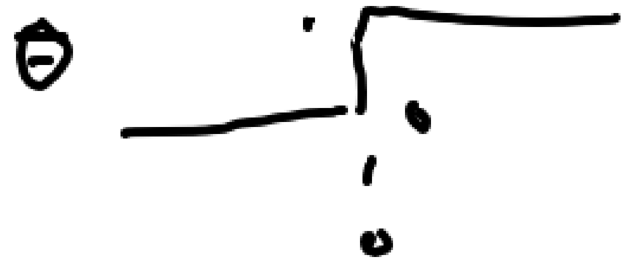
$$H_I = \epsilon\, \delta(t)\, S p$$

$P, q \Rightarrow q$ = pointer variable



$$H(p,q) = 0$$

$$U = e^{-i \epsilon S p\, \Theta(t)}$$

$e^{-i\alpha p} \longrightarrow$ Displacement op of q.

$$e^{-i\alpha p}|q\rangle \longrightarrow |q+\alpha\rangle$$

$$\int \phi(q)|q\rangle\, dq \longrightarrow \int \phi(q-\alpha)|q\rangle\, dq$$

$$\dot{Q} = -\epsilon S\, \delta(t)$$

$$\underline{\phi(q)|\zeta\rangle} \implies \underline{\phi(q-\epsilon s)|\zeta\rangle}$$

$$= \sum \phi(q-\epsilon s)\langle s|\zeta\rangle|s\rangle$$

Amp for final meas. $|x\rangle$

$\langle x|\phi(q-\epsilon s)|\zeta\rangle$ - Ampl for finding q.

$$P = \frac{\langle x|\phi(q-\epsilon s)|\zeta\rangle}{\int|\langle x|\phi(q-s)|\zeta\rangle|^2 dq}$$

If $\phi(q - \epsilon S)$ is well approx by Taylor series.

$$\phi \approx \phi(q) - \epsilon S \partial_q \phi(q)$$

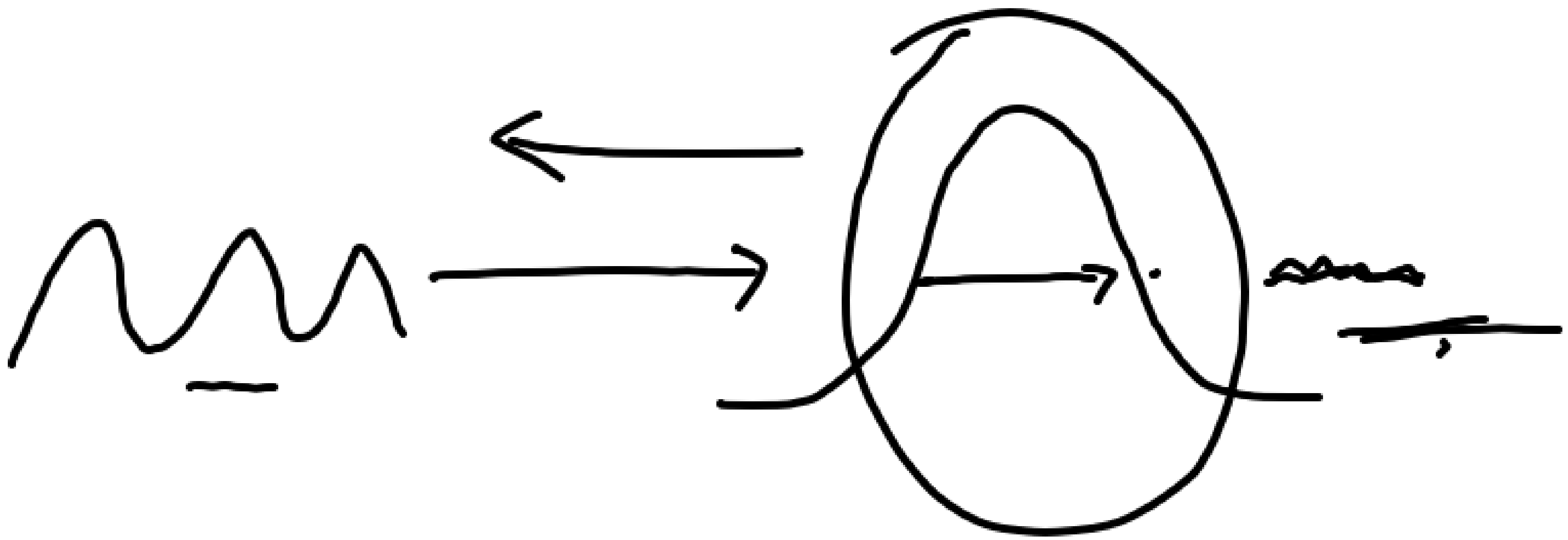
$$\langle x|\, \phi(q) \,|\xi\rangle - \epsilon \langle x| \partial_q \phi(q)\, S \,|\xi\rangle$$

$$\approx \langle k|\xi\rangle \left[\phi(q) - \epsilon \boxed{\frac{\langle k|S|\xi\rangle}{\langle k|\xi\rangle}} \partial_q \phi(q)\right]$$

$$\approx \boxed{\langle k|\xi\rangle} \left[\phi\left(q - \epsilon \overbrace{\frac{\langle k|S|\xi\rangle}{\langle k|\xi\rangle}}^{\text{weak value}}\right)\right]$$

weak value can be $\gg$ the max s

weak value can be <u>complex</u>



$$e^{-i(E(t))}$$

$$= e^{-iE\tau_R} - E\tau_I$$

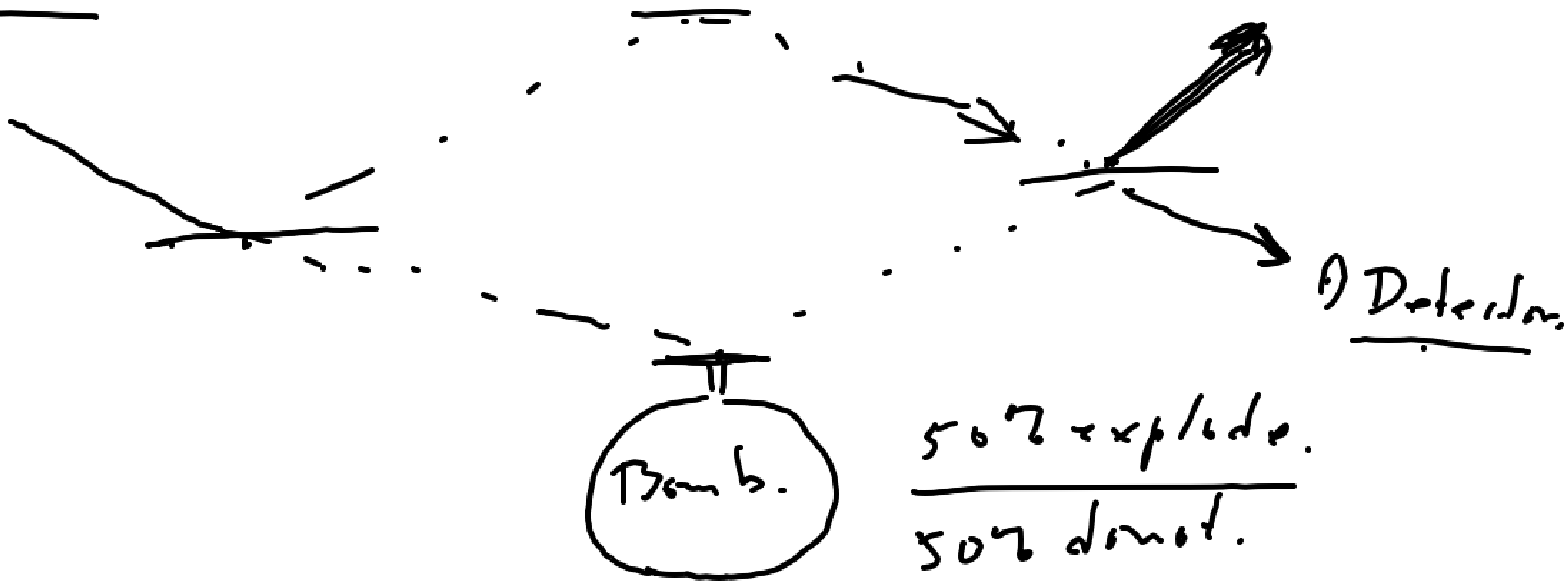
Damping

Cost: Prob of getting final result is small

Interaction free meas

or Vaidman bomb.

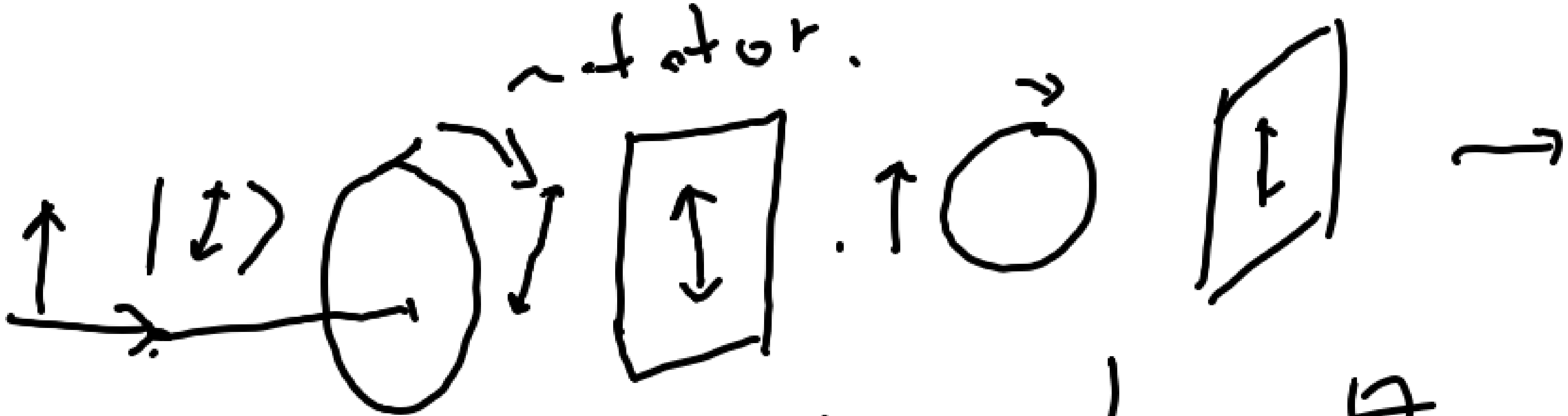
Dicke → Elizer Vaidman.



50% explode.

50% donot.

?



rotates polsn by $\underline{\theta}$

material in which the 2 circ. polsm. have diff velocities

$|\updownarrow\rangle \;,\; |\leftrightarrow\rangle$

$|\uparrow\rangle \longrightarrow \cos\theta\,|\updownarrow\rangle + \sin\theta\,|\leftrightarrow\rangle$

Absorb $|\leftrightarrow\rangle \longrightarrow \cos\theta\,|\updownarrow\rangle$

$\cos^2|\updownarrow\rangle$

If polarizer were not there each rotator would rotate polsn by θ after N rotns

No θ chosen - $\theta = \frac{\pi}{2N}$

After N rotns $\rightarrow$ angle $\frac{\pi}{2}$ $\leftrightarrow$

If pols. in place. output would b 0 $\updownarrow$

What is prob. that any photon survives this obstacle course?

Prob of absorption is.

$$(\sin\theta)^2 = \left(\sin\frac{\pi}{2N}\right)^2 \simeq \frac{\pi^2}{4N^2}$$

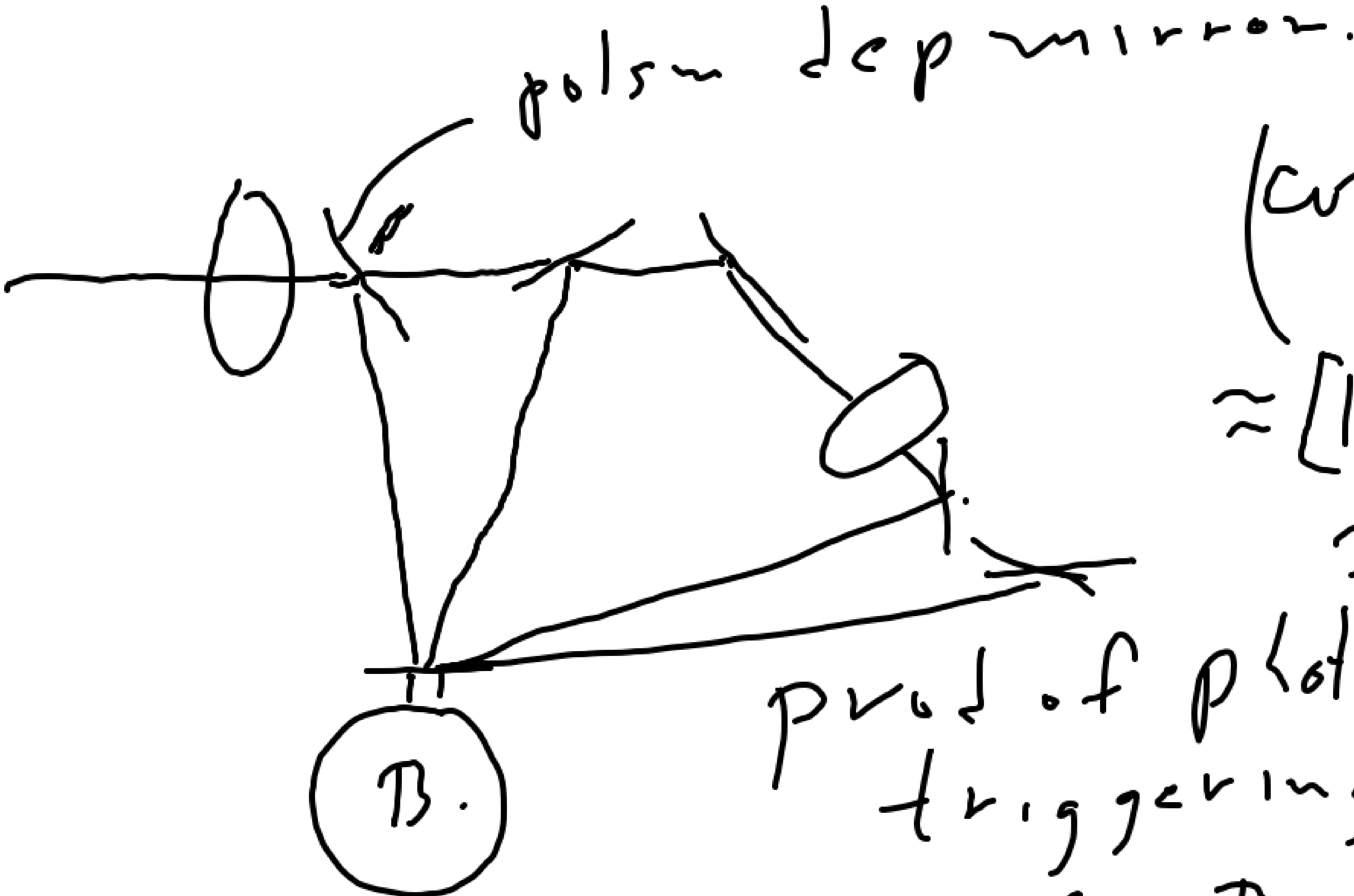
Prob of absorbing photon is

$$\left(N \sin^2\frac{\pi}{2N}\right) \simeq \frac{\pi^2}{4N} \longrightarrow 0$$

as N large

output $\updownarrow$ or $\leftrightarrow$

Detected the polsm without interacting with them.



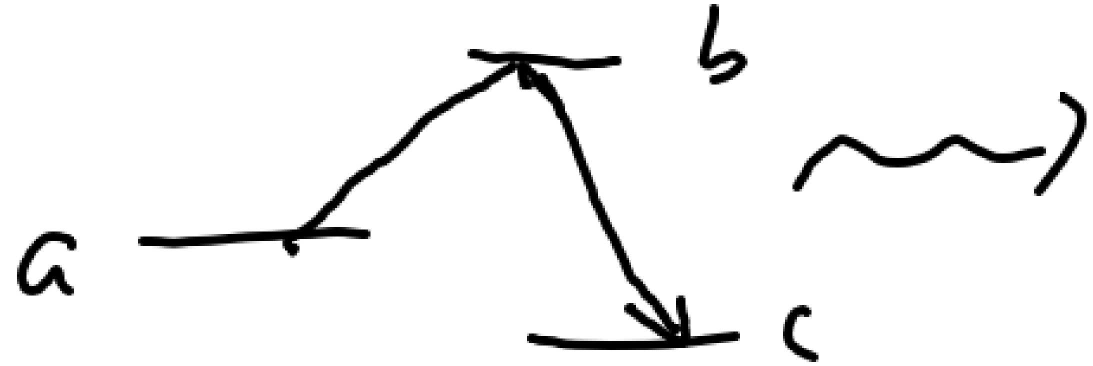
$$\left(\cos\frac{\pi}{2N}\right)^{2N}$$

$$\approx \left[1-\left(\frac{\pi}{2N}\right)\right]^{2N}$$

$$\approx \left(1-\frac{\pi^2}{4N}\right)$$

Prob of photon triggering bomb $\longrightarrow 0$. But prob of detection of good bomb $\longrightarrow 1$

Atom.



Process could have exp applications

Zeno's effect

In Q.M. If you measure system often it does not change.

(Watched pot effect)

(In Q.M. A watched pot never boils.)