非线性
三维全息

$$g_{3z}^{\pm} = A\cdot g_{10}^{\pm}\cdot g_{20}^{\pm}\cdot C\left(\boldsymbol{k}_3-\boldsymbol{k}_1-\boldsymbol{k}_2\right)$$

$g_{i0}^{\pm}=\delta\left(\boldsymbol{k}_{i\perp}\right),\ i=12$　双泵浦：平面波

$$\mathrm{d}\boldsymbol{k} := \boldsymbol{k}_1+\boldsymbol{k}_2+\boldsymbol{g}-\boldsymbol{k}_3=\boldsymbol{0}$$

$$\begin{cases} k_i^2=k_{ix}^2+k_{iy}^2+k_{iz}^2, & i=123 \\ k_{3j}=k_{1j}+k_{2j}+g_j, & j=\mathrm{xyz} \end{cases}$$

$A\left(k_{3z}\right)\to A\left(k_3\right)$　$\boldsymbol{k}$：完全匹配

量子
三维全息

$$g_{1z}^{\pm} = A\cdot g_{30}^{\pm}\cdot g_{20}^{\pm*}\cdot C\left(\boldsymbol{k}_3-\boldsymbol{k}_2-\boldsymbol{k}_1\right)$$

$g_{30}^{\pm}=\delta\left(\boldsymbol{k}_{3\perp}\right)$　单泵浦：平面波

$$\mathrm{d}\boldsymbol{k} := \boldsymbol{k}_3-\boldsymbol{k}_2-\boldsymbol{g}-\boldsymbol{k}_1=\boldsymbol{0}$$

$$\begin{cases} k_i^2=k_{ix}^2+k_{iy}^2+k_{iz}^2, & i=123 \\ k_{3j}=k_{1j}+k_{2j}+g_j, & j=\mathrm{xyz} \end{cases}$$

$A\left(k_{1z}\right)\to A\left(k_1\right)$　$\boldsymbol{k}$：完全匹配

非线性
角谱理论

$$g_{3z}^{\pm} = A\cdot\iiint C\cdot\left[\iint g_{10}^{\pm}\cdot g_{20}^{\pm}\cdot \mathrm{sinc}\left(\mathrm{d}k_z\frac{z}{2}\right)\cdot e^{i\,\mathrm{d}k_z\frac{z}{2}}\cdot \mathrm{d}\boldsymbol{k}_{1\perp}\right]\cdot\mathrm{d}\boldsymbol{g}$$

$$A=\chi_{\mathrm{eff}}\frac{k_{30}^2}{k_{3z}^2}\cdot i k_{3z}\frac{z}{2}$$

$$\mathrm{d}k_z := k_{1z}+k_{2z}+g_z-k_{3z}$$

$$k_{3j}=k_{1j}+k_{2j}+g_j,\quad j=\mathrm{xy}$$

$$\begin{cases} k_i^2=k_{ix}^2+k_{iy}^2+k_{iz}^2, & i=123 \\ k_{2j}=k_{3j}-k_{1j}-g_j, & j=\mathrm{xy} \end{cases}$$

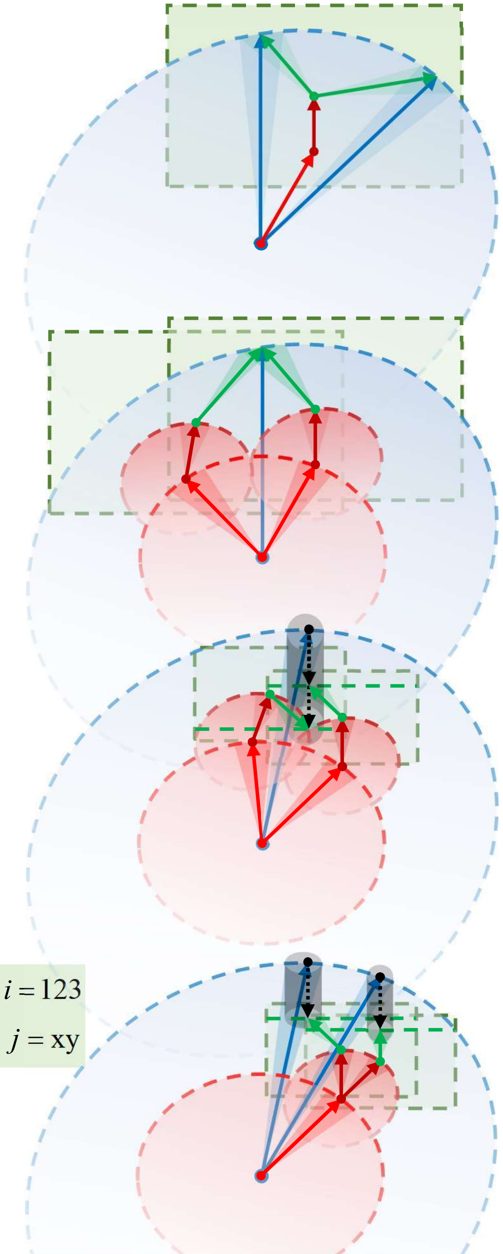
量子
NLAST

$$g_{1z}^{\pm} = A\cdot\iiint C\cdot\left[\iint g_{30}^{\pm}\cdot g_{20}^{\pm*}\cdot \mathrm{sinc}\left(\mathrm{d}k_z\frac{z}{2}\right)\cdot e^{i\,\mathrm{d}k_z\frac{z}{2}}\cdot \mathrm{d}\boldsymbol{k}_{3\perp}\right]\cdot\mathrm{d}\boldsymbol{g}$$

$$A=\chi_{\mathrm{eff}}\frac{k_{10}^2}{k_{1z}^2}\cdot i k_{1z}\frac{z}{2}$$

$$\mathrm{d}k_z := k_{3z}-k_{2z}-g_z-k_{1z}$$

$$k_{1j}=k_{3j}-k_{2j}-g_j,\quad j=\mathrm{xy}$$



$\int_z$ $2\mathrm{D}_\perp + 1\mathrm{D}_z$
$\int_z$ $3\mathrm{D}$
⬇
$2\mathrm{D}_\perp$

$\int_z$ $4\mathrm{D}_\perp + 1\mathrm{D}_z$
$\int_z$ $5\mathrm{D}$
⬇
$4\mathrm{D}_\perp$

$\int_z \iiiint_\perp$ $6\mathrm{D}_\perp + 1\mathrm{D}_z$
$\iiint\iint_\perp$ $4\mathrm{D}_\perp + 3\mathrm{D}$
⬇
$2\mathrm{D}_\perp$

$\int_z \iiiint_\perp$ $6\mathrm{D}_\perp + 1\mathrm{D}_z$
$\iiint\iint_\perp$ $4\mathrm{D}_\perp + 3\mathrm{D}$
⬇
$2\mathrm{D}_\perp$