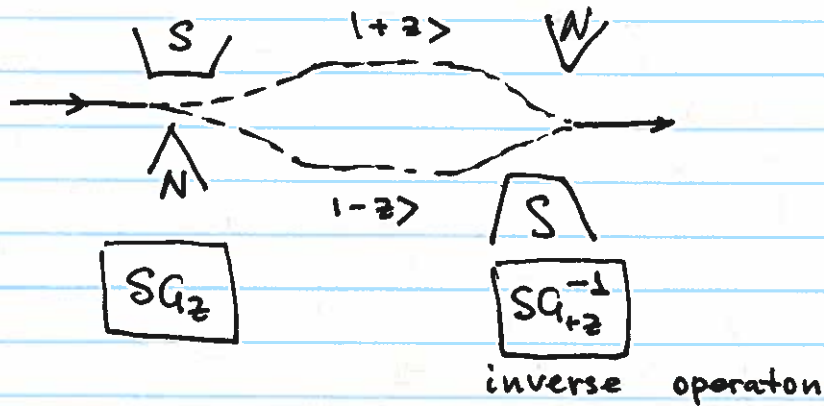
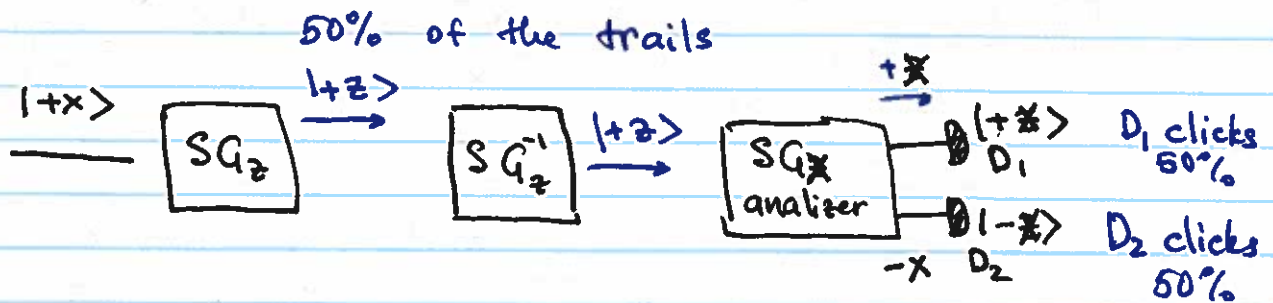


Which-way witchery

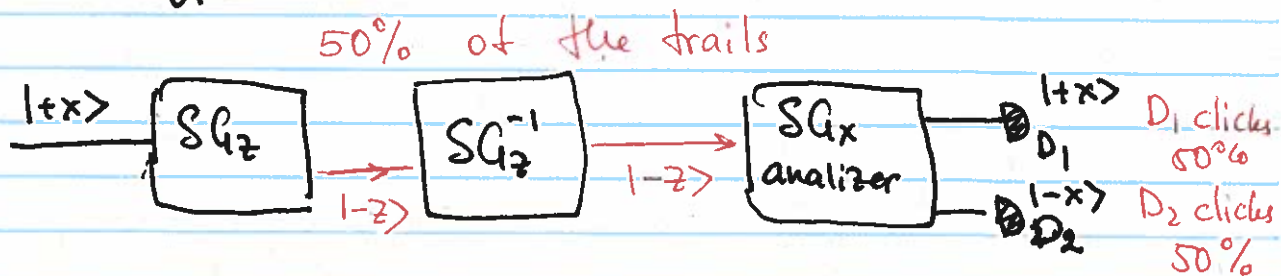
Stern-Gerlach loop



What we see in the output of the loop strongly depends on if we know which path the particle took!

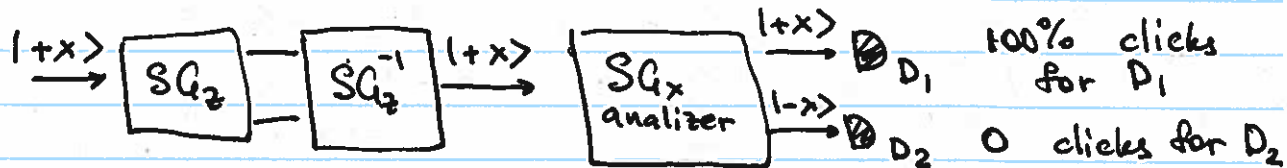
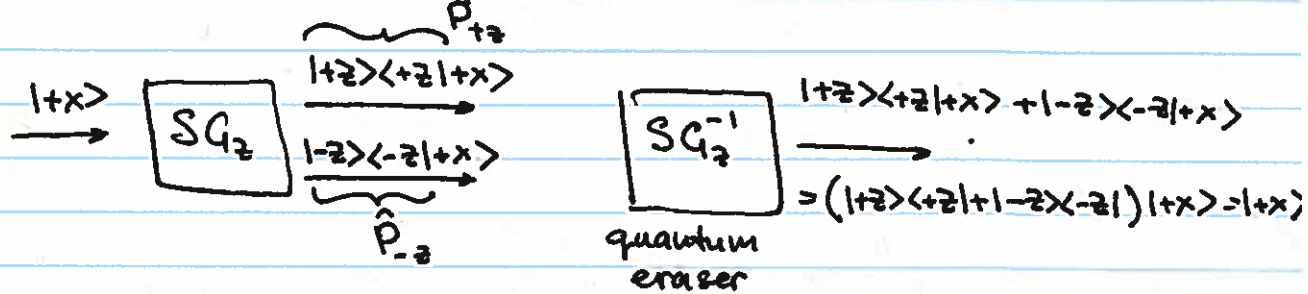


or



So at the end 50% we'll detect $|+x\rangle$ and 50% - $|-x\rangle$

But what if we don't look?



The outcome is completely different!

If one obtains which-way information, that collapses the wave function, and changes the output state.

Note, that usually it is not necessary to gain the information about which path the particle took, if this information can be possibly obtained, the quantum interference will disappear!

Moreover, one can develop a clever scheme to "erase" the which-way information. In this case, it is possible to recover the quantum interference

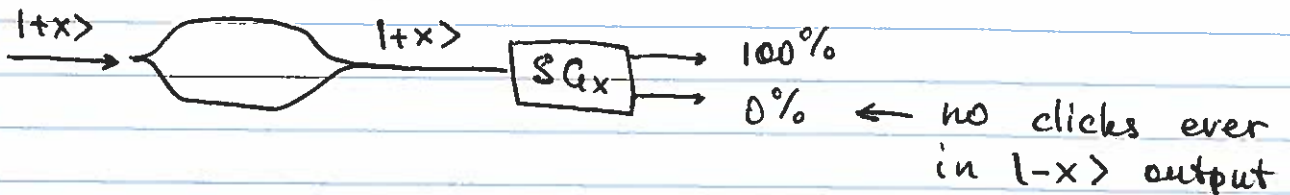
Spooky action on a distance

Can we detect something without being there?

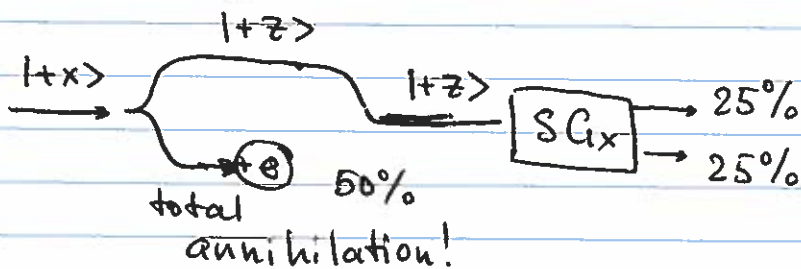
Imagine someone dropped a positron in one of the loop's path. Can we possibly notice with one measurement?

Not always, but actually yes!

No positron



With positron



So in 50% no \bar{e} emerges (positron is there, but it is too late)

In 25% the \bar{e} emerges from $|+x\rangle$ - no useful information

BUT

In 25% the \bar{e} emerges from $| -x \rangle$ - we detected $+e$ without even getting close!