

Fixování fáze báze $|\vec{e}_z:+\rangle, |\vec{e}_z:-\rangle$

$$|\vec{e}_z:-\rangle = i \hat{U}_x |\vec{e}_z\rangle = \hat{G}[\vec{e}_z] |\vec{e}_z:+\rangle$$

$$\hat{U}_{20}[\vec{e}] = -\hat{1}$$

$$|\vec{e}_z:+\rangle = i \hat{U}_x |\vec{e}_z\rangle = \hat{G}[\vec{e}_z] |\vec{e}_z:-\rangle$$

$$\textcircled{2} \quad \hat{G}[\vec{e}_z] = |\vec{e}_z+\rangle \langle \vec{e}_z+| - |\vec{e}_z-\rangle \langle \vec{e}_z-|$$

$$\hat{G}[\vec{e}_x] = ?$$

pomocí $|\vec{e}_z:\pm\rangle$

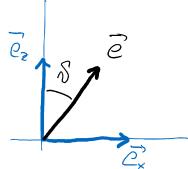
$$\hat{G}[\vec{e}_y] = ?$$

$$\hat{G}[\vec{e}_x] |\vec{e}_z+\rangle = |\vec{e}_z-\rangle \quad (\Rightarrow) \quad \hat{G}[\vec{e}_x] = |\vec{e}_z-\rangle \langle \vec{e}_z+| + |\vec{e}_z+\rangle \langle \vec{e}_z-|$$

$$\begin{aligned} \hat{G}[\vec{e}_y] &= \hat{G}[\vec{e}_z \times \vec{e}_x] = \frac{1}{2i} [\hat{G}[\vec{e}_z], \hat{G}[\vec{e}_x]] = \frac{1}{2i} \left((|\vec{e}_z+\rangle \langle \vec{e}_z+| - |\vec{e}_z-\rangle \langle \vec{e}_z-|)(|\vec{e}_z-\rangle \langle \vec{e}_z+| + |\vec{e}_z+\rangle \langle \vec{e}_z-|) \right. \\ &\quad \left. - (|\vec{e}_z-\rangle \langle \vec{e}_z+| + |\vec{e}_z+\rangle \langle \vec{e}_z-|)(|\vec{e}_z+\rangle \langle \vec{e}_z+| - |\vec{e}_z-\rangle \langle \vec{e}_z-|) \right) \\ &= -\frac{1}{2} \left(|\vec{e}_z+\rangle \langle \vec{e}_z-| - |\vec{e}_z-\rangle \langle \vec{e}_z+| - |\vec{e}_z-\rangle \langle \vec{e}_z+| + |\vec{e}_z+\rangle \langle \vec{e}_z-| \right) = \\ &= i |\vec{e}_z-1\rangle \langle \vec{e}_z+| - i |\vec{e}_z+\rangle \langle \vec{e}_z-| \end{aligned}$$

Fixování relativní fáze $|\vec{e}:+\rangle$

$$\vec{e} = \cos \delta \vec{e}_z + \sin \delta \vec{e}_x$$



$$|\vec{e}:+\rangle = \hat{U}_\delta[\vec{e}_z] |\vec{e}_z+\rangle = \text{vyjdešte} = \cos \frac{\delta}{2} |\vec{e}_z+\rangle + \sin \frac{\delta}{2} |\vec{e}_z-\rangle$$

$$\vec{e} = \cos \delta \vec{e}_z + \sin \delta (\cos \varphi \vec{e}_x + \sin \varphi \vec{e}_y)$$

$$|\vec{e}:+\rangle = e^{i\frac{\delta}{2}} \hat{U}_\varphi[\vec{e}_x] \hat{U}_\delta[\vec{e}_z] |\vec{e}_z+\rangle = \cos \frac{\delta}{2} |\vec{e}_z+\rangle + e^{i\varphi} \sin \frac{\delta}{2} |\vec{e}_z-\rangle = |4\rangle$$

ověřte, že

$$|4\rangle \langle 4| - \hat{1} = \hat{G}[\vec{e}] \quad (\text{svouj s předložím vicičný o vztahu } |\vec{e}+\rangle = \hat{G}[\vec{e}])$$

$$\begin{aligned} |4\rangle \langle 4| - \hat{1} &= 2 \left(\cos^2 \frac{\delta}{2} |\vec{e}_z+\rangle \langle \vec{e}_z+| + \sin^2 \frac{\delta}{2} |\vec{e}_z-\rangle \langle \vec{e}_z-| \right) - \hat{1} + 2 \cos \frac{\delta}{2} \sin \frac{\delta}{2} (e^{i\varphi} |\vec{e}_z-\rangle \langle \vec{e}_z+| + e^{-i\varphi} |\vec{e}_z+\rangle \langle \vec{e}_z-|) \\ &= \cos \delta (|\vec{e}_z+\rangle \langle \vec{e}_z+| - |\vec{e}_z-\rangle \langle \vec{e}_z-|) + \sin \delta (\cos \varphi (|\vec{e}_z-\rangle \langle \vec{e}_z+| + |\vec{e}_z+\rangle \langle \vec{e}_z-|) + \sin \varphi (i |\vec{e}_z-\rangle \langle \vec{e}_z+| - i |\vec{e}_z+\rangle \langle \vec{e}_z-|)) \\ &= \cos \delta \hat{G}[\vec{e}_z] + \sin \delta (\cos \varphi \hat{G}[\vec{e}_x] + \sin \varphi \hat{G}[\vec{e}_y]) = \\ &= \hat{G} \left[\cos \delta \vec{e}_z + \sin \delta (\cos \varphi \vec{e}_x + \sin \varphi \vec{e}_y) \right] = \hat{G}[\vec{e}] \end{aligned}$$

