CARACTERIZACIÓN DE UN CANAL DE DESFASAMIENTO CUÁNTICO

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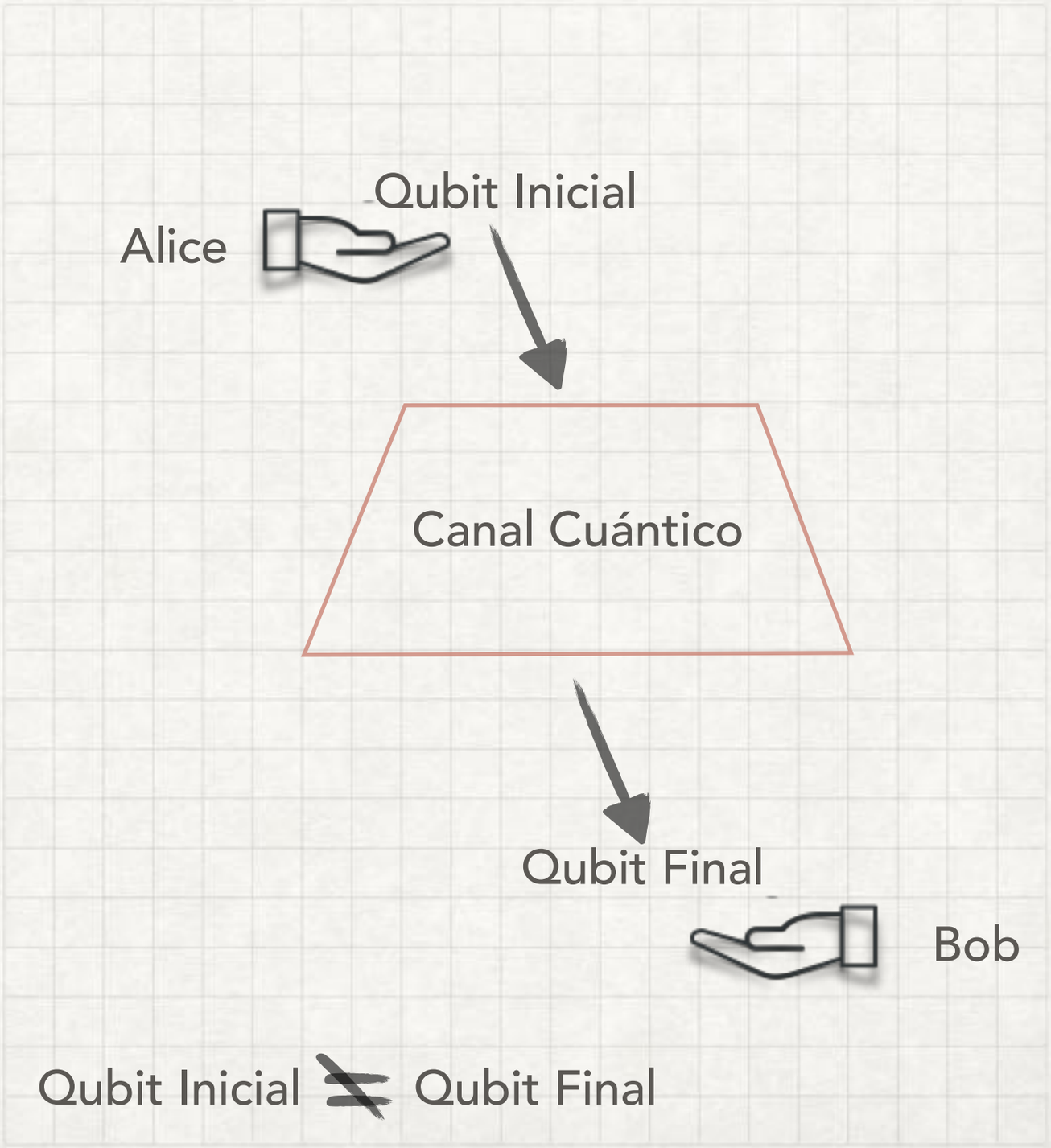
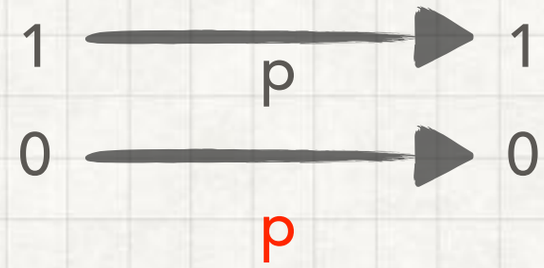
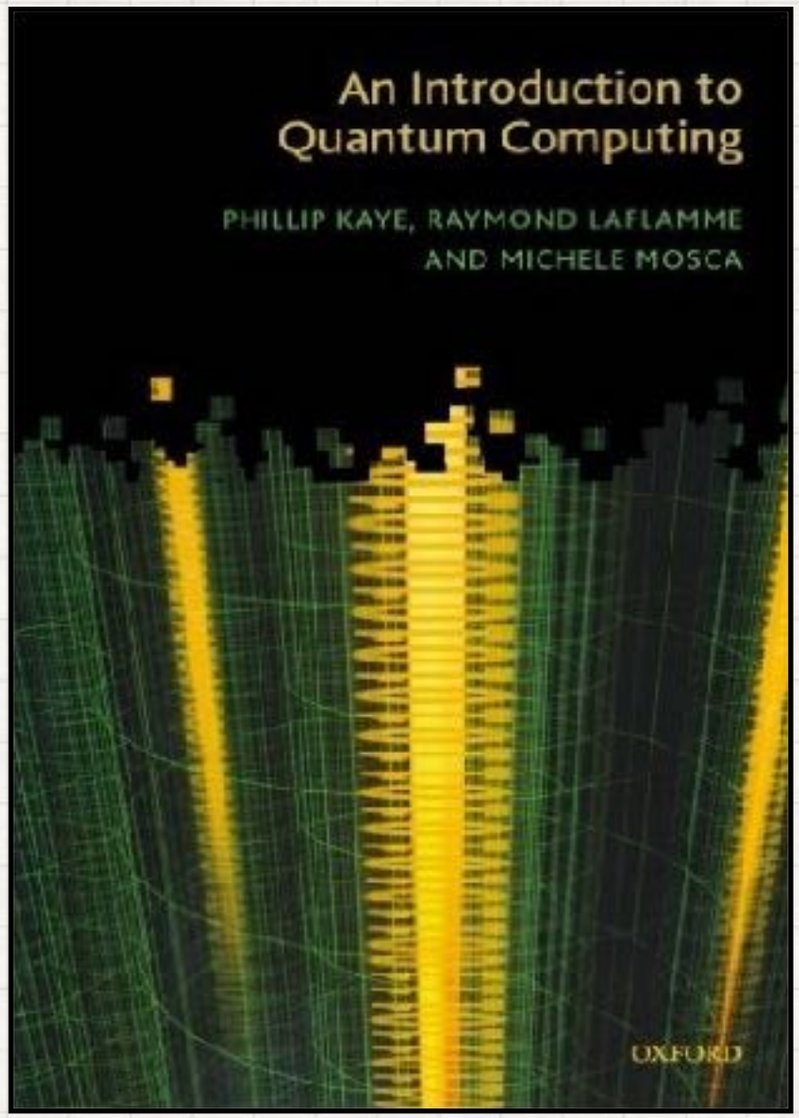


QUANTUM

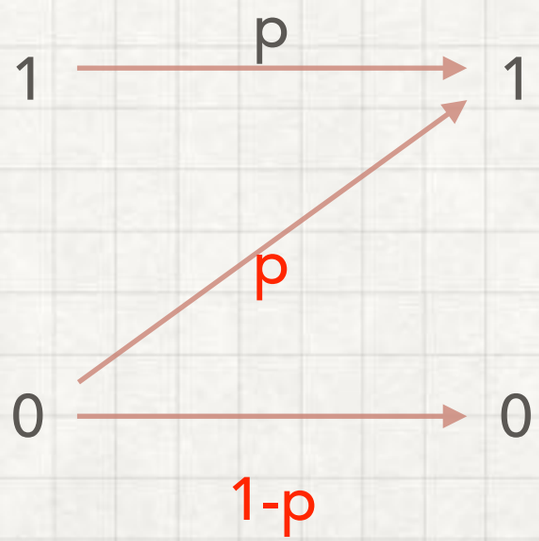
CHANNEL

"…being moved around from one point of the computer to another, it is often called a channel. Ideally, we would like the state of our bits to be unaffected by the channel (i.e. we do not want a bit to change its value while it is in storage, or being moved from one place to another). We say that an *error-free channel* is an *identity channel.* "



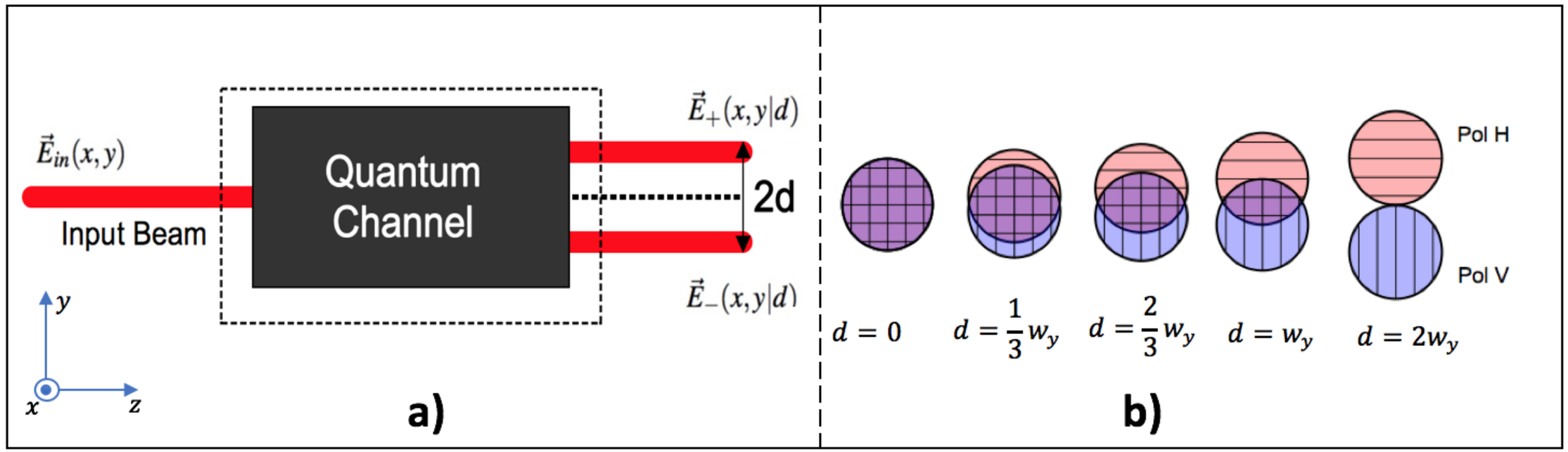


Channel with Noise



CHANNEL

CHANNEL



$$\vec{E}_{in}(x,y) = u(x,y)[\alpha\vec{H} + \beta\vec{V}] \longrightarrow \vec{E}_{out}(x,y|d) = E_H\vec{H} + E_V e^{i\pi}\vec{V}$$

$$E_H = \alpha u(x, y+d)$$

$$E_V = \beta u(x, y-d)$$

$U(x,y)$ = spatial distribution

$\vec{H}$ and $\vec{V}$ = horizontal and vertical polarizations

α_0 and β_0 = polarization probability amplitudes

TRANSVERSE MOMENTUM

transverse momentum distribution

$$\tilde{u}(q_y) = \tilde{u}_0 e^{-\frac{(q_y - q_{0y})^2}{4\sigma_y^2}}$$

Using

$$u(x,y) = u(y) = \int dq_y \, \tilde{u}(q_y) e^{-iq_y y}$$

the spatial distribution is written

$$u(y) = u_0 e^{-\frac{y^2}{4w_y^2}}$$

STOKES PARAMETERS

Definitions

$$
\begin{aligned}
S_0 &= \int (E_H E_H^* + E_V E_V^*)\, dxdy \\
S_1 &= \int (E_H E_H^* - E_V E_V^*)\, dxdy \\
S_2 &= Re(\int E_H E_V^*\, dxdy) \\
S_3 &= Im(\int E_H E_V^*\, dxdy),
\end{aligned}
$$

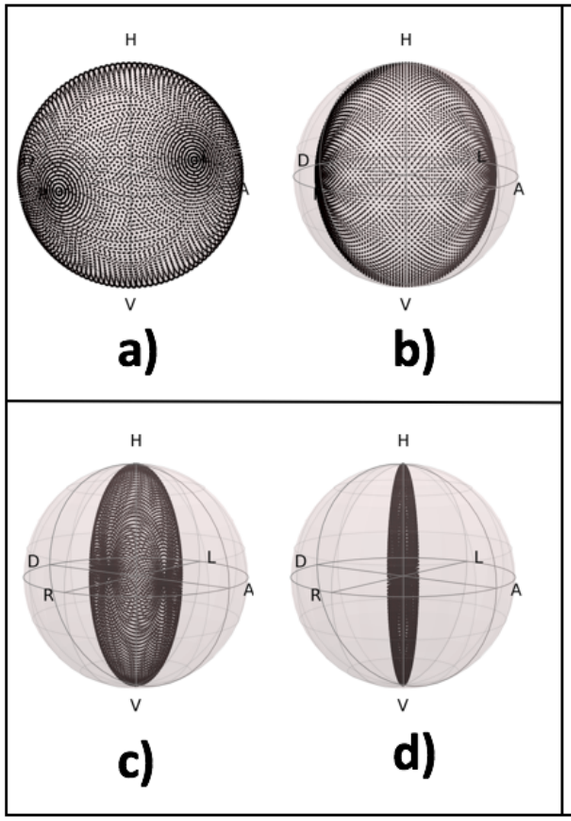
$$
P = \sqrt{S_1^2 + S_2^2 + S_3^2}
$$

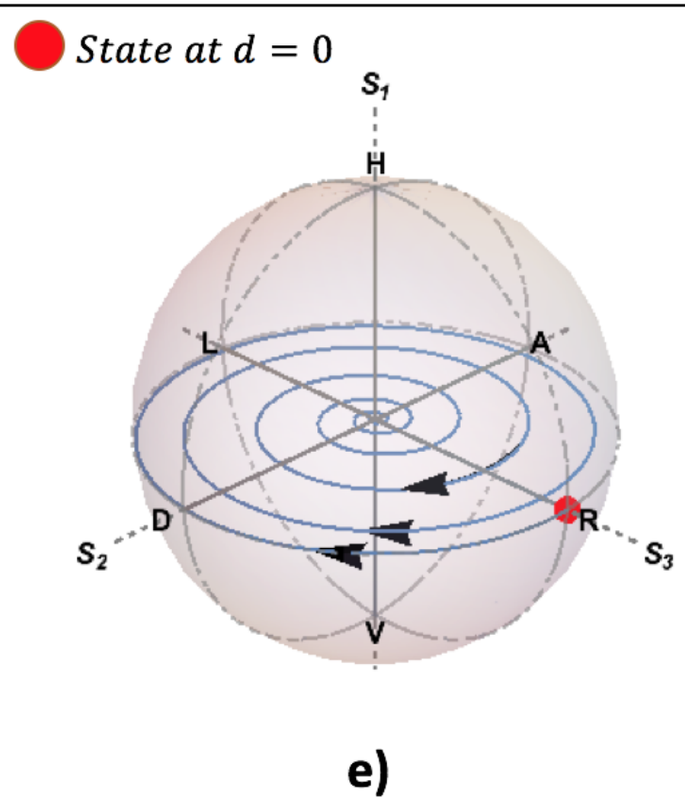
Expectation

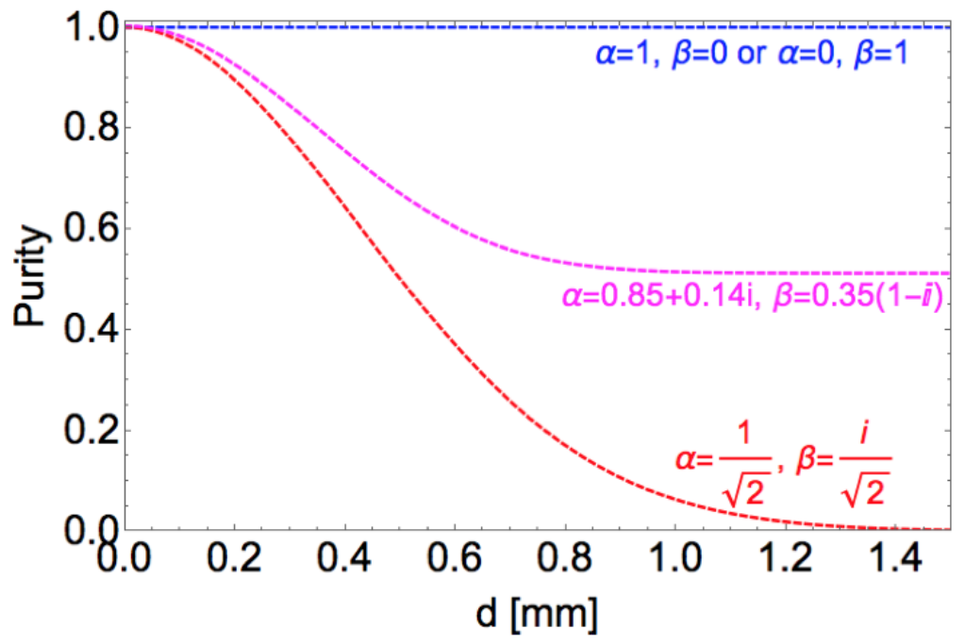
$$
\begin{aligned}
S_0 &= |u_0|^2(|\alpha|^2 + |\beta|^2), \\
S_1 &= |u_0|^2(|\alpha|^2 - |\beta|^2), \\
S_2(d) &= 2|u_0|^2|\alpha\beta^*| e^{-\frac{2d^2}{w_y^2}} \cos(q_{0y}d + \varphi), \\
S_3(d) &= 2|u_0|^2|\alpha\beta^*| e^{-\frac{2d^2}{w_y^2}} \sin(q_{0y}d + \varphi).
\end{aligned}
$$

$$
P(d) = \sqrt{(|\alpha|^2 - |\beta|^2)^2 + 4|\alpha\beta^*|^2 e^{-\frac{4d^2}{w^2}}}
$$

EXPECTED RESULT

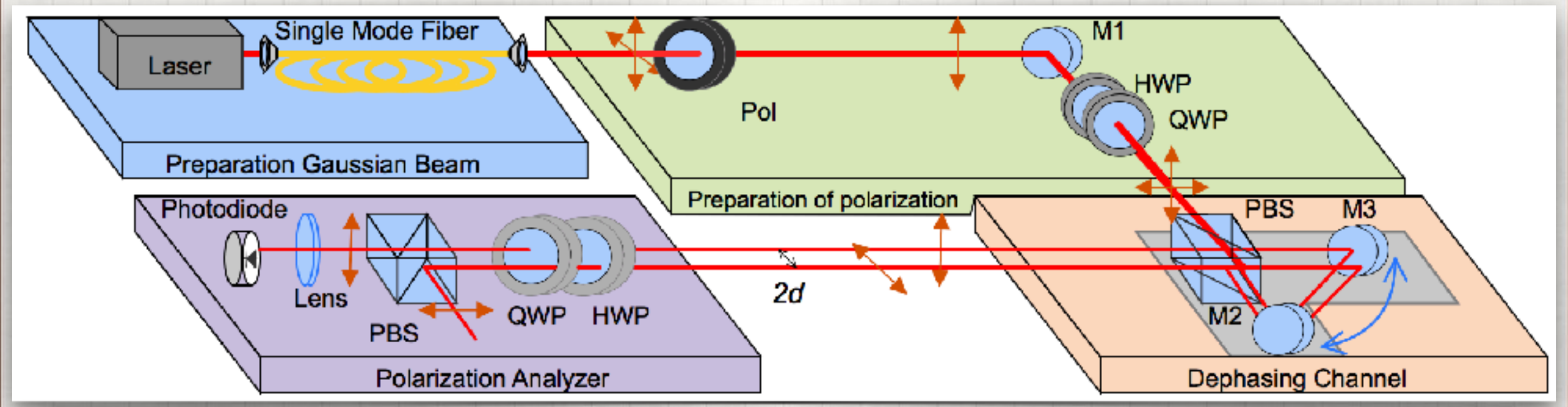






EXPERIMENT

SETUP

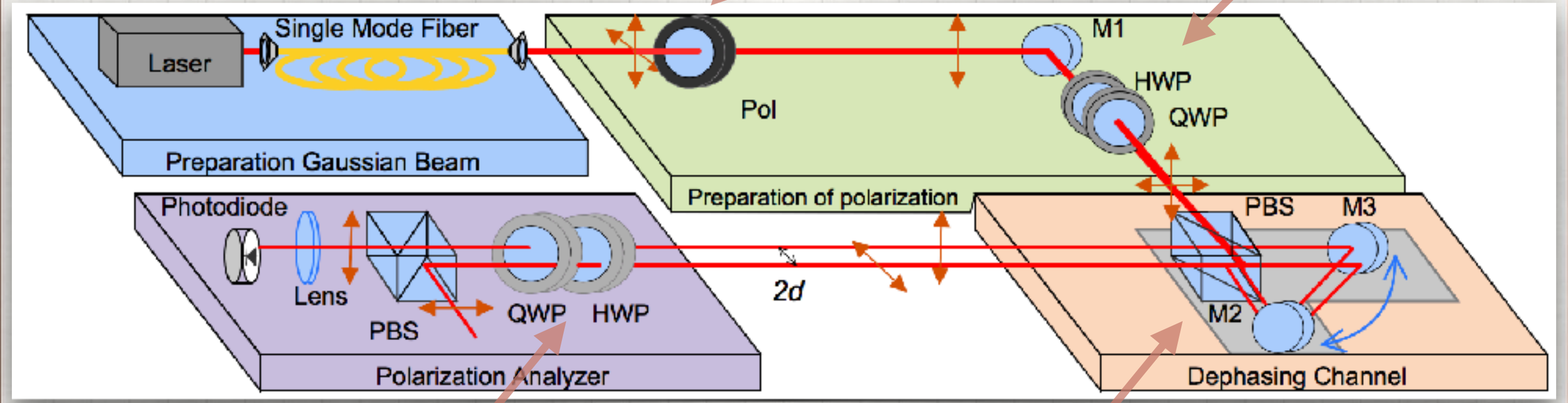


M# Espejos
Pol Polarizador
QWP Quarter Wave Plate
HWP Half Wave Plate
PBS Divisor de haces polarizados

SETUP

Vertical

4 States

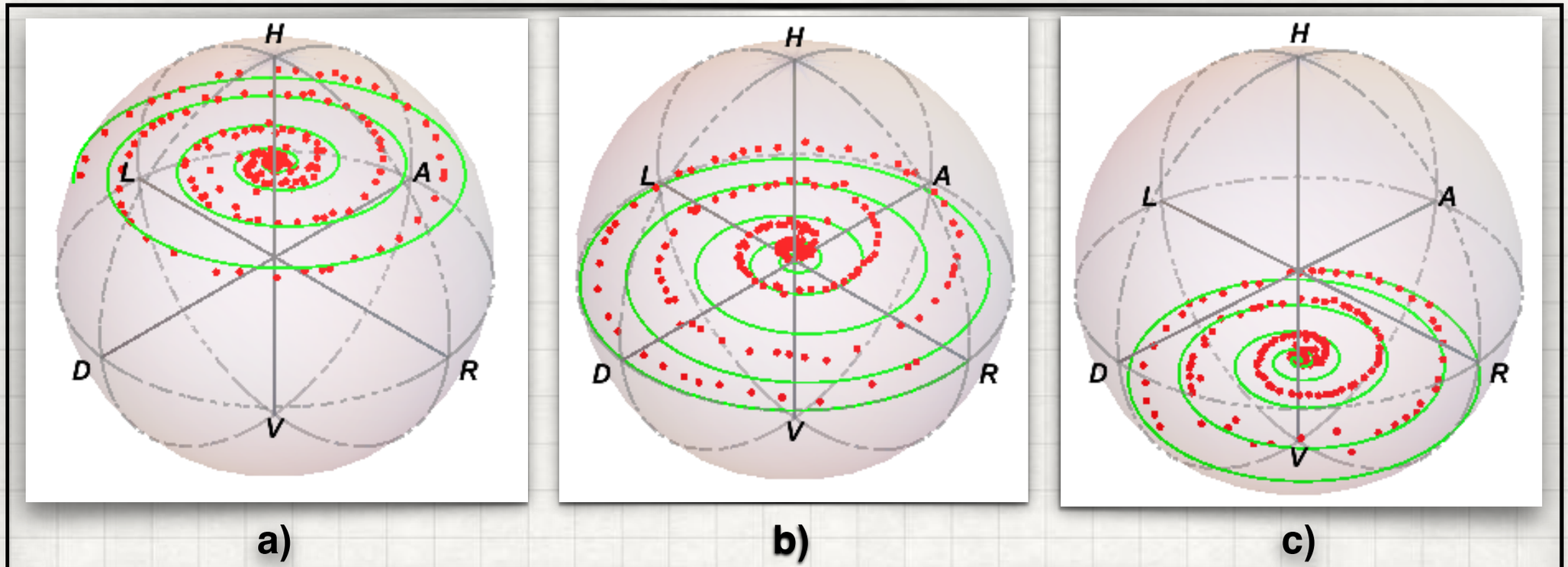


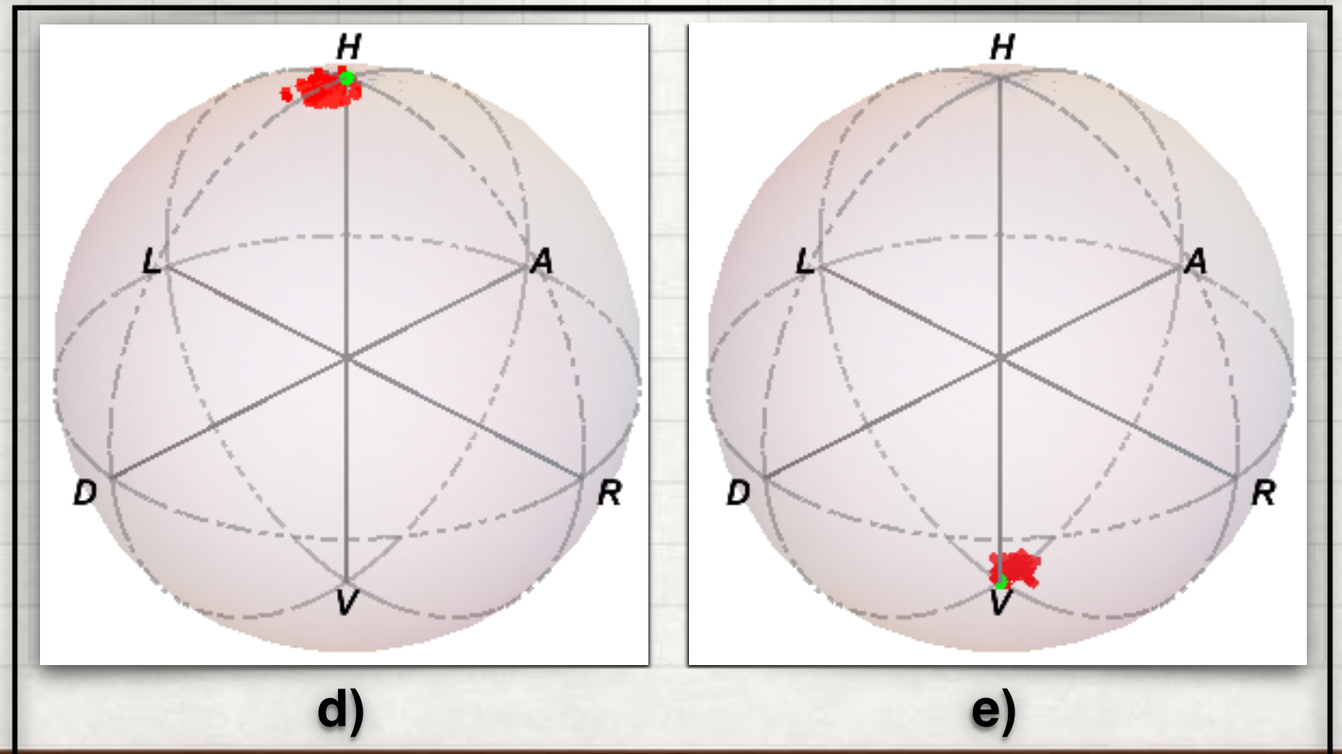
6 project measurement

Range [0,4mm]

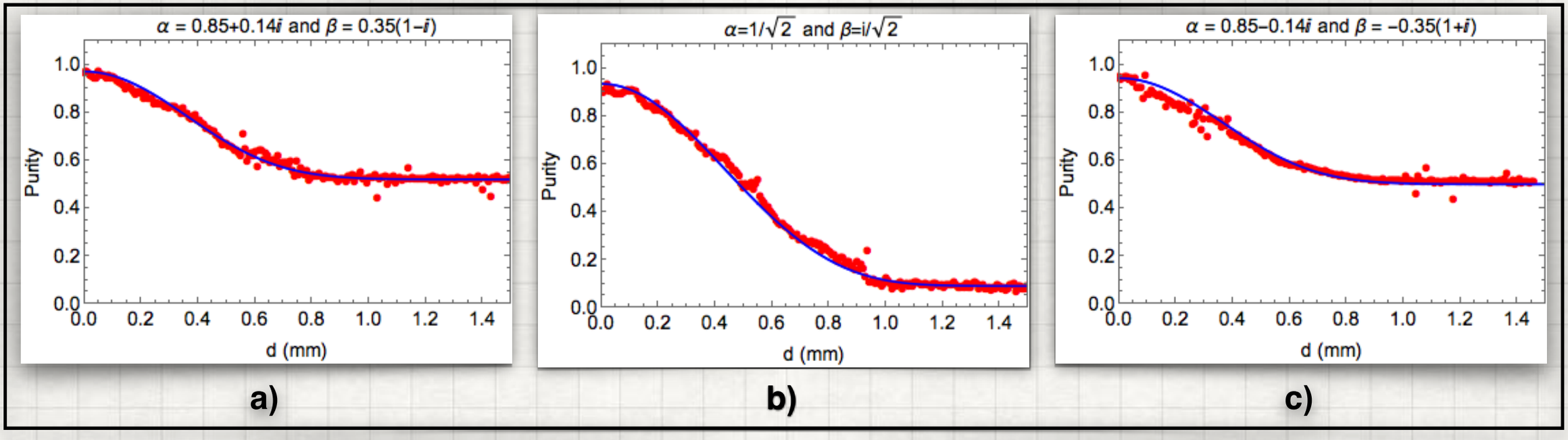
RESULTS

RESULTADOS





RESULTADOS


α = 0.85+0.14i and β = 0.35(1−i)
Purity
d (mm)
a)
α=1/√2 and β=i/√2
Purity
d (mm)
b)
α = 0.85−0.14i and β = −0.35(1+i)
Purity
d (mm)
c)
α = 1 and β = 0
Purity
d (mm)
d)
α = 0 and β = 1
Purity
d (mm)
e)

CONCLUSIONS

CONCLUSIONS

- Quantum Channel: **Dephasing Quantum channel**

- The previous observations can be interpreted in terms of indistinguishability between the two beams that leave from our channel. When the two beams are completely overlapped, d = 0, it is impossible to know the polarization of the beams by observing the position of its corresponding centroid. As result, the state obtained is pure. On the other hand, when d increases and the overlapping of the spatial distribution of the beams decreases and it is possible to distinguish the polarization of the beams by observing the position of its centroids. in this case, a mixed state is obtained

THANKS