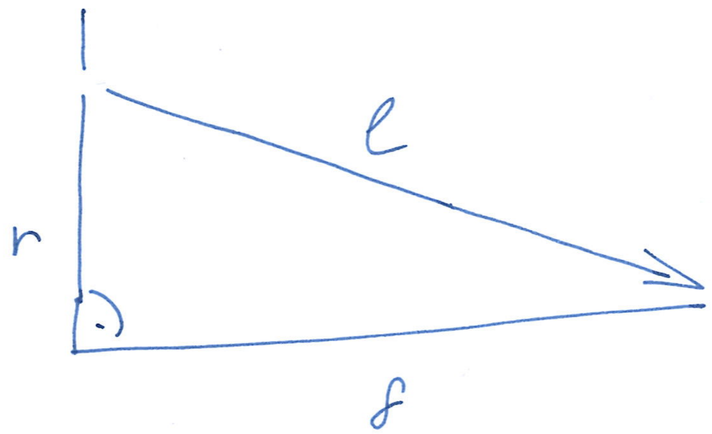
$\langle 1 \rangle$

Fresnelova zonální destička



$$l^2 = r^2 + f^2 \Rightarrow l = \sqrt{r^2+f^2}$$

$$l - f = n\lambda$$ (konstr. interf.)

$$\sqrt{r^2+f^2} = n\lambda + f$$

$$r^2 + \cancel{f^2} = n^2\lambda^2 + 2n\lambda f + \cancel{f^2}$$

$$r = \sqrt{n^2\lambda^2 + 2n\lambda f}$$

nízké řády: $r \simeq \sqrt{2n\lambda f}$ $\quad (2\lambda f \gg \lambda^2)$

polarizace – geom. fáze

báze $|V\rangle = \begin{pmatrix} 1 \\ 0 \end{pmatrix}$, $|H\rangle = \begin{pmatrix} 0 \\ 1 \end{pmatrix}$

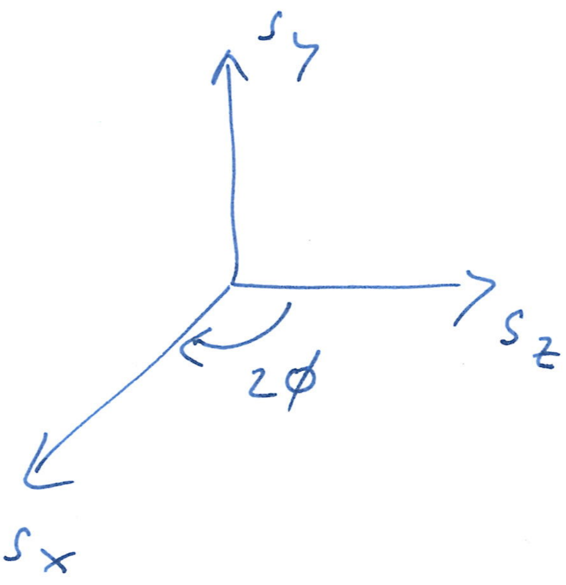
$$|\psi\rangle = \alpha \begin{pmatrix} 1 \\ 0 \end{pmatrix} + \beta \begin{pmatrix} 0 \\ 1 \end{pmatrix} = \begin{pmatrix} \alpha \\ \beta \end{pmatrix}$$

$$\| |\psi\rangle \| = \langle \psi | \psi \rangle = (\alpha^* \ \beta^*) \begin{pmatrix} \alpha \\ \beta \end{pmatrix} = |\alpha|^2 + |\beta|^2 = 1$$

$$\rho = |\psi\rangle\langle\psi| = \begin{pmatrix} \alpha \\ \beta \end{pmatrix} (\alpha^* \ \beta^*) = \begin{pmatrix} |\alpha|^2 & \alpha\beta^* \\ \alpha^*\beta & |\beta|^2 \end{pmatrix}$$

$$\rho = \frac{s_0}{2} \begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix} + \frac{s_x}{2} \begin{pmatrix} 0 & 1 \\ 1 & 0 \end{pmatrix} + \frac{s_y}{2} \begin{pmatrix} 0 & -i \\ i & 0 \end{pmatrix} + \frac{s_z}{2} \begin{pmatrix} 1 & 0 \\ 0 & -1 \end{pmatrix}$$

$$\rho = \frac{1}{2} \begin{pmatrix} s_0 + s_z & s_x - i s_y \\ s_x + i s_y & s_0 - s_z \end{pmatrix}$$



$\mathrm{Tr}\rho = 1 \Rightarrow s_0 = 1$

spec. případy

$$|V\rangle = \begin{pmatrix} 1 \\ 0 \end{pmatrix}, \quad |H\rangle = \begin{pmatrix} 0 \\ 1 \end{pmatrix}, \quad \rho_V = \begin{pmatrix} 1 & 0 \\ 0 & 0 \end{pmatrix}$$

$$\vec{S}_V = (0, 0, 1)$$

$$|R\rangle = \frac{1}{\sqrt{2}} \begin{pmatrix} 1 \\ i \end{pmatrix}, \quad |L\rangle = \frac{1}{\sqrt{2}} \begin{pmatrix} 1 \\ -i \end{pmatrix}, \quad \rho_R = \frac{1}{2} \begin{pmatrix} 1 & -i \\ i & 1 \end{pmatrix}$$

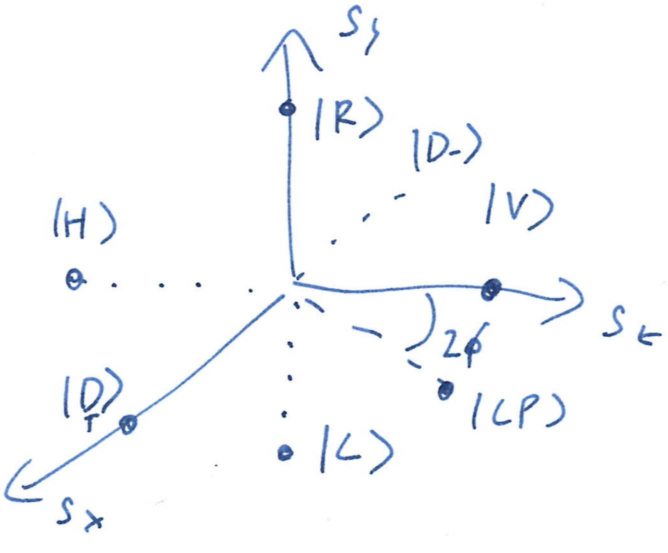
$$\vec{S}_R = (0, 1, 0)$$

$$|D_+\rangle = \frac{1}{\sqrt{2}} \begin{pmatrix} 1 \\ 1 \end{pmatrix}, \quad |D_-\rangle = \frac{1}{\sqrt{2}} \begin{pmatrix} 1 \\ -1 \end{pmatrix}, \quad \rho_{D_+} = \frac{1}{2} \begin{pmatrix} 1 & 1 \\ 1 & 1 \end{pmatrix}$$

$$\vec{S}_{D_+} = (1, 0, 0)$$

$$|LP\rangle = \begin{pmatrix} \cos\phi \\ \sin\phi \end{pmatrix}, \quad \rho_{LP} = \begin{pmatrix} \cos^2\phi & \cos\phi\sin\phi \\ \cos\phi\sin\phi & \sin^2\phi \end{pmatrix}$$

$$\vec{S}_{LP} = (\sin 2\phi, 0, \cos 2\phi)$$



kompenzátor

$$C_\varphi |e_1\rangle = |e_1\rangle$$

$$C_\varphi |e_2\rangle = e^{i\varphi} |e_2\rangle$$

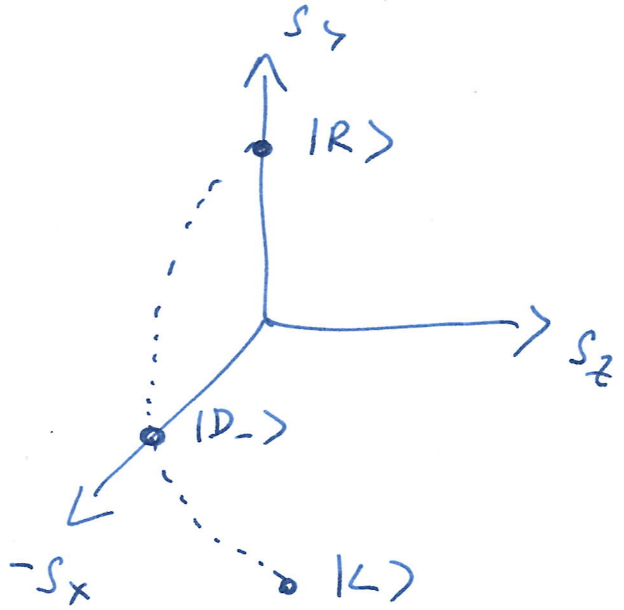
$$\langle e_1 | e_2 \rangle = 0$$

① HV

$$\left.\begin{aligned} |V\rangle &\to |V\rangle \\ |H\rangle &\to e^{i\varphi}|H\rangle \end{aligned}\right\} C_\varphi = \begin{pmatrix} 1 & 0 \\ 0 & e^{i\varphi} \end{pmatrix}$$

$$C_{\frac{\pi}{2}} |R\rangle = \frac{1}{\sqrt{2}} \begin{pmatrix} 1 & 0 \\ 0 & i \end{pmatrix} \begin{pmatrix} 1 \\ i \end{pmatrix} = \frac{1}{\sqrt{2}} \begin{pmatrix} 1 \\ -1 \end{pmatrix} = |D_-\rangle$$

$$C_\pi |R\rangle = \frac{1}{\sqrt{2}} \begin{pmatrix} 1 & 0 \\ 0 & -1 \end{pmatrix} \begin{pmatrix} 1 \\ i \end{pmatrix} = \frac{1}{\sqrt{2}} \begin{pmatrix} 1 \\ -i \end{pmatrix} = |L\rangle$$



② $D_+ D_-$

$$C'_\varphi \begin{pmatrix} 1 \\ 1 \end{pmatrix} = \begin{pmatrix} 1 \\ 1 \end{pmatrix}$$

$$C'_\varphi \begin{pmatrix} 1 \\ -1 \end{pmatrix} = e^{i\varphi} \begin{pmatrix} 1 \\ -1 \end{pmatrix}$$

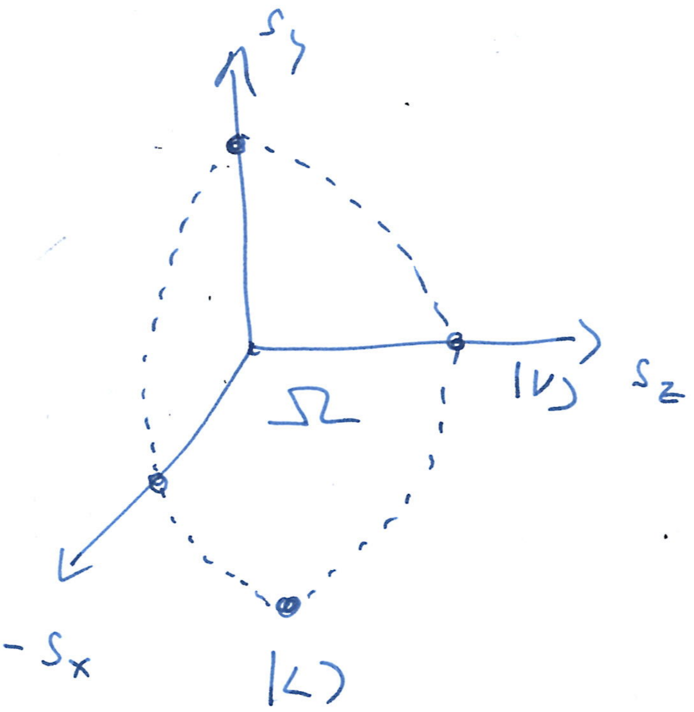
$$C'_\varphi = \frac{1}{2} \begin{pmatrix} 1+e^{i\varphi} & 1-e^{i\varphi} \\ 1-e^{i\varphi} & 1+e^{i\varphi} \end{pmatrix}$$

$$C'_{\frac{\pi}{2}} |R\rangle = e^{i\frac{\pi}{4}} |V\rangle$$

$$C'_\pi = \begin{pmatrix} 0 & 1 \\ 1 & 0 \end{pmatrix}$$

$$C'_\pi |R\rangle = \frac{1}{\sqrt{2}} \begin{pmatrix} 0 & 1 \\ 1 & 0 \end{pmatrix} \begin{pmatrix} 1 \\ i \end{pmatrix} = \frac{1}{\sqrt{2}} \begin{pmatrix} i \\ 1 \end{pmatrix} = i |L\rangle$$

$e^{i\frac{\pi}{2}}$ geom.-ische



konjugace fáze

$P \sim E^3$ (kerrovské prostředí)

$E = E_1 + E_2 + E_3$

$E_j = A_j(\vec{r})\, e^{i(\omega_j t + \vec{k}_j \cdot \vec{r})} + c.c.$

$P \sim \underbrace{A_1 A_2 A_3^*}_{A}\, e^{i(\omega t + \vec{k} \cdot \vec{r})} + \dots$

$\omega = \omega_1 + \omega_2 - \omega_3$, $\vec{k} = \vec{k}_1 + \vec{k}_2 - \vec{k}_3$

$\vec{k}_1 = -\vec{k}_2 \Rightarrow \vec{k} = -\vec{k}_3$ (odraz)

$A_1 A_2 \sim 1$

$\Downarrow$

$A \sim A_3^*$ (konjugace)

např. $\frac{e^{ikr}}{r} \rightarrow \frac{e^{-ikr}}{r}$ tj. konverg $\Leftrightarrow$ diverg