

NLAST

几乎已能

99.99 %

SFG

完全理解

拉曼奈斯

NLAST

z 向非完美匹配时,
> 99.99 %

$$\mathcal{F}[E_3(x, y, z)] \approx \frac{\chi_{\text{eff}} \omega_3^2}{c^2} \cdot \sum_{l_z=-\infty}^{+\infty} C_{l_z} \cdot \left[\frac{\mathcal{F}[M_{\text{eff}}(x, y) \cdot E_1(\mathbf{r}) E_2(\mathbf{r})] \cdot e^{ig_{l_z} z} - \mathcal{F}[M_{\text{eff}}(x, y) \cdot E_{10} E_{20}] \cdot e^{ik_{3z} z}}{(\overline{k_{1z}} + \overline{k_{2z}} + g_{l_z})^2 - k_{3z}^2} \right]$$

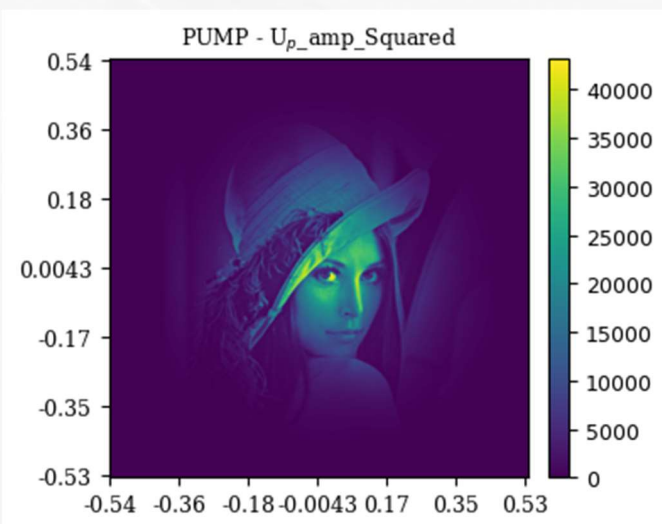
$$\left\{ \begin{array}{l} \overline{k_{1z}} = \sum_{k_{1x}, k_{1y}} \frac{\mathcal{F}[E_{10}]^2}{\sum_{k_{1x}, k_{1y}} \mathcal{F}[E_{10}]^2} k_{1z} \\ \overline{k_{2z}} = \sum_{k_{2x}, k_{2y}} \frac{\mathcal{F}[E_{20}]^2}{\sum_{k_{2x}, k_{2y}} \mathcal{F}[E_{20}]^2} k_{2z} \end{array} \right.$$

SFG

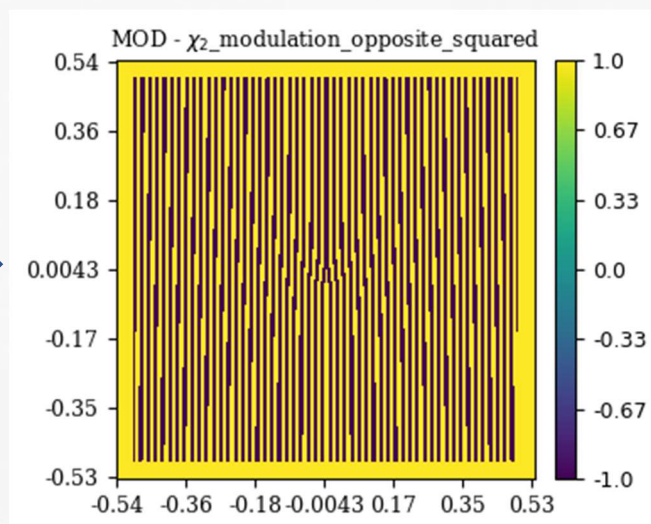
$$\mathcal{F}[E_3(x, y, z)] \approx \frac{\chi_{\text{eff}} \omega_3^2}{c^2} \cdot \sum_{l_z=-\infty}^{+\infty} C_{l_z} \cdot \left[\frac{\mathcal{F}[M_{\text{eff}}(x, y) \cdot E_1(\mathbf{r}) E_2(\mathbf{r})] \cdot e^{ig_{l_z} z} - \mathcal{F}[M_{\text{eff}}(x, y) \cdot E_{10} E_{20}] \cdot e^{ik_{3z} z}}{(\overline{k_{1z}} + \overline{k_{2z}} + g_{l_z})^2 - k_{3z}^2} \right]$$

新公式，无视 晶体长度，一步到位

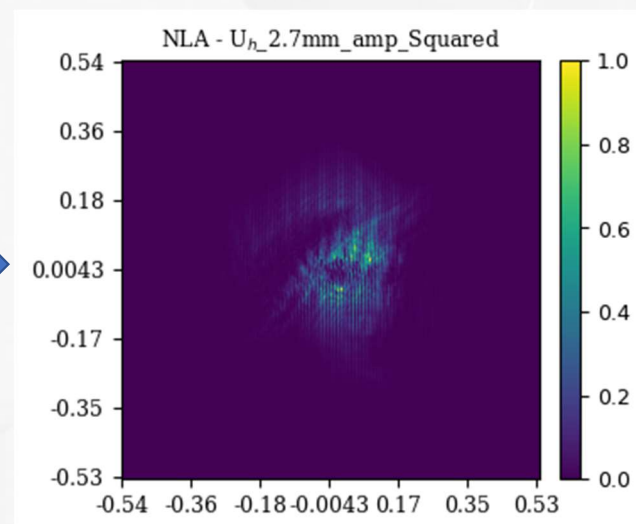
耗时 < 1 s



任一 泵浦



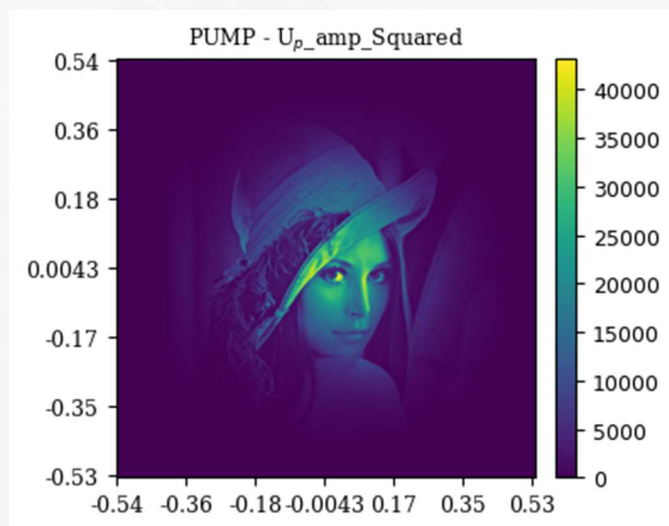
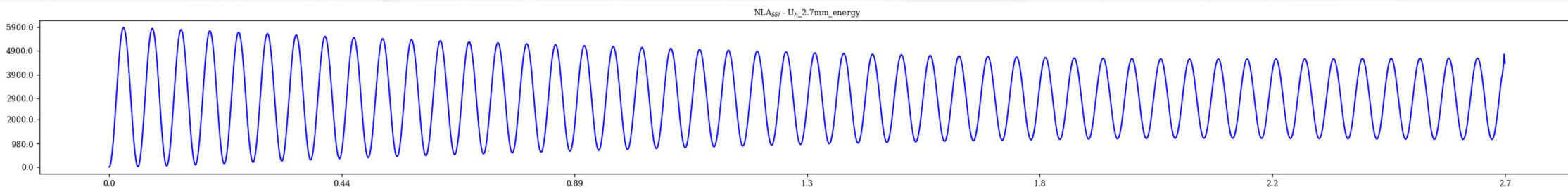
任一 调制



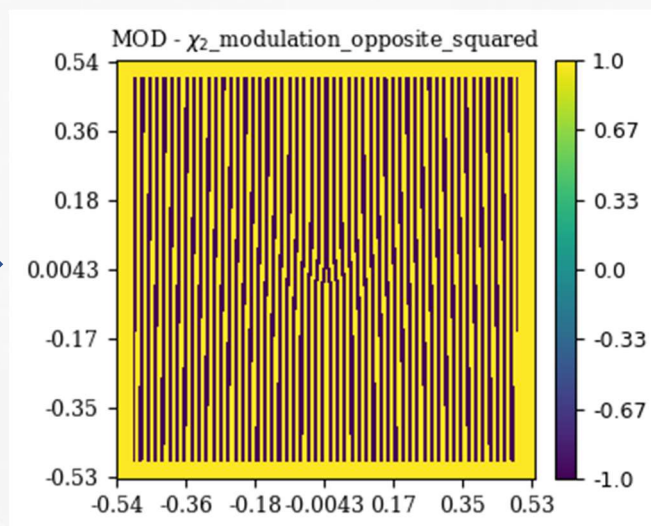
一步 输出

旧公式，只能迭代
一般耗时 > 100 s

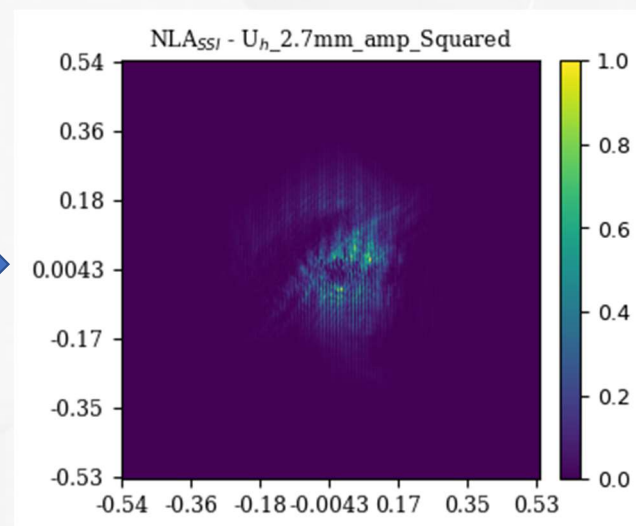
$$\mathcal{F}[E_3(x, y, z)] = \frac{\omega_3^2}{c^2} \cdot \frac{1 - e^{-ik_{3z}dz}}{k_{3z}^2} \cdot \sum_{j=1}^{z/dz} Q_{3,z-j \cdot dz} \cdot e^{ik_{3z} \cdot j \cdot dz}$$



任一泵浦

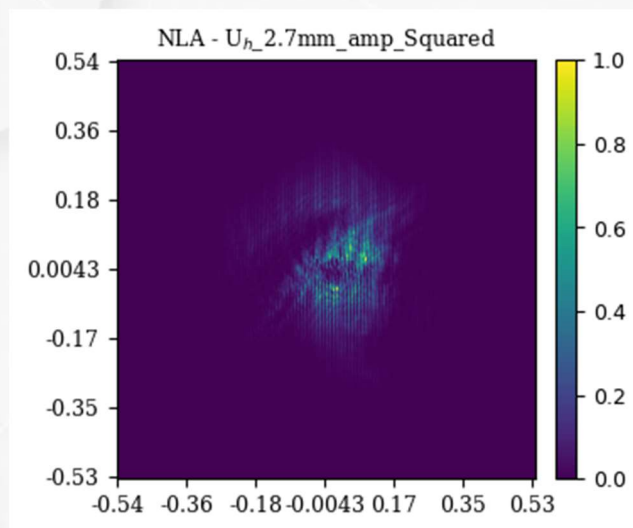


任一调制



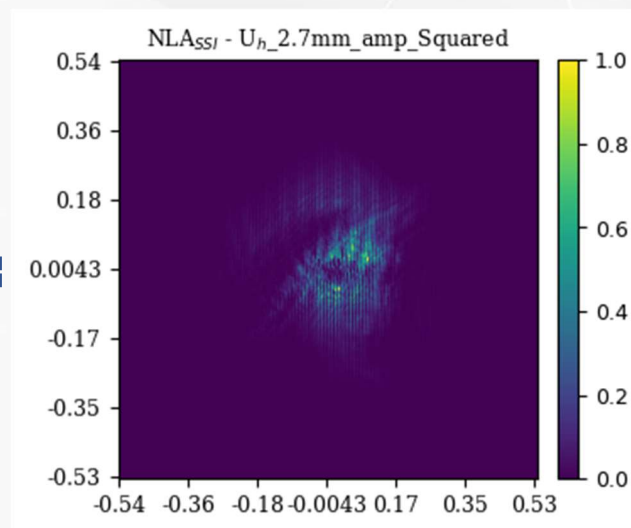
迭代输出

$$\mathcal{F}[E_3(x, y, z)] \approx \frac{\chi_{\text{eff}} \omega_3^2}{c^2} \cdot \sum_{l_z=-\infty}^{+\infty} C_{l_z} \cdot \left[\frac{\mathcal{F}[M_{\text{eff}}(x, y) \cdot E_1(\mathbf{r}) E_2(\mathbf{r})] \cdot e^{ig_{l_z} z} - \mathcal{F}[M_{\text{eff}}(x, y) \cdot E_{10} E_{20}] \cdot e^{ik_{3z} z}}{(\overline{k_{1z}} + \overline{k_{2z}} + g_{l_z})^2 - k_{3z}^2} \right]$$



一步 输出

=



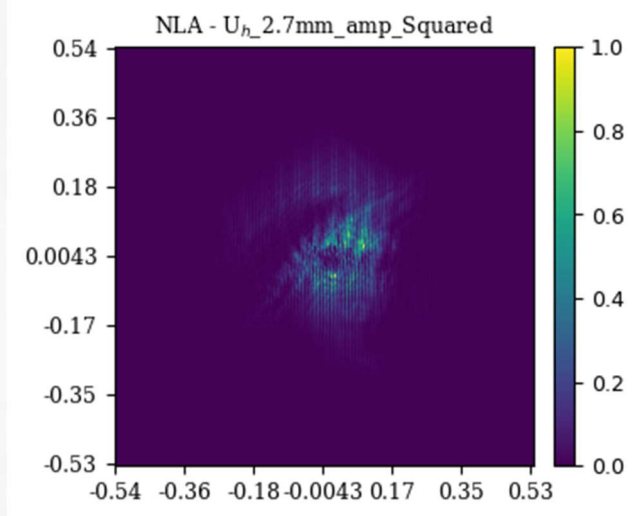
迭代 输出



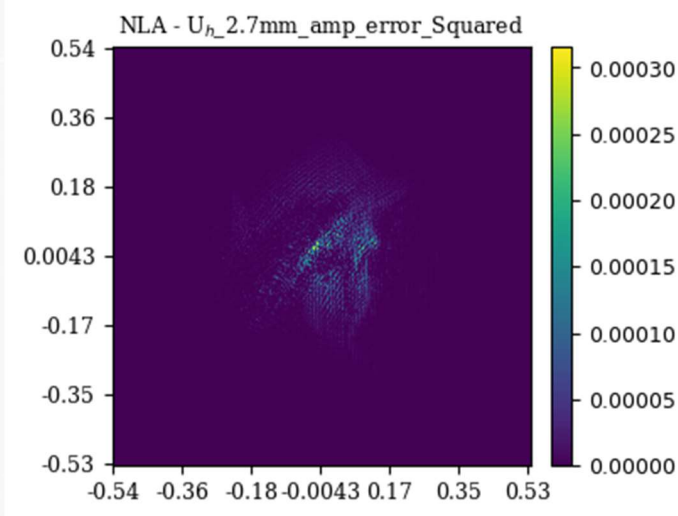
$$\mathcal{F}[E_3(x, y, z)] = \frac{\omega_3^2}{c^2} \cdot \frac{1 - e^{-ik_{3z} dz}}{k_{3z}^2} \cdot \sum_{j=1}^{z/dz} Q_{3,z-j \cdot dz} \cdot e^{ik_{3z} \cdot j \cdot dz}$$

$$\mathcal{F}[E_3(x, y, z)] \approx \frac{\chi_{\text{eff}} \omega_3^2}{c^2} \cdot \sum_{l_z=-\infty}^{+\infty} C_{l_z} \cdot \left[\frac{\mathcal{F}[M_{\text{eff}}(x, y) \cdot E_1(\mathbf{r}) E_2(\mathbf{r})] \cdot e^{ig_{l_z} z} - \mathcal{F}[M_{\text{eff}}(x, y) \cdot E_{10} E_{20}] \cdot e^{ik_{3z} z}}{(\overline{k_{1z}} + \overline{k_{2z}} + g_{l_z})^2 - k_{3z}^2} \right]$$

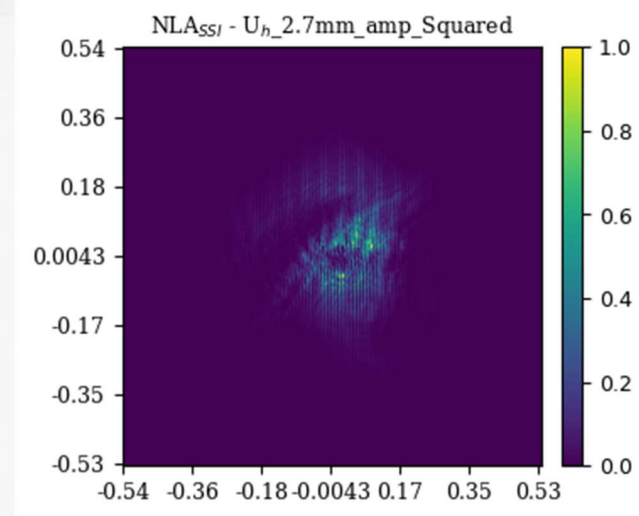
```
U_NonZero_size=0.9, w0=0.3,
L0_Crystal=2.66, z0_structu
lam1=1.064, is_air_pump=0,
deff=30, is_fft=1, fft_mode
```



一步 输出



二者之差 ~ 0.01 %



迭代 输出

```
Tx=18.769, Ty=20, Tz=6.2,
mx=1, my=0, mz=1,
is_stripe=0, is_NLAST=1,
```

真 · 随机 参数
(但 T_z 得远离 $2|l_c|$)

$$\mathcal{F}[E_3(x, y, z)] = \frac{\omega_3^2}{c^2} \cdot \frac{1 - e^{-ik_{3z} dz}}{k_{3z}^2} \cdot \sum_{j=1}^{z/dz} Q_{3,z-j \cdot dz} \cdot e^{ik_{3z} \cdot j \cdot dz}$$

U_NonZero_size=0.9, w0=0.1,
z0=10,

lam1=1.064, is_air_pump=0, is_a
deff=30, is_fft=1, fft_mode=0,

Tx=10, Ty=10, Tz=3,
mx=1, my=0, mz=0,

$$\mathcal{F}[E_3(x, y, z)] \approx \frac{\chi_{\text{eff}} \omega_3^2}{c^2} \cdot \sum_{l_z=-\infty}^{+\infty} C_{l_z} \cdot \left[\frac{\mathcal{F}[M_{\text{eff}}(x, y) \cdot E_1(\mathbf{r}) E_2(\mathbf{r})] \cdot e^{ig_{l_z} z} - \mathcal{F}[M_{\text{eff}}(x, y) \cdot E_{10} E_{20}] \cdot e^{ik_{3z} z}}{(\overline{k_{1z}} + \overline{k_{2z}} + g_{l_z})^2 - k_{3z}^2} \right]$$

倒空间

$$E_3(x, y, z) \approx \frac{\chi_{\text{eff}} \omega_3^2}{c^2} \cdot \sum_{l_z=-\infty}^{+\infty} C_{l_z} \cdot \left\{ \mathcal{F}^{-1} \left[\frac{\mathcal{F}[M_{\text{eff}}(x, y) \cdot E_1(\mathbf{r}) E_2(\mathbf{r})] \cdot e^{ig_{l_z} z}}{(\overline{k_{1z}} + \overline{k_{2z}} + g_{l_z})^2 - k_{3z}^2} \right] \right. \\ \left. \mathcal{F}^{-1} \left[\frac{\mathcal{F}[M_{\text{eff}}(x, y) \cdot E_{10} E_{20}] \cdot e^{ik_{3z} z}}{(\overline{k_{1z}} + \overline{k_{2z}} + g_{l_z})^2 - k_{3z}^2} \right] \right\}$$

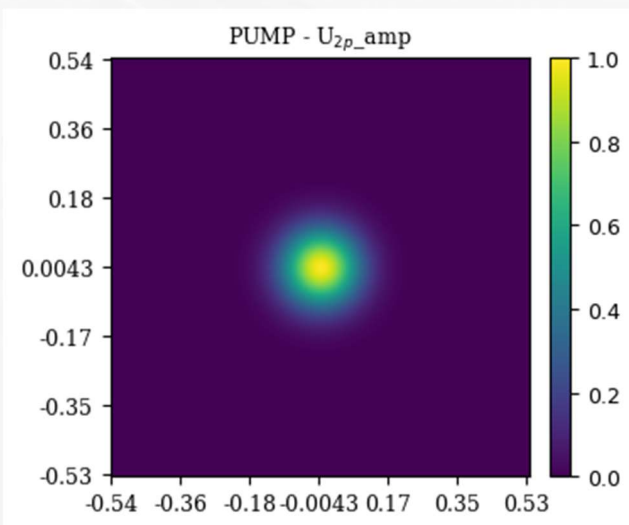
正空间

(晶体内)

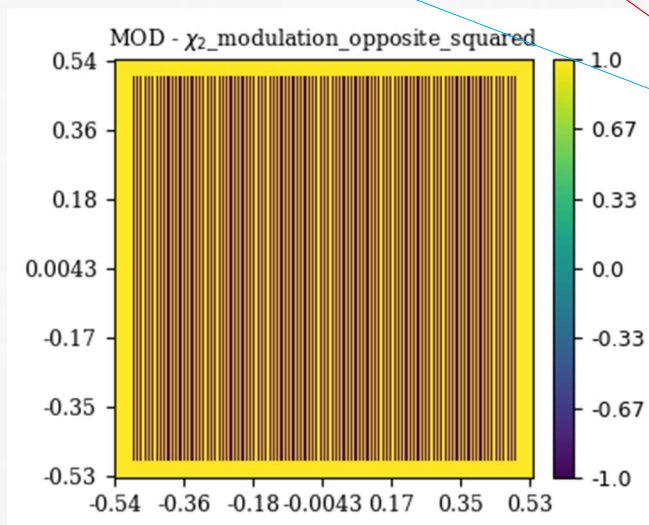
正向传播

斜向传播

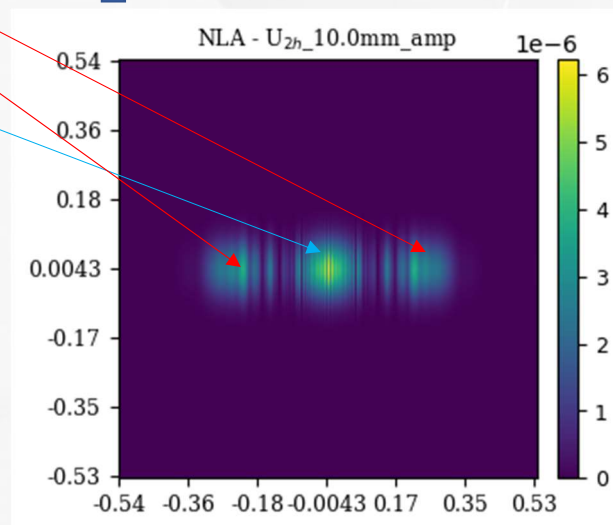
拉曼奈斯 远场



高斯 入射



1 维 光栅



拉曼奈斯 近场

U_NonZero_size=0.9, w0=0.1,
z0=10,

lam1=1.064, is_air_pump=0, is_ai
deff=30, is_fft=1, fft mode=1,

Tx=10, Ty=10, Tz=3,
mx=1, my=0, mz=0,

$$\mathcal{F}[E_3(x, y, z)] \approx \frac{\chi_{\text{eff}} \omega_3^2}{c^2} \cdot \sum_{l_x, l_y, l_z=-\infty}^{+\infty} C_{l_x, l_y, l_z} \left[\frac{\mathcal{F}[E_1(r)E_2(r)]|_{k_{3x}-g_x, k_{3y}-g_y} \cdot e^{ig_{l_z}z} - \mathcal{F}[E_{10}E_{20}]|_{k_{3x}-g_x, k_{3y}-g_y} \cdot e^{ik_{3z}z}}{(\overline{k_{1z}} + \overline{k_{2z}} + g_{l_z})^2 - k_{3z}^2} \right] \xrightarrow{\text{倒空间}}$$

$$E_3(x, y, z) \approx \frac{\chi_{\text{eff}} \omega_3^2}{c^2} \cdot \sum_{l_x, l_y, l_z=-\infty}^{+\infty} C_{l_x, l_y, l_z} \cdot \left\{ \mathcal{F}^{-1} \left[\frac{\mathcal{F}[E_1(r)E_2(r)]|_{k_{3x}-g_x, k_{3y}-g_y} \cdot e^{ig_{l_z}z}}{(\overline{k_{1z}} + \overline{k_{2z}} + g_{l_z})^2 - k_{3z}^2} \right] - \mathcal{F}^{-1} \left[\frac{\mathcal{F}[E_{10}E_{20}]|_{k_{3x}-g_x, k_{3y}-g_y} \cdot e^{ik_{3z}z}}{(\overline{k_{1z}} + \overline{k_{2z}} + g_{l_z})^2 - k_{3z}^2} \right] \right\}$$

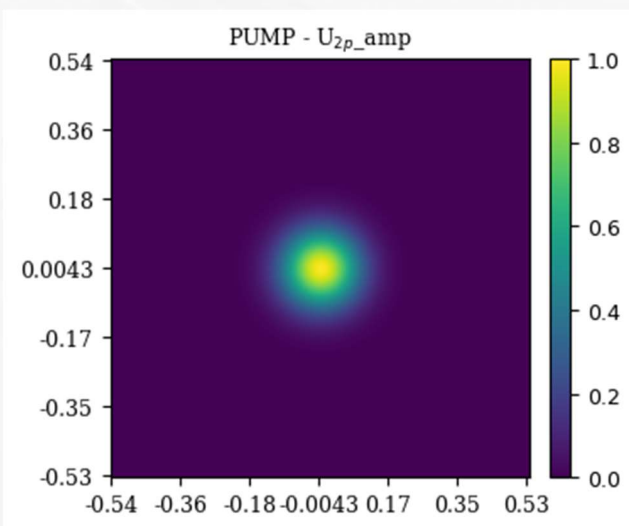
正空间

(晶体内)

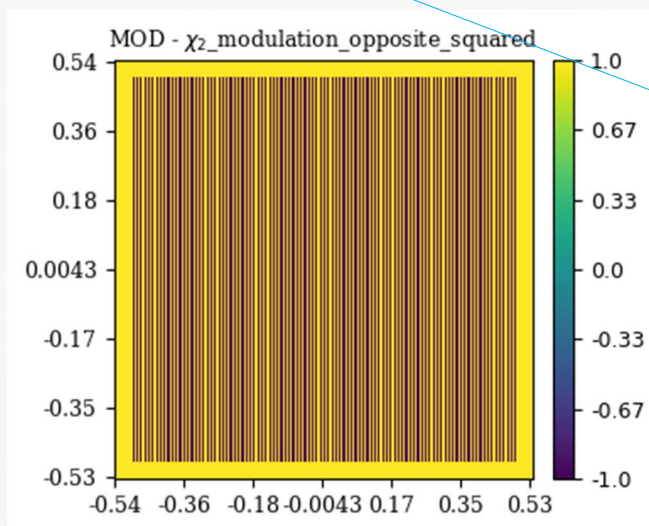
正向传播

斜向传播

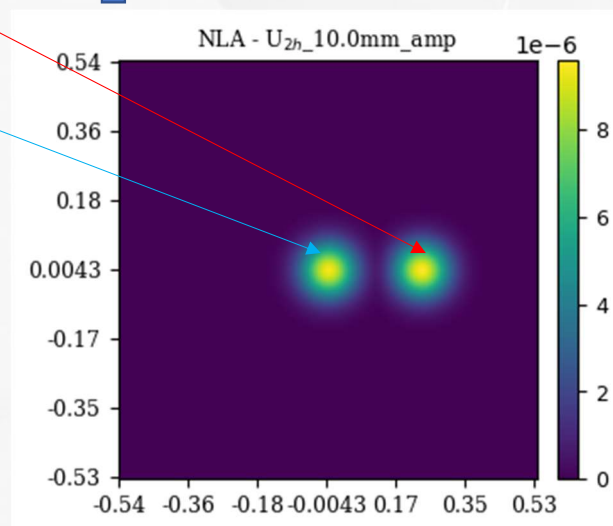
拉曼 奈斯 远场



高斯 入射



1 维 光栅



拉曼 奈斯 近场

U_NonZero_size=0.9, w0=0.1,
z0=10,

lam1=1.064, is_air_pump=0, is_ai
deff=30, is_fft=1, fft mode=1,

Tx=10, Ty=10, Tz=3,
mx=1, my=0, mz=0,

$$\mathcal{F}[E_3(x, y, z)] \approx \frac{\chi_{\text{eff}} \omega_3^2}{c^2} \cdot \sum_{l_x, l_y, l_z=-\infty}^{+\infty} C_{l_x, l_y, l_z} \left[\frac{\mathcal{F}[E_1(r)E_2(r)]|_{k_{3x}-g_x, k_{3y}-g_y} \cdot e^{ig_{l_z}z} - \mathcal{F}[E_{10}E_{20}]|_{k_{3x}-g_x, k_{3y}-g_y} \cdot e^{ik_{3z}z}}{(\overline{k_{1z}} + \overline{k_{2z}} + g_{l_z})^2 - k_{3z}^2} \right] \xrightarrow{\text{倒空间}}$$

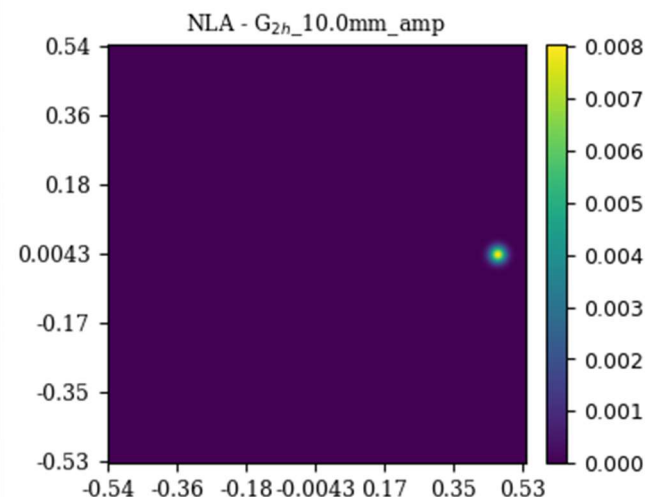
$$E_3(x, y, z) \approx \frac{\chi_{\text{eff}} \omega_3^2}{c^2} \cdot \sum_{l_x, l_y, l_z=-\infty}^{+\infty} C_{l_x, l_y, l_z} \cdot \left\{ \mathcal{F}^{-1} \left[\frac{\mathcal{F}[E_1(r)E_2(r)]|_{k_{3x}-g_x, k_{3y}-g_y} \cdot e^{ig_{l_z}z}}{(\overline{k_{1z}} + \overline{k_{2z}} + g_{l_z})^2 - k_{3z}^2} \right] - \mathcal{F}^{-1} \left[\frac{\mathcal{F}[E_{10}E_{20}]|_{k_{3x}-g_x, k_{3y}-g_y} \cdot e^{ik_{3z}z}}{(\overline{k_{1z}} + \overline{k_{2z}} + g_{l_z})^2 - k_{3z}^2} \right] \right\}$$

正空间

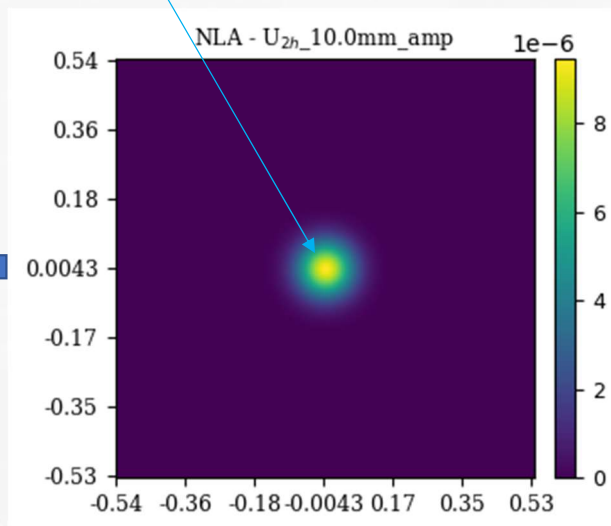
(晶体内)

正向传播

斜向传播



正向 远场

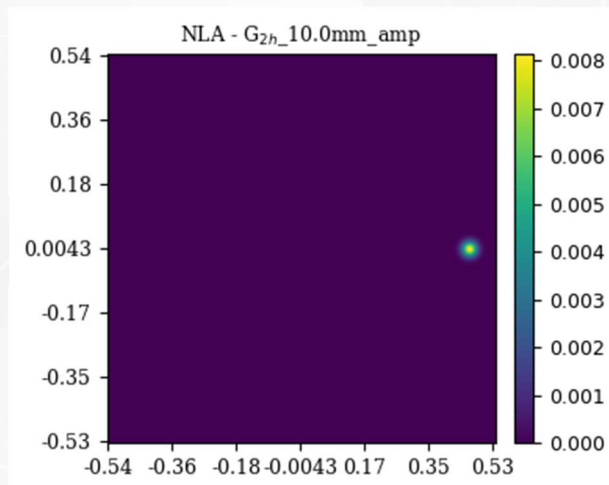


正向 近场

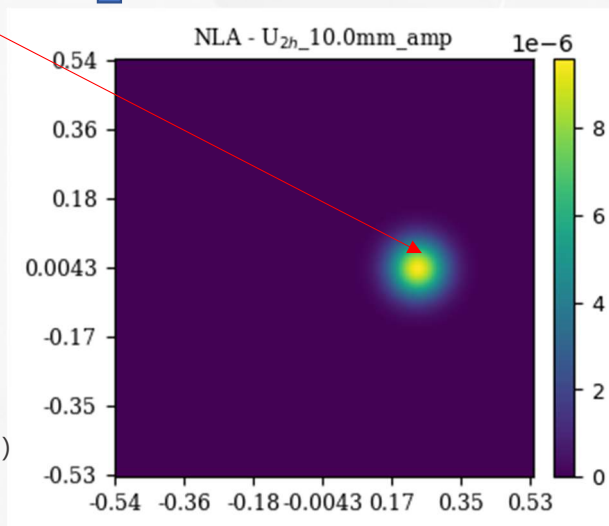


干涉

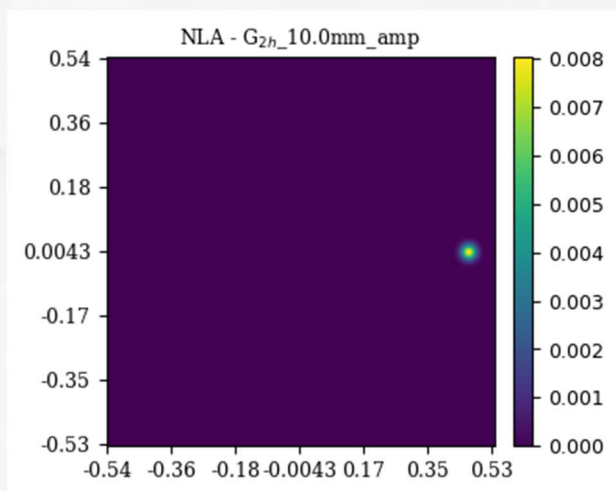
(缺级 来源)



斜向 远场



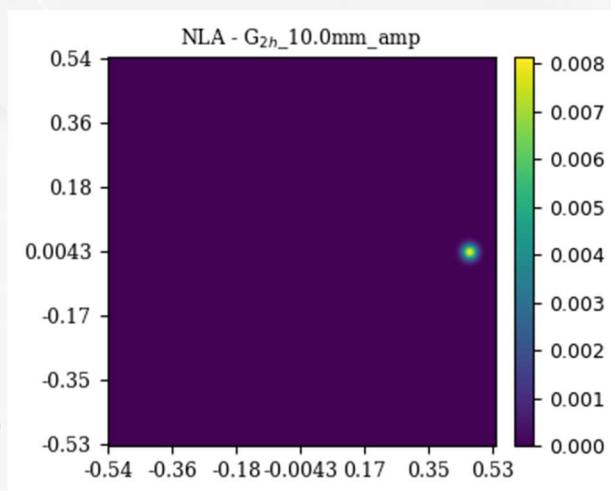
斜向 近场



正向 远场

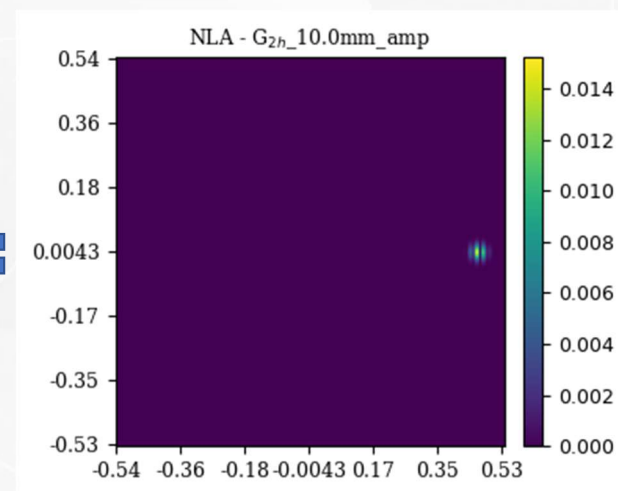
+

干涉
(缺级 来源)

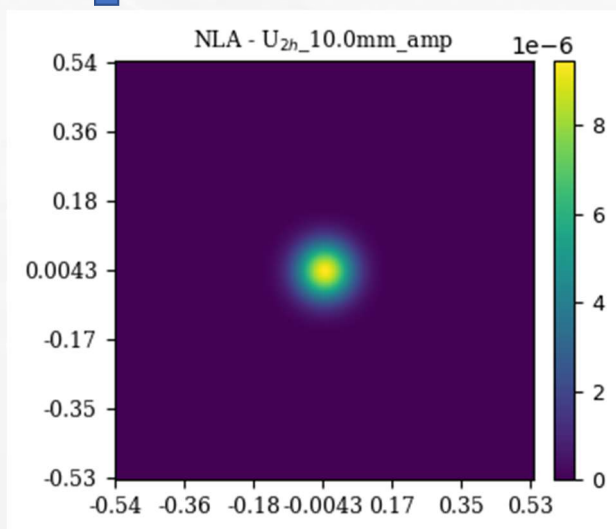


斜向 远场

=



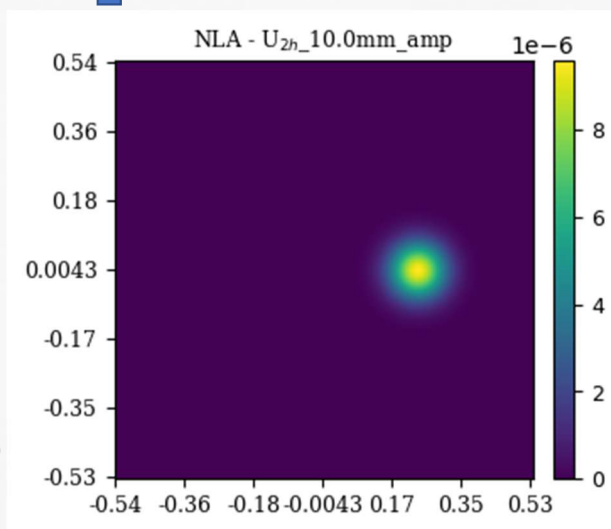
拉曼 奈斯 远场



正向 近场

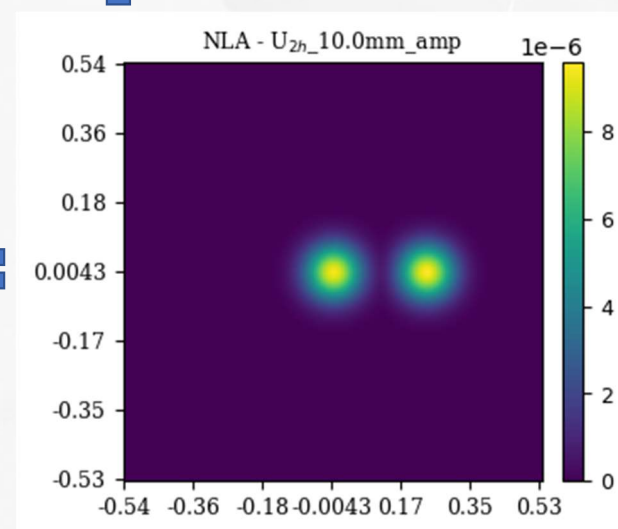
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干涉
(缺级 来源)

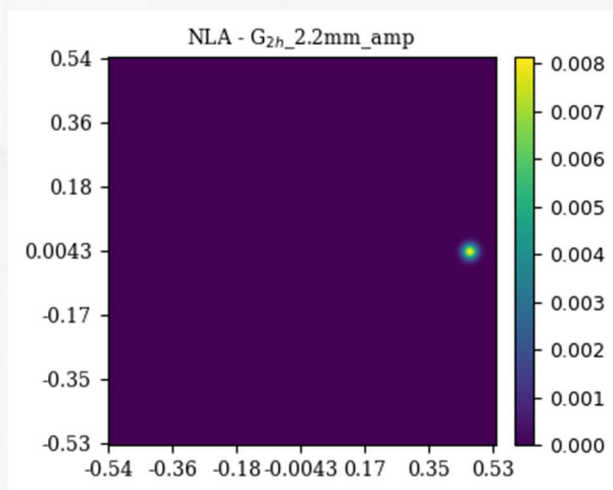


斜向 近场

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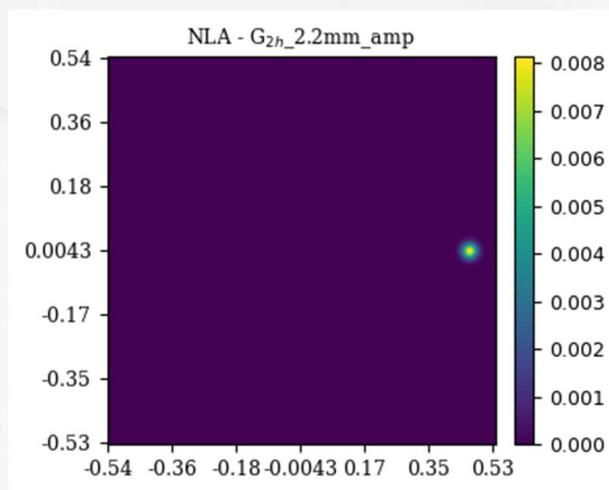


拉曼 奈斯 近场

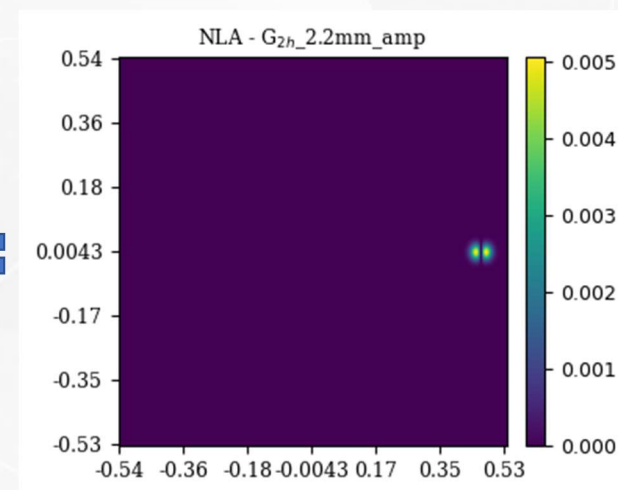


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干涉
(缺级来源)



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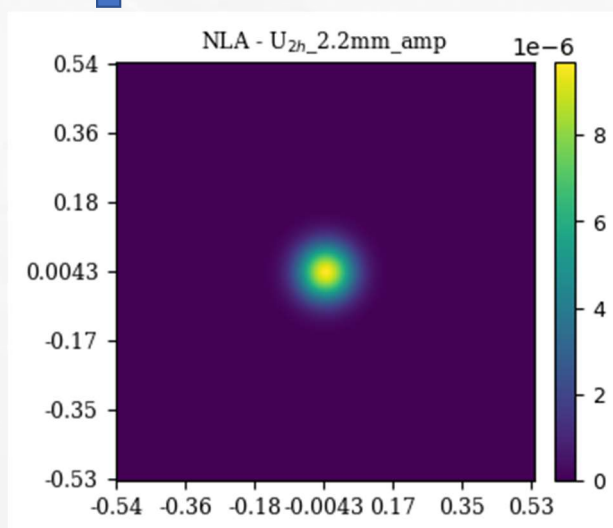
正向 远场



斜向 远场

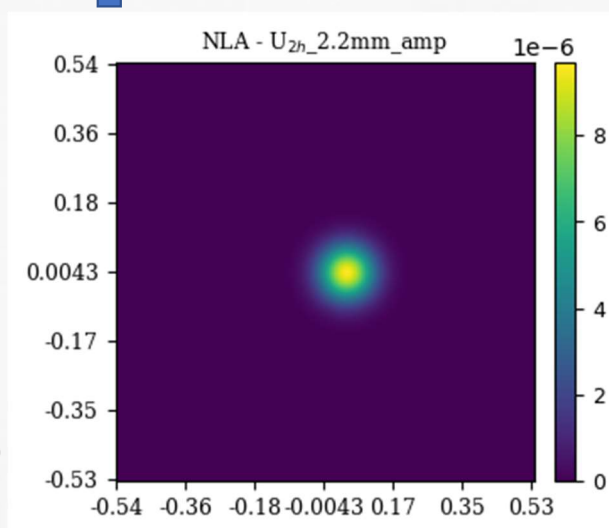


拉曼 奈斯 远场

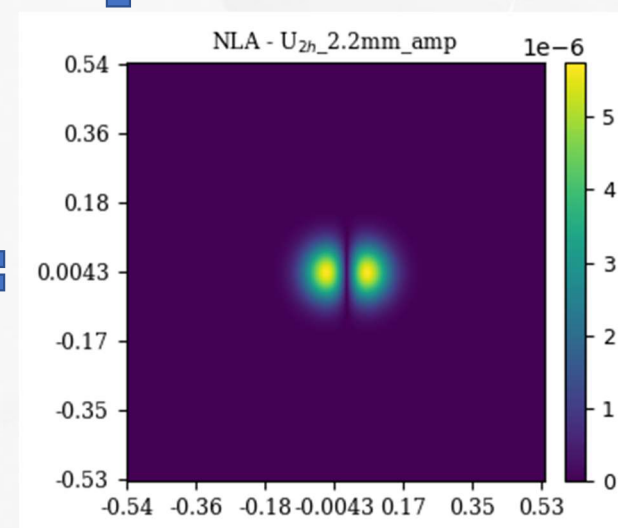


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干涉
(缺级来源)



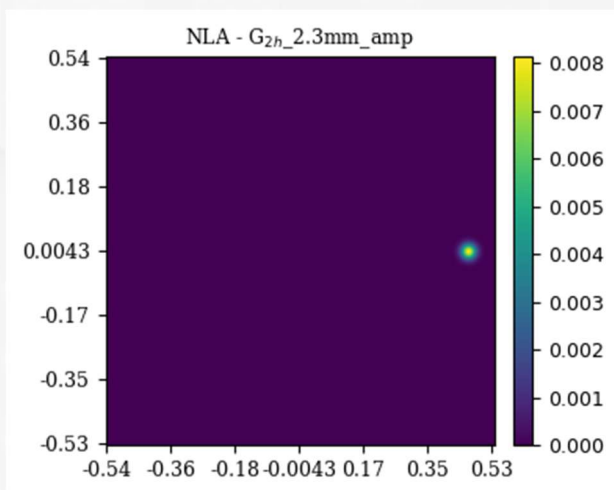
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正向 近场

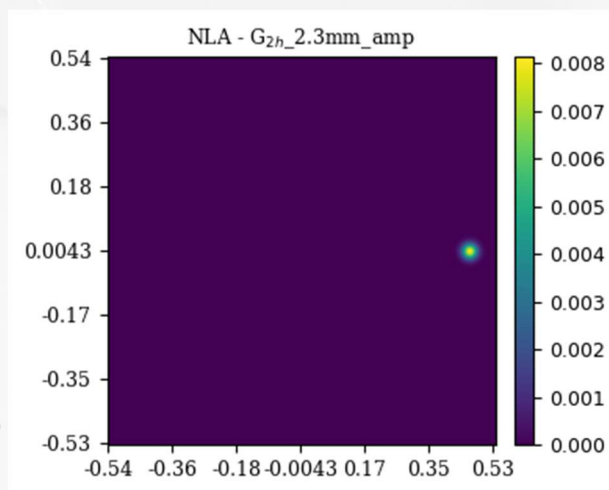
斜向 近场

拉曼 奈斯 近场

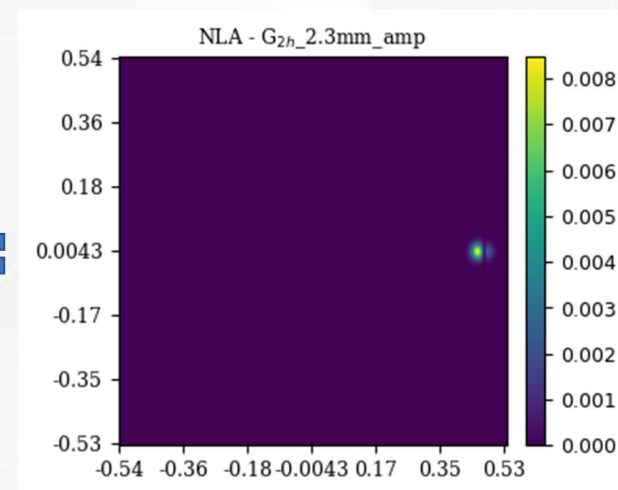


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干涉
(缺级来源)



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↑

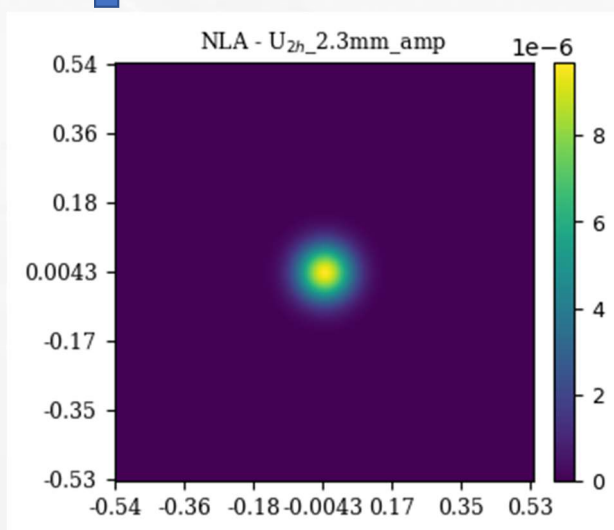
正向 远场

↑

斜向 远场

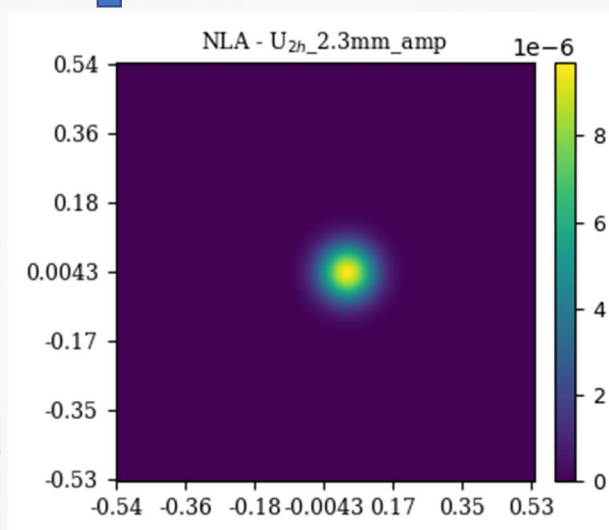
↑

拉曼 奈斯 远场

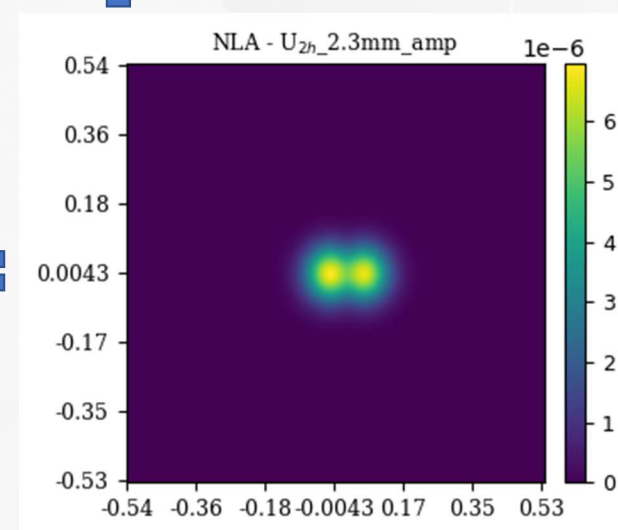


+

干涉
(缺级来源)



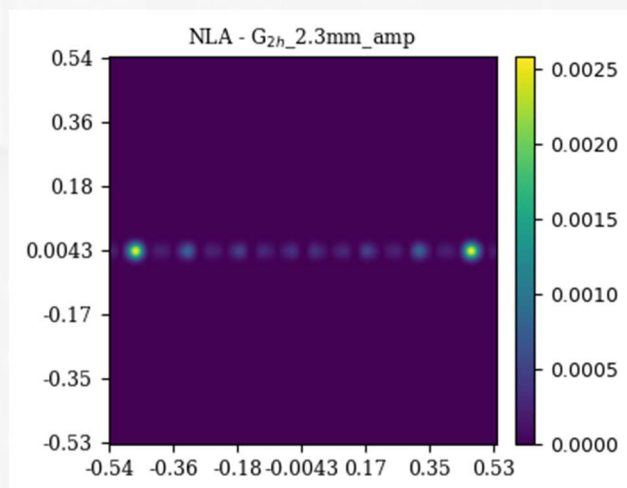
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正向 近场

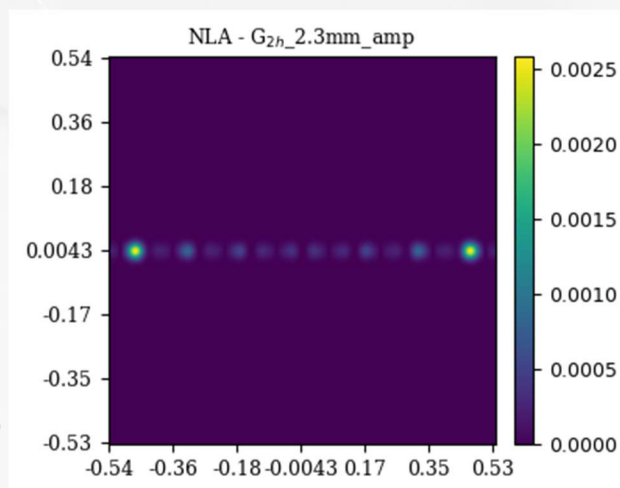
斜向 近场

拉曼 奈斯 近场

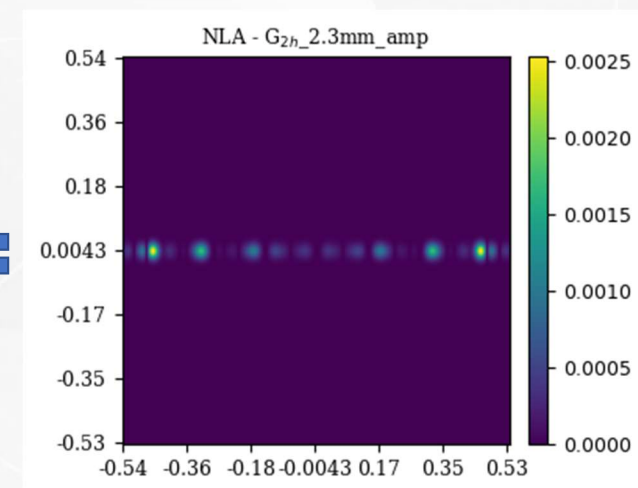


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干涉
(缺级来源)



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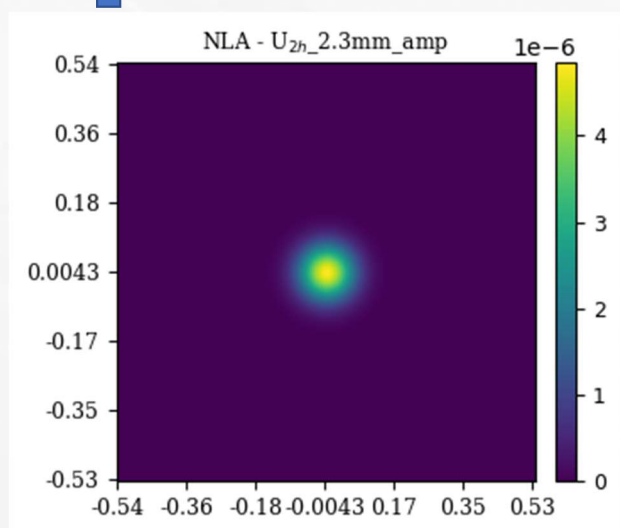
正向 远场



斜向 远场

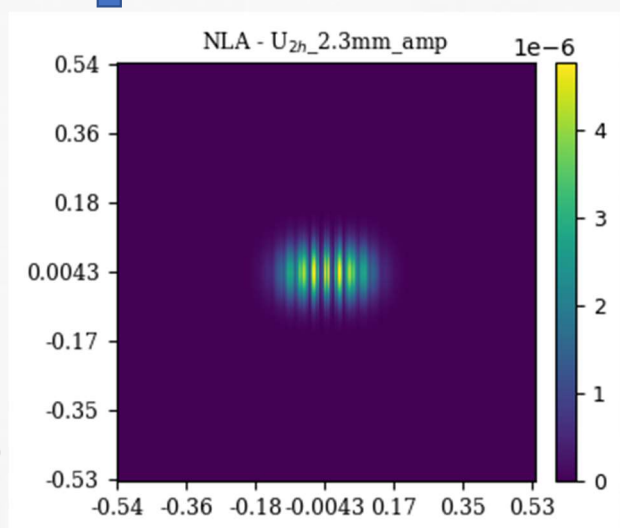


拉曼 奈斯 远场

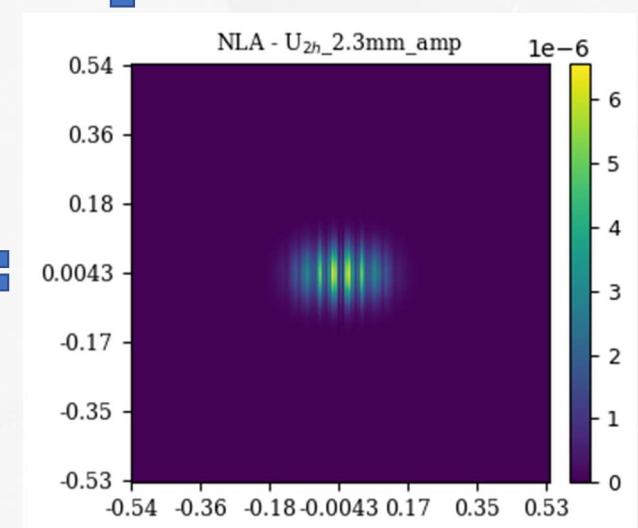


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干涉
(缺级来源)



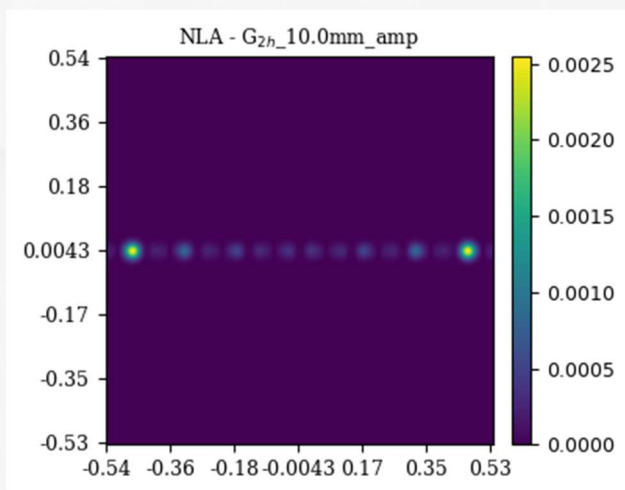
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正向 近场

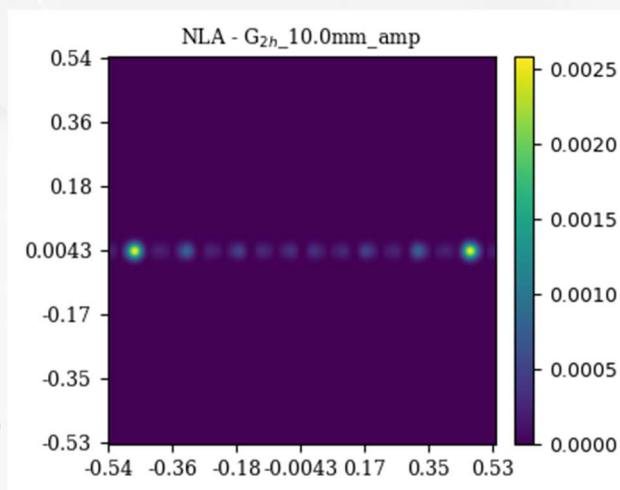
斜向 近场

拉曼 奈斯 近场

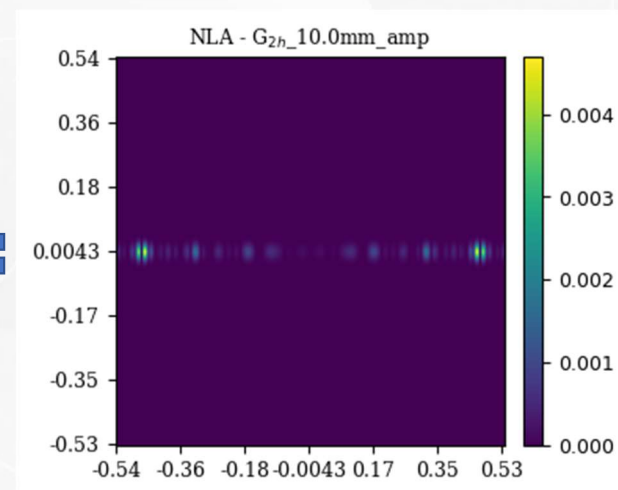


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干涉
(缺级来源)



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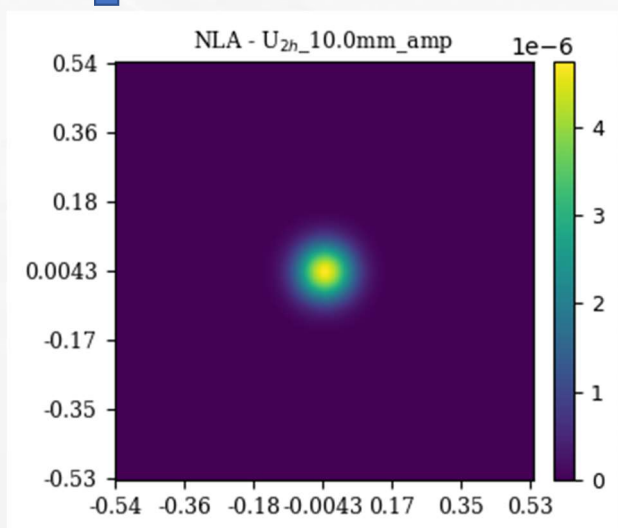
正向 远场



斜向 远场

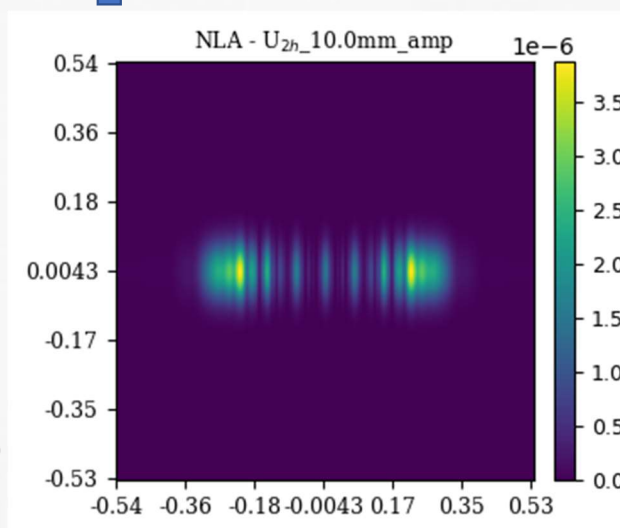


拉曼 奈斯 远场

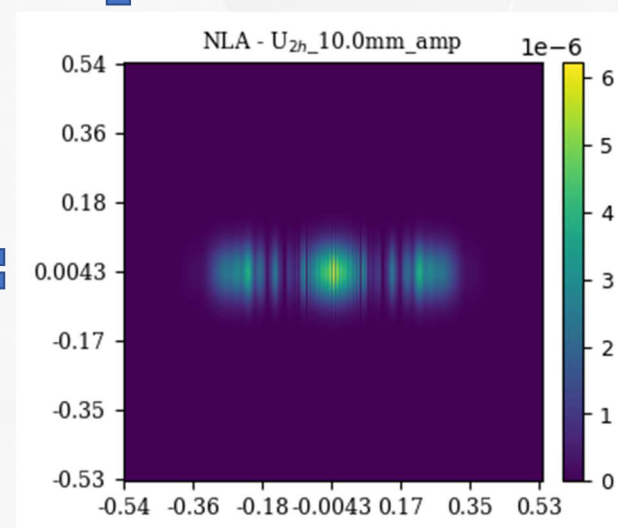


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干涉
(缺级来源)



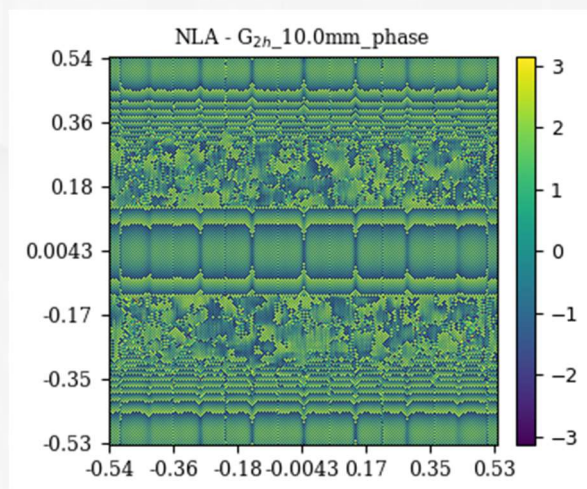
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正向 近场

斜向 近场

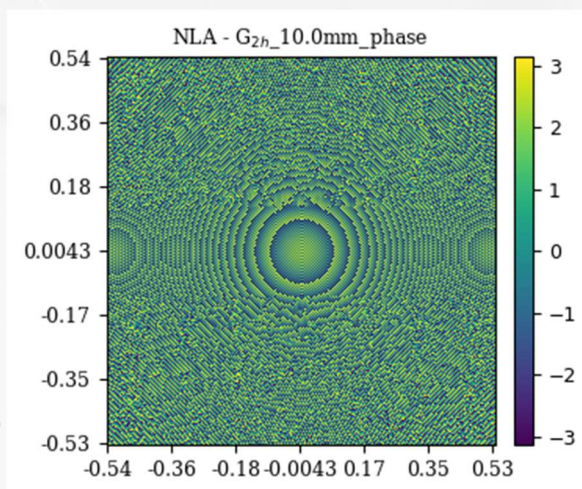
拉曼 奈斯 近场



正向 远场

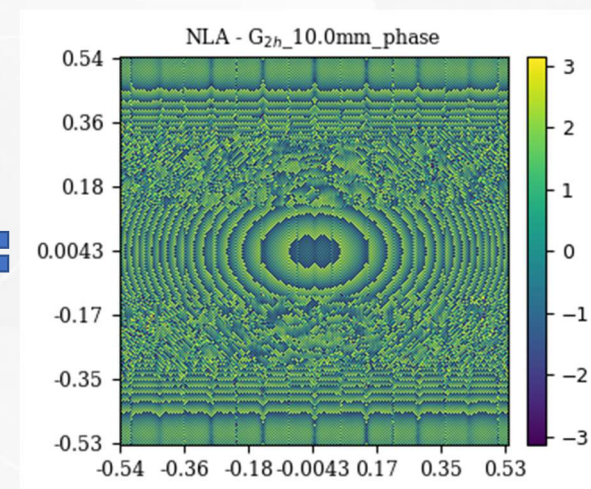
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干涉
(缺级 来源)

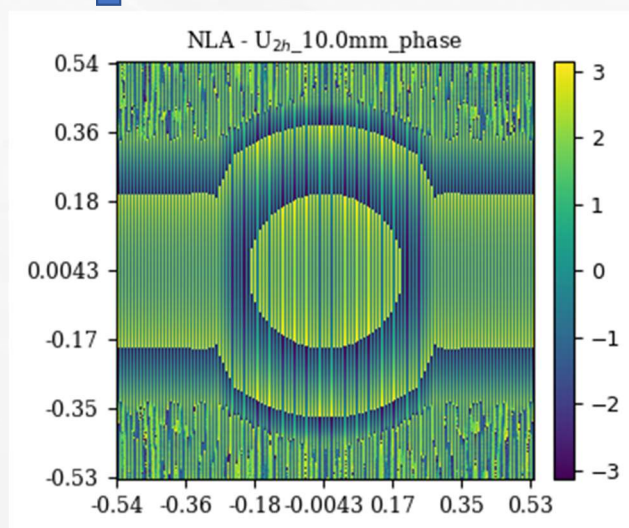


斜向 远场

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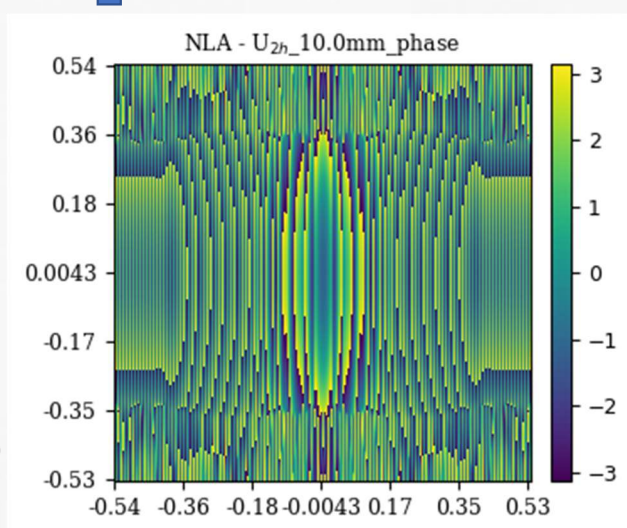
拉曼 奈斯 远场



正向 近场

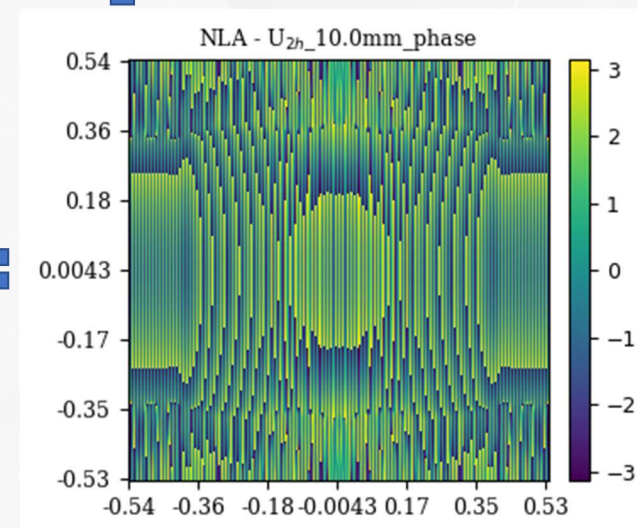
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干涉
(缺级 来源)



斜向 近场

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拉曼 奈斯 近场