

Quantum mysteries: Interaction-free measurement

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Quantum mysteries and paradoxes,
University of Calgary

Recap: Experiments 1–4

Quiz-I Solutions

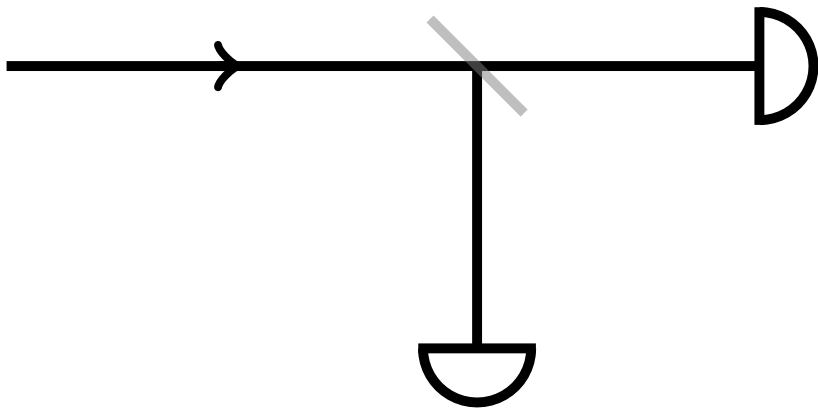
Interaction Free Measurement

Quiz-II and Solutions

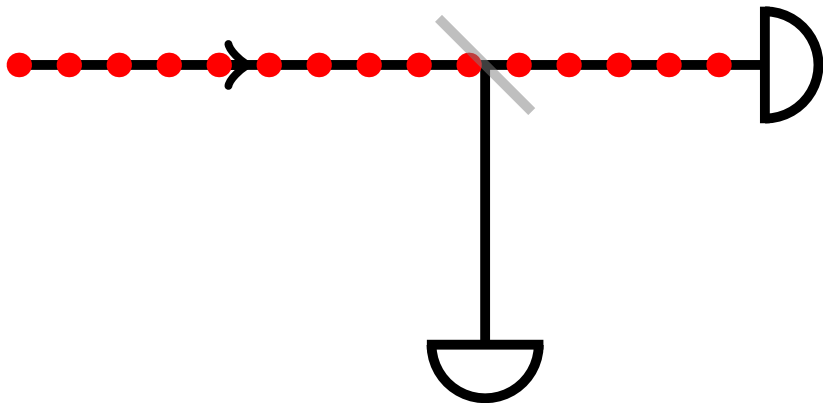
Looking ahead

Recap: Experiments 1–4

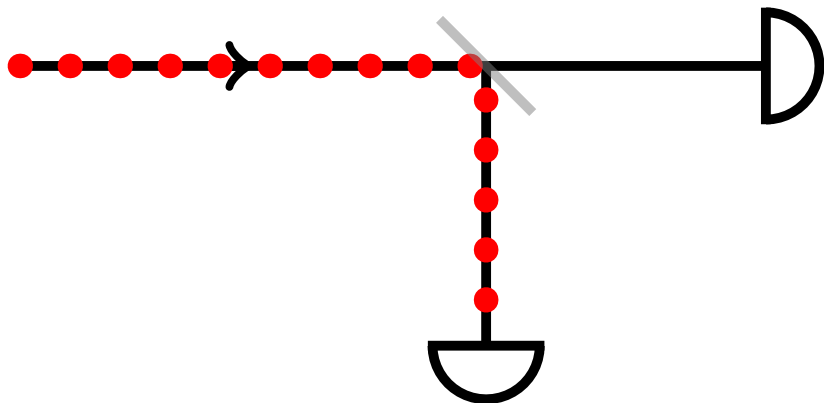
Experiment 1



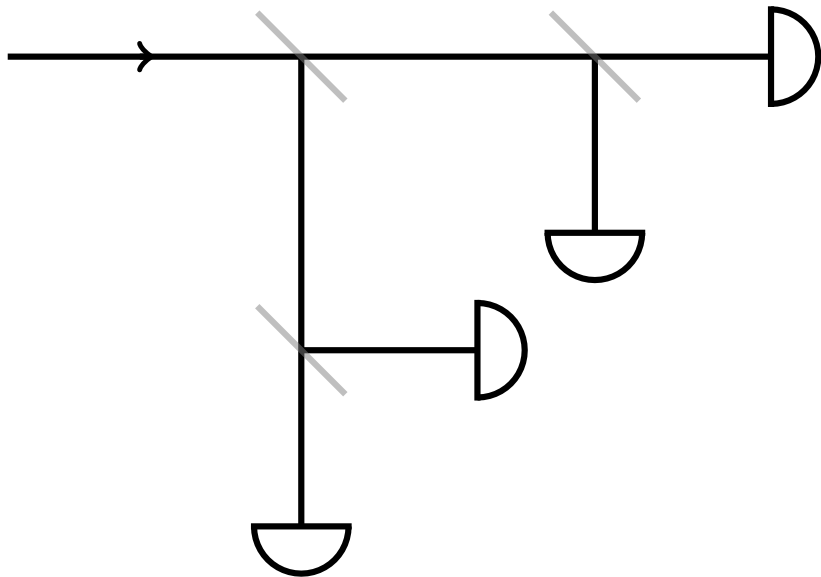
Experiment 1



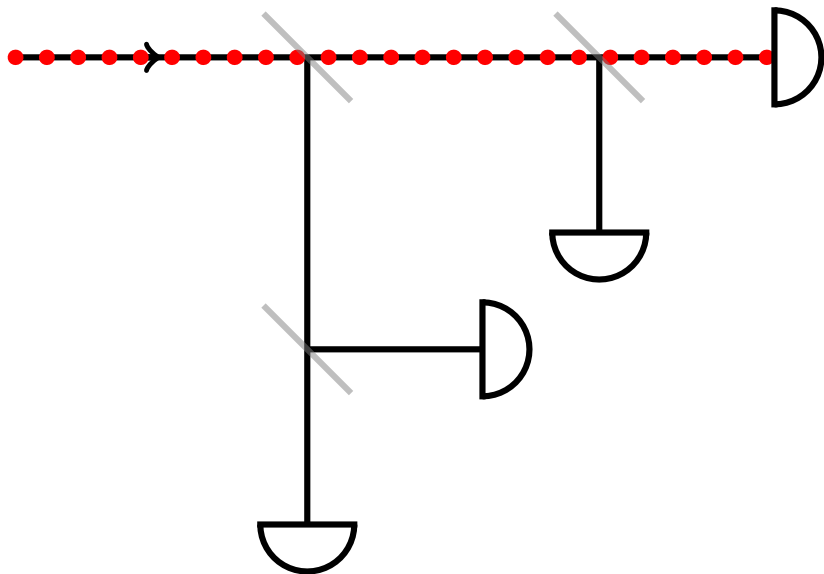
Experiment 1



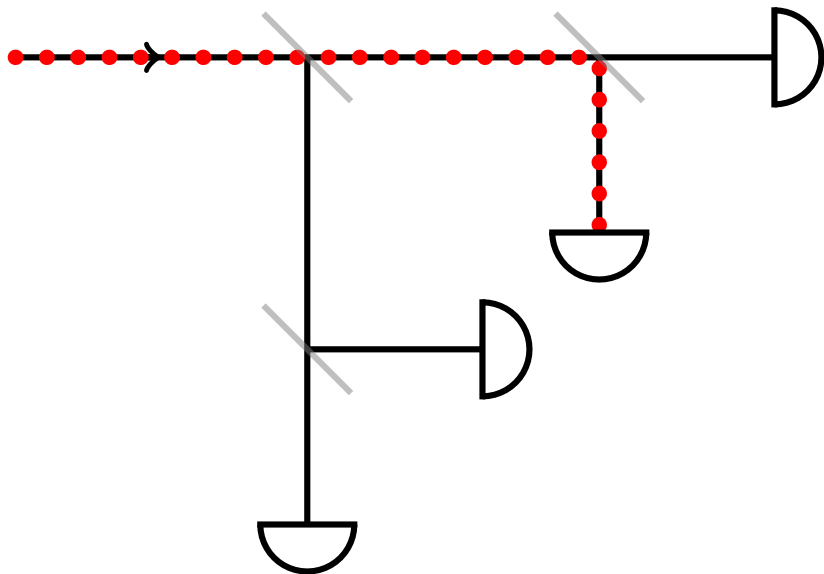
Experiment 2



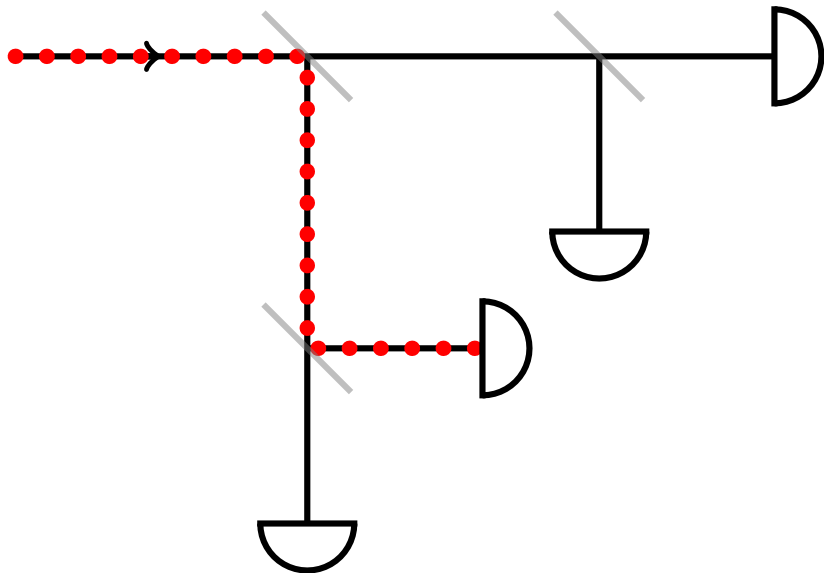
Experiment 2



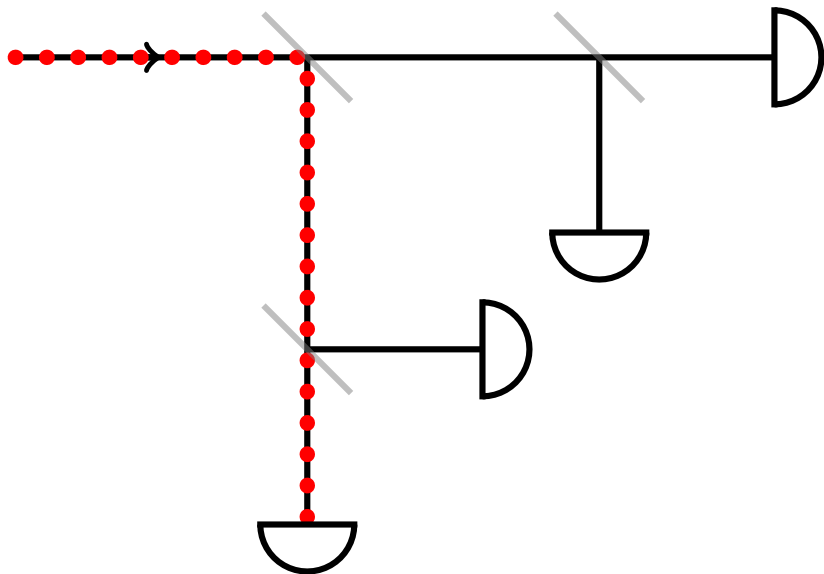
Experiment 2



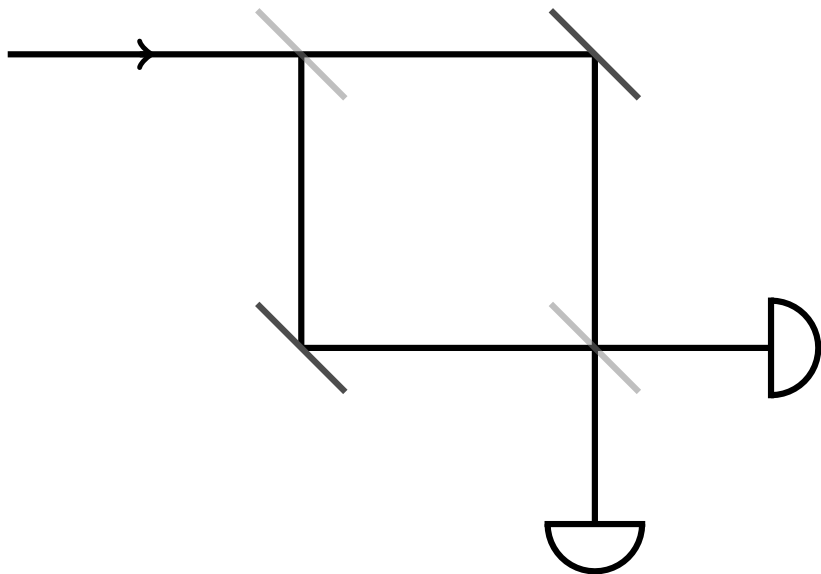
Experiment 2



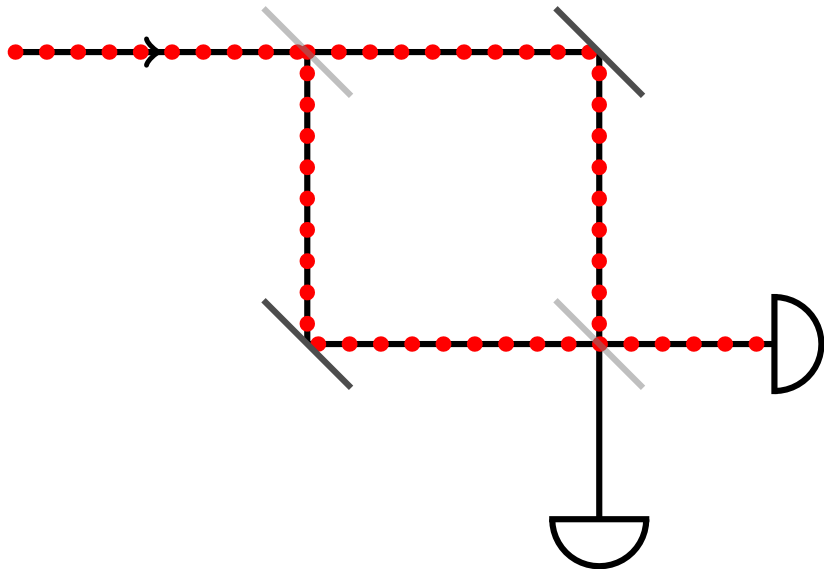
Experiment 2



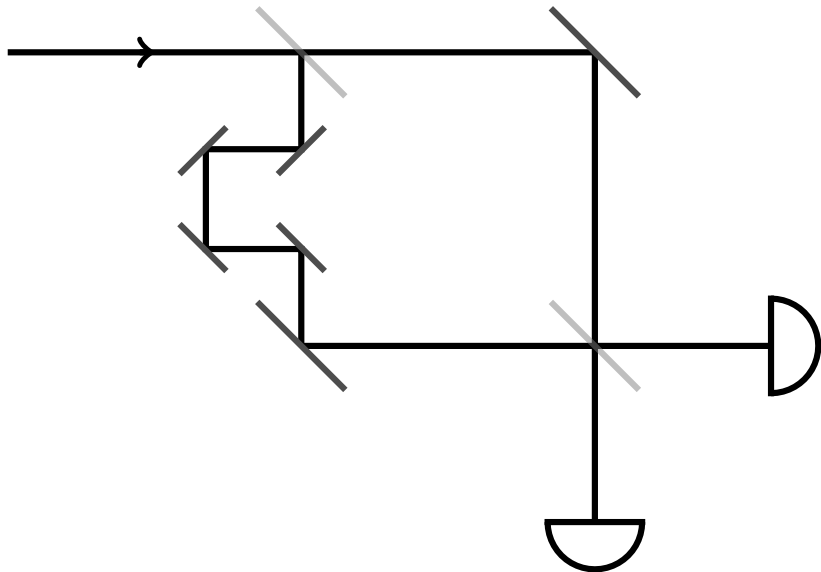
Experiment 3



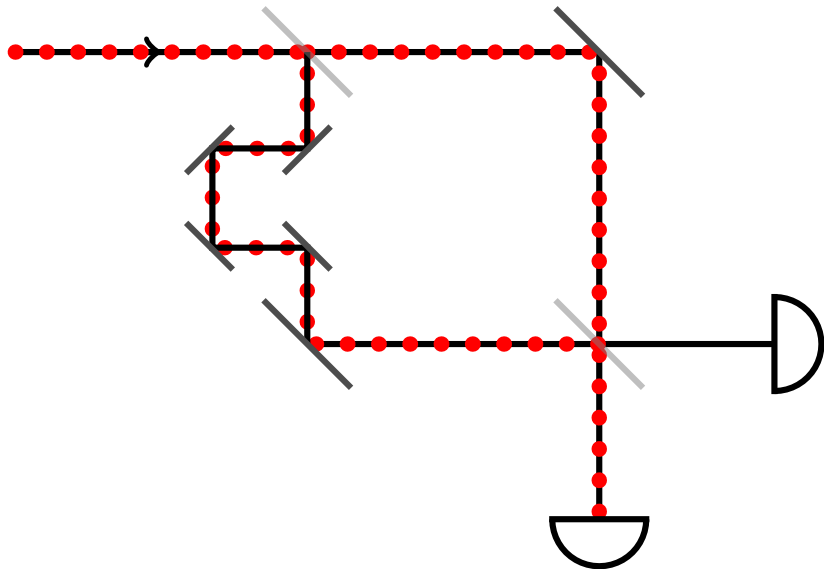
Experiment 3



Experiment 4

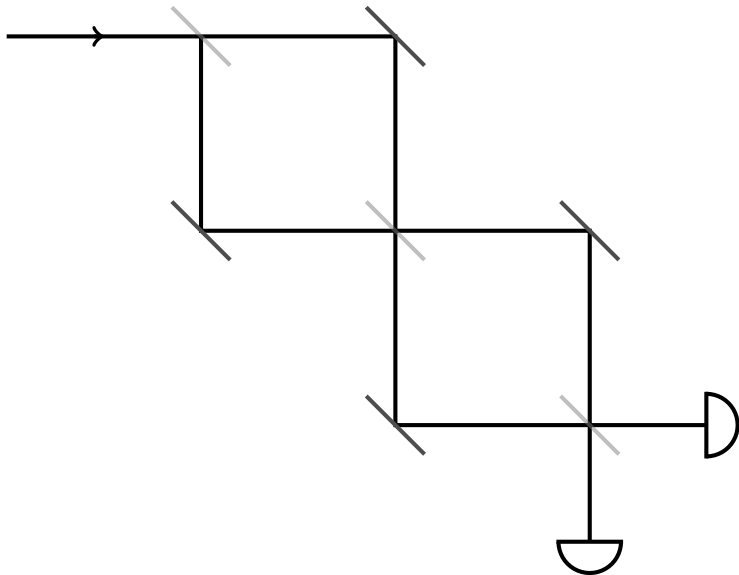


Experiment 4

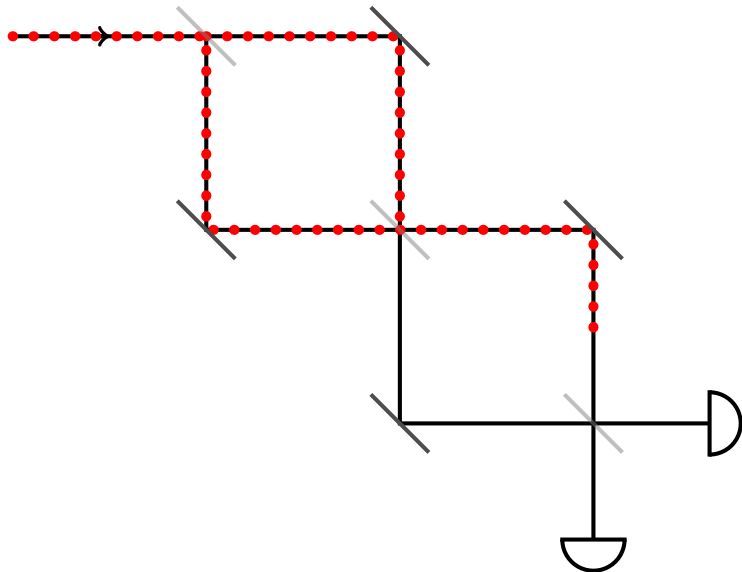


Quiz-I Solutions

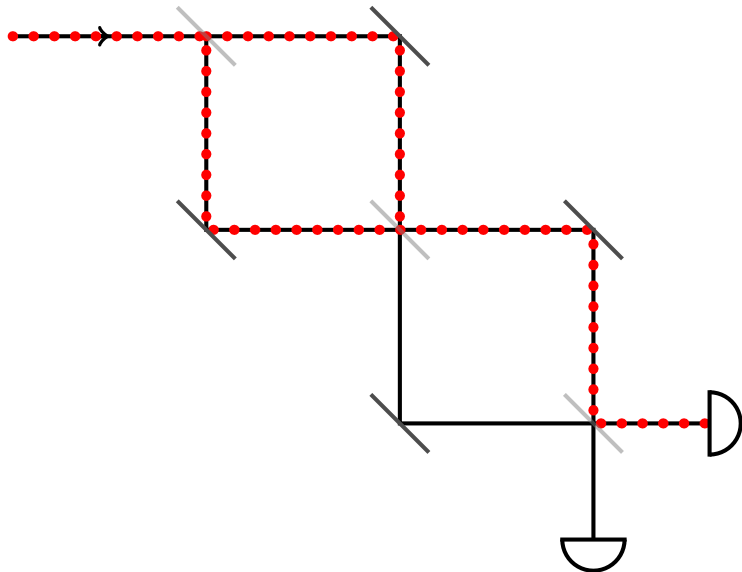
Quiz-I Solutions



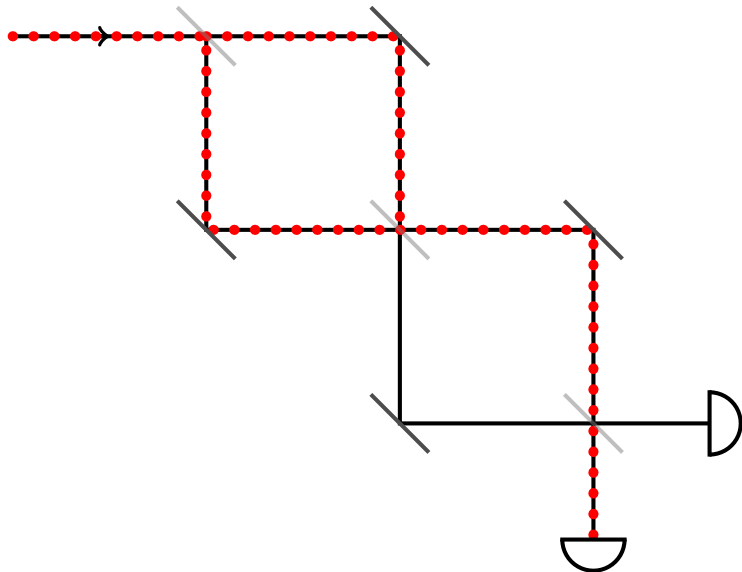
Quiz-I Solutions



Quiz-I Solutions



Quiz-I Solutions



Interaction Free Measurement

Interaction free measurement: Task

Task: to optically detect the presence of something, but with no photons hitting it.

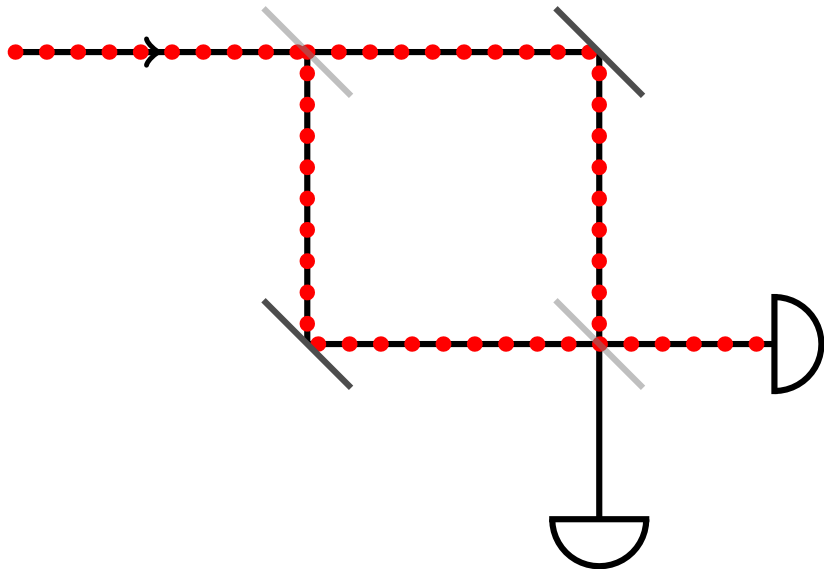
Interaction free measurement: Task

Task: to optically detect the presence of something, but with no photons hitting it.

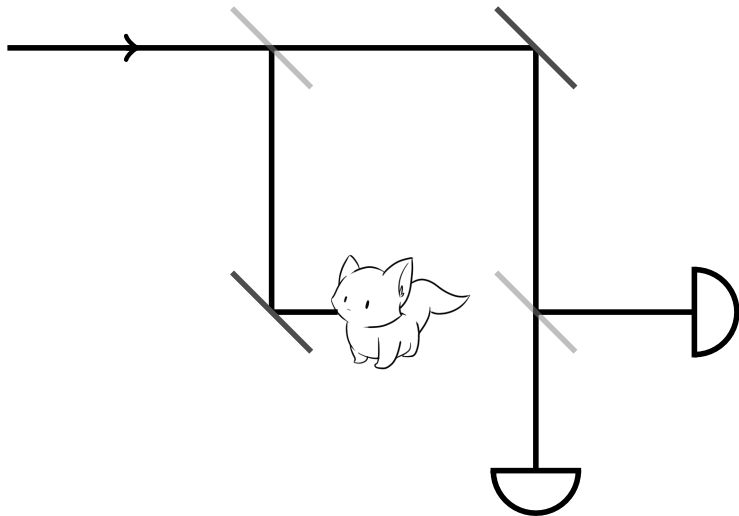
Find the sleeping kitten
without waking it up.



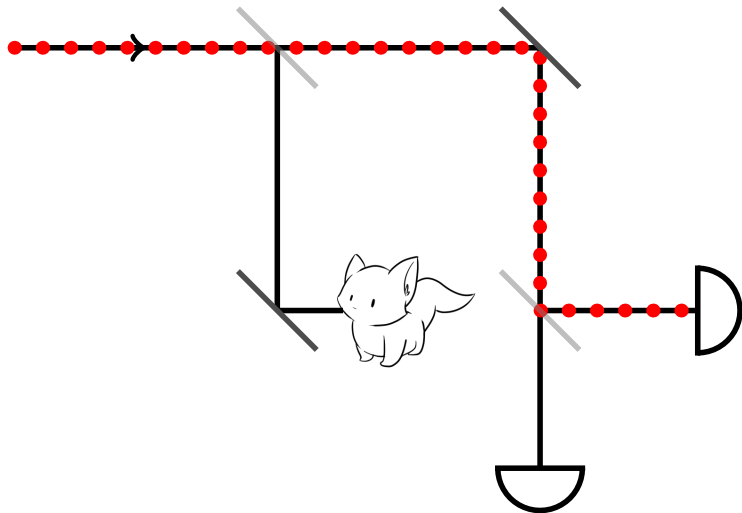
No kitten



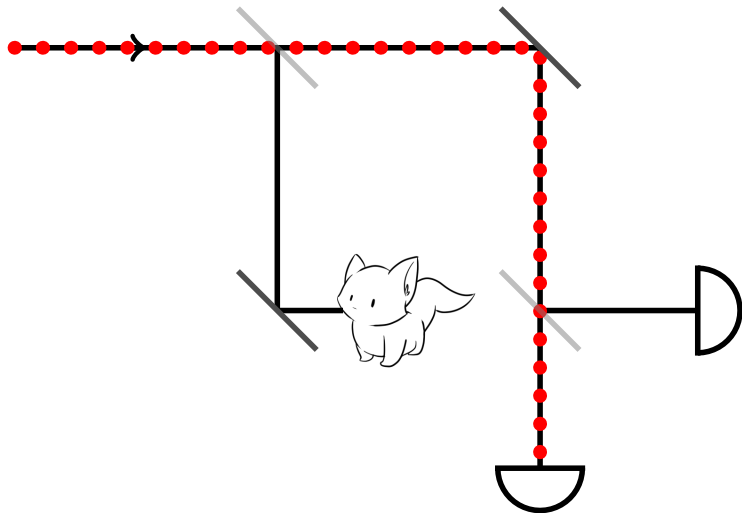
Kitten



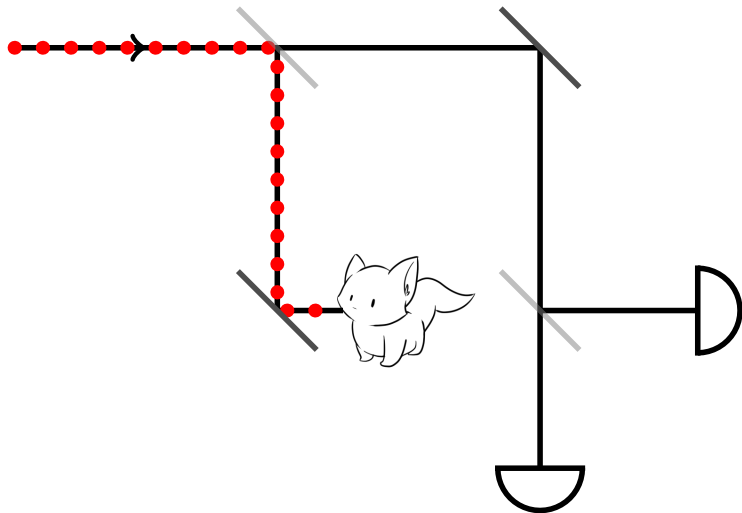
Kitten undetected



Kitten detected. Not woken up!



Kitten woken up



Interaction free measurement

If no kitten, then only the bright detector ever lights up.

If kitten present, then sometimes the bright detector lights up.

If kitten present, then sometimes the dark detector lights up!

Interaction free measurement

Dark detector lights up only if kitten present.

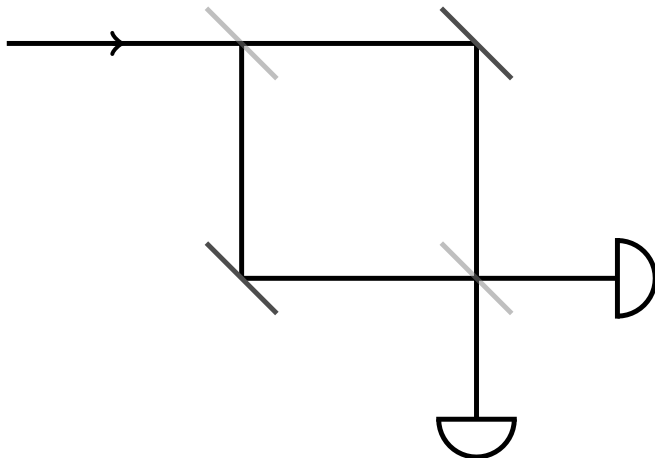
This event measured the presence of the kitten without waking it up!

i.e., measurement performed without interaction.

Quiz-II and Solutions

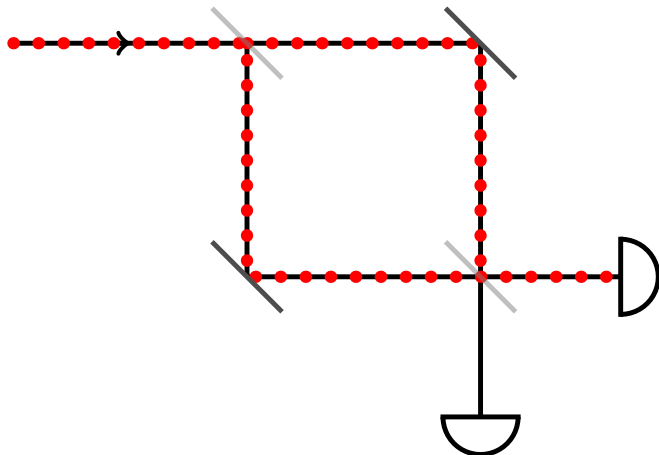
Quiz

1(A) What percentage of photons would have arrived at the bottom detector?



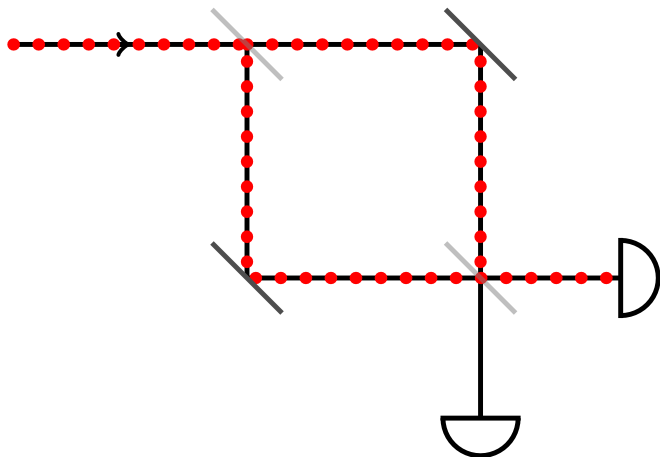
Quiz

1(A) What percentage of photons would have arrived at the bottom detector?



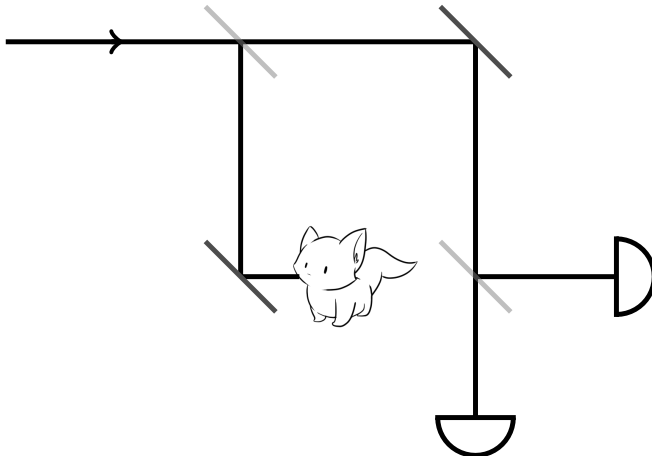
Quiz

1(B) What percentage of photons would have arrived at the right detector?



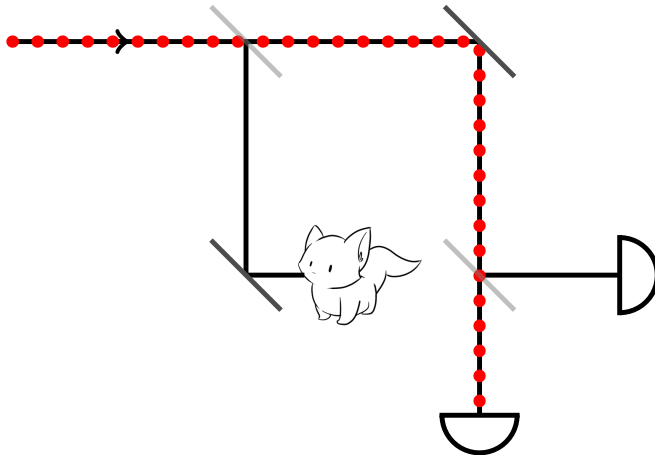
Quiz

2(A) What percentage of the photons are detected at the bottom detector?



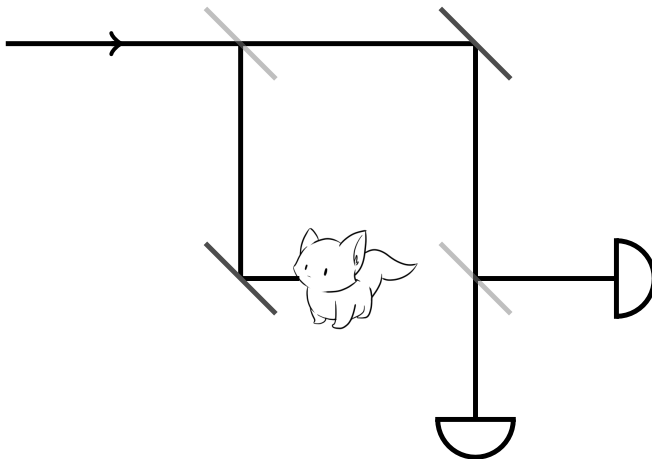
Quiz

2(A) What percentage of the photons are detected at the bottom detector?



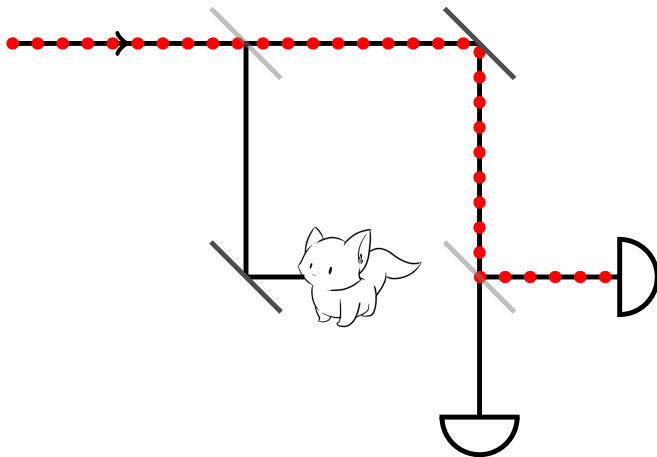
Quiz

2(B) What percentage of the photons are detected at the detector on the right?



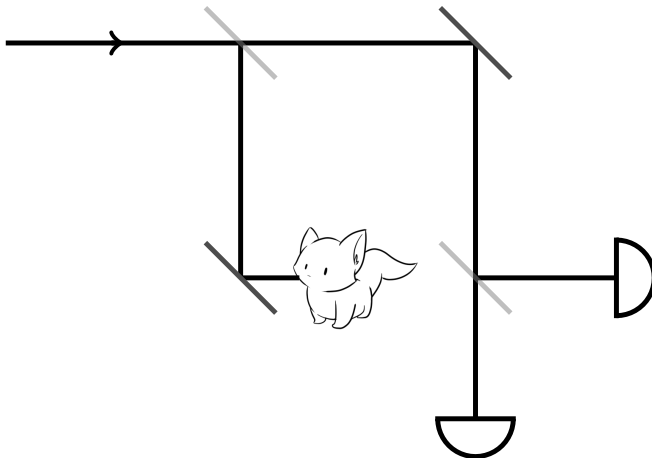
Quiz

2(B) What percentage of the photons are detected at the detector on the right?



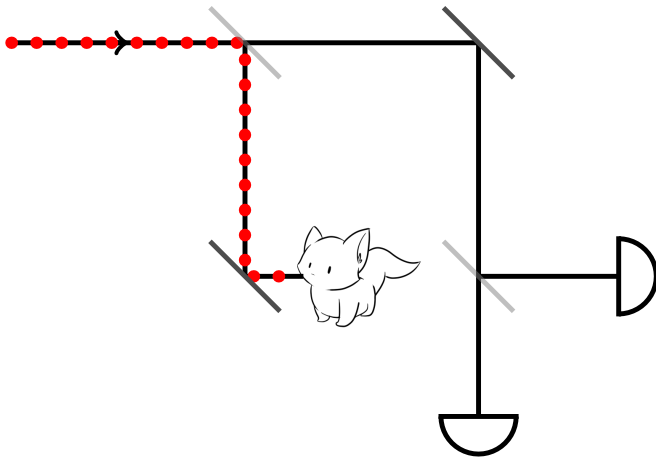
Quiz

2(C) What percentage of the events resulted in the kitten being woken up?



Quiz

2(C) What percentage of the events resulted in the kitten being woken up?



3 Suppose an experiment was performed and some photons were detected at the bottom detector. What does this tell us?

Looking ahead

Pair of interaction free measurements

What do we know about the obstacles (kittens) if the two Dark detectors light up?

