.

EPR Faster-than-light communication

Information Estimation

Sender

Information		Detection	
"1"	Entangled	100%	Detector 1
		0%	Detector 0
"0"	Not entangled	50%	Detector 1
		50%	Detector 0

Recipient

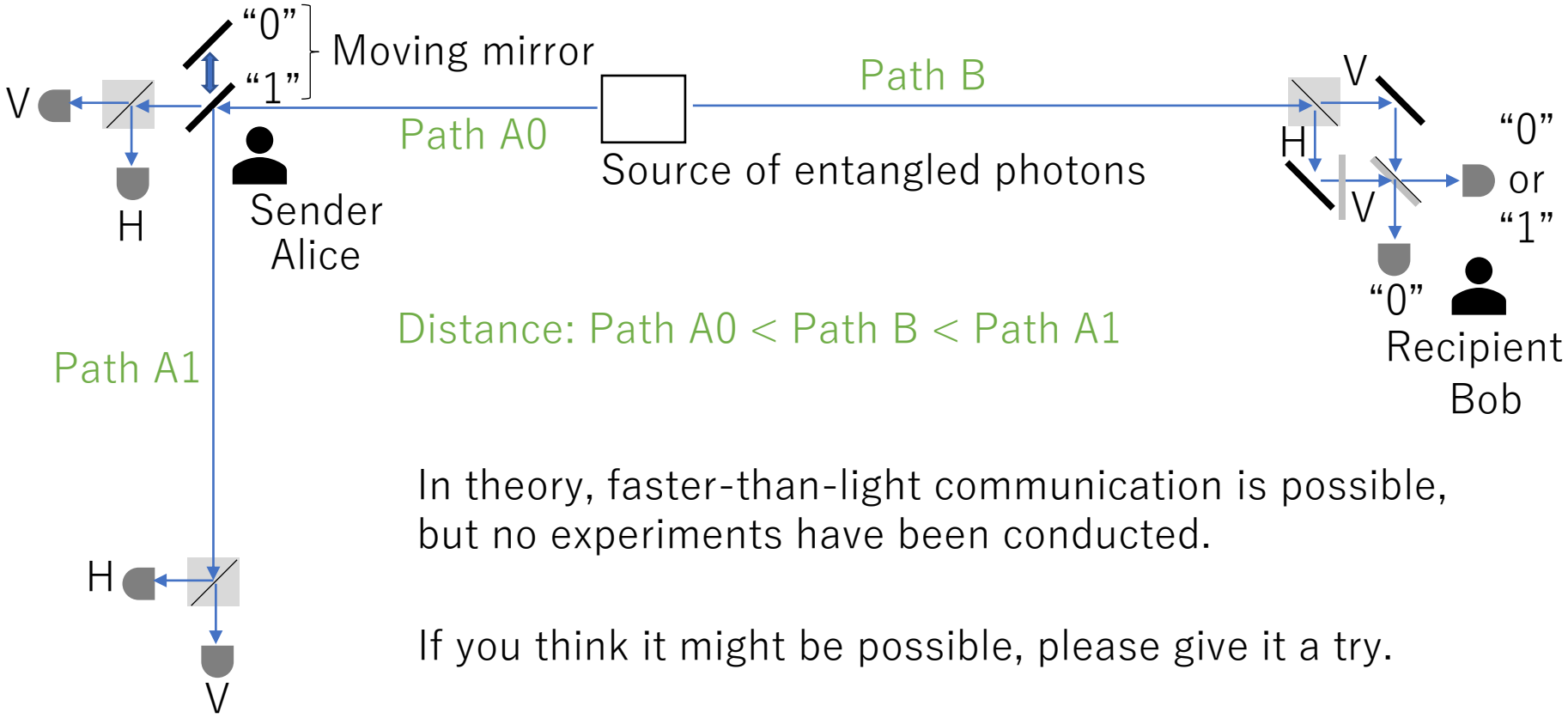
Detection	Information Estimation		
Detector 1	50%	Entangled	"1"
	50%	Not entangled	"0"
Detector 0	0%	Entangled	"1"
	100%	Not entangled	"0"

If it is done multiple times,
the information can be estimated from the detection ratio.

If it is observed by detector 1, it is not clear whether it is entangled.
It is not clear whether the information is "1" or "0".
If it is observed by detector 0, it is 100% not entangled.
It is clear that the information is "0".
It is not possible to reliably convey information in one go.
If it is done multiple times, the information can be estimated from the detection ratio.
If the ratio for detector 0 is low, it can be estimated that the information is "1".

EPR Faster-than-light communication

Overall view



In theory, faster-than-light communication is possible,
but no experiments have been conducted.

If you think it might be possible, please give it a try.

This shows an overall diagram of faster-than-light communication.
Alice sends information by moving the mirror to change the path.
Alice observes the direction of polarization either before or after Bob.
The distance is set accordingly.
In theory, faster-than-light communication is possible, but no experiments have been conducted.
If you think it might be possible, please give it a try.
That's all.

Contact Information

For inquiries,

please contact us here.

https://ultagi.org/