- $H(u) = H(Ms) = \int P_{s*}(x_p) \exp(-j2\pi b x_p s)\, dx_p$

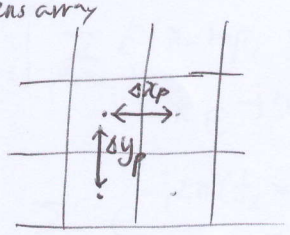
  $M = -\frac{2f}{\ell}$, $b = \frac{2}{\lambda\ell}$ $\theta = \frac{s}{\ell}$, $\Delta u = M\Delta s = \Delta s \frac{2f}{\ell} = 2f\Delta\theta$

  $2L_u = 2M s_{max} = 4f\theta_{max}$

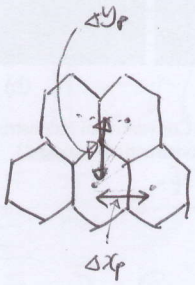
- $H(u,v) = \exp\left[-j\frac{2\pi}{\lambda f^2}(u^2+v^2)\right] \iint O(x,y;z) \exp\left[j\frac{2\pi}{\lambda f}(xu+yv)\right] dx\,dy$

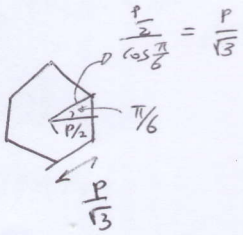
- comparison

  * lens array



vs.

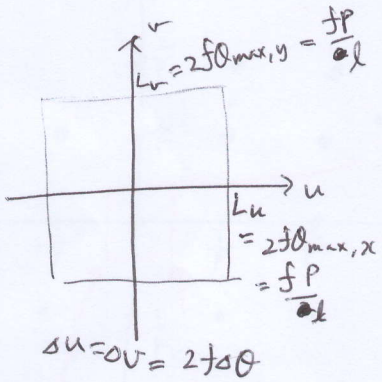




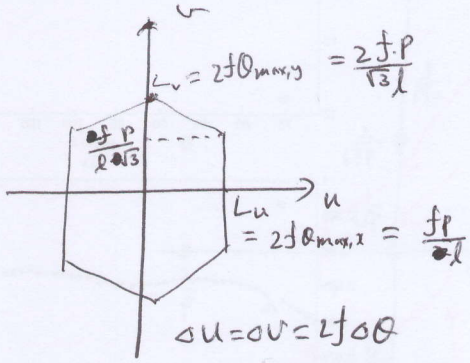
$\Delta x_p = \Delta y_p = P$

$\Delta x_p = P$, $\Delta y_p = \frac{\sqrt{3}}{2}P$

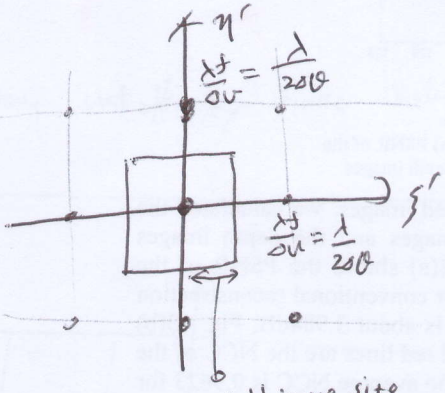
  * generated hologram



vs.



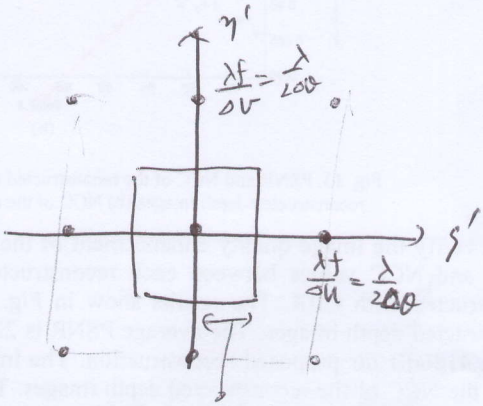
- reconstruction image size



max half image size

$\left(L_\xi < \frac{\lambda}{4\Delta\theta}, L_\eta < \frac{\lambda}{4\Delta\theta}\right)$

vs.



max half image size

$\left(L_\xi < \frac{\lambda}{4\Delta\theta}, L_\eta < \frac{\lambda}{4\Delta\theta}\right)$

= same

⑥ spatial frequency

1. sampling in orthographic image generation

(Rectangular)

sampling grid $= \sum \delta(x - m\Delta x_p, y - n\Delta y_p)$

$= \sum \delta(x - mp, y - np)$

$FT\left\{ \sum_{m,n} \delta(x - mp, y - np) \right\}$

$= \int \sum_{m,n} \delta(x - mp, y - np) \times e^{-j2\pi(f_x x + f_y y)} \, dx dy$

$= \sum_{m,n} e^{-j2\pi(f_x mp + f_y np)}$

$= \sum_{m,n} \delta\left(f_x - \frac{m}{p}, f_y - \frac{n}{p}\right)$

(Hexagonal)

sampling grid $= \sum_{m,n} \delta\left(x - \frac{m\Delta x_p}{2}\right) \delta\left(\frac{2\Delta y_p}{\Delta x_p} x - y + n\, 2\Delta y_p\right)$

$= \sum \delta\left(x - \frac{mp}{2}\right) \delta(\sqrt{3}x - y + n\sqrt{3}p)$

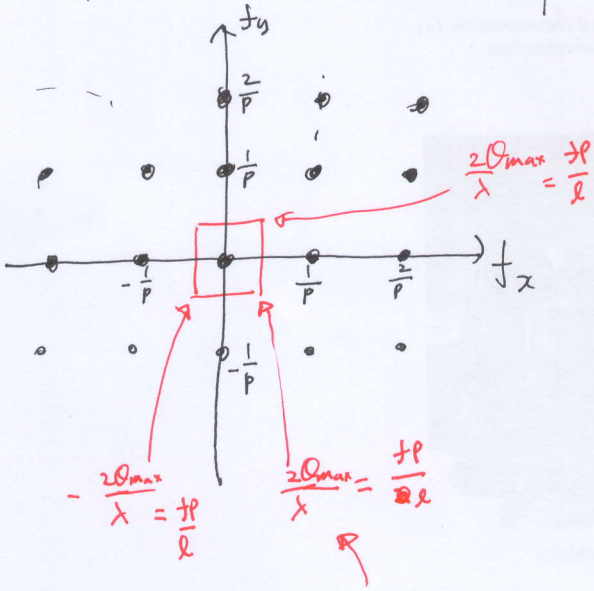
$FT\left\{ \sum_{m,n} \delta\left(x - \frac{mp}{2}\right) \delta(\sqrt{3}x - y + n\sqrt{3}p) \right\}$

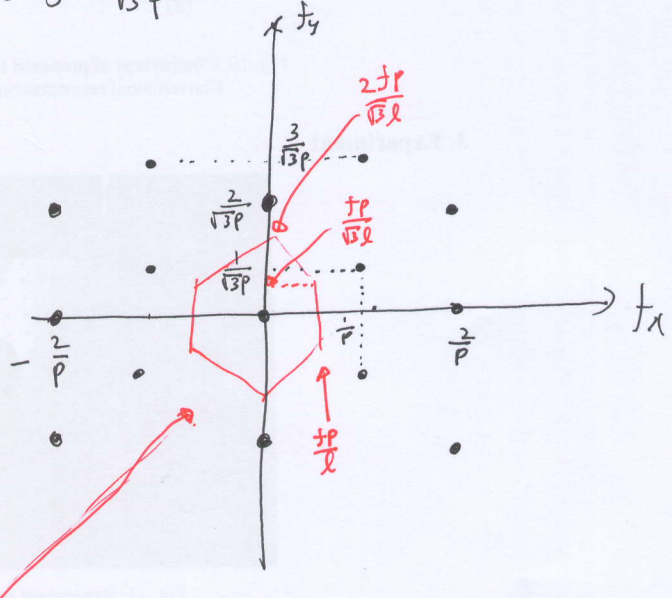
$= \iint \sum \delta\left(x - \frac{mp}{2}\right) \delta(\sqrt{3}x - y + n\sqrt{3}p) \cdot e^{-j2\pi(f_x x + f_y y)} \, dx dy$

$= \sum_{m,n} e^{-j2\pi\left(\frac{mp}{2} f_x + f_y\left(\frac{\sqrt{3}}{2}mp + \sqrt{3}np\right)\right)}$

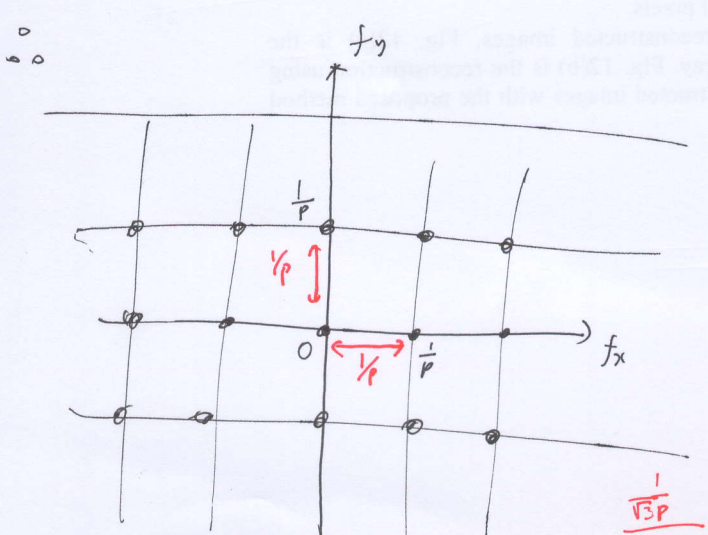
$= \sum e^{-j2\pi\left\{\left(\frac{p}{2}f_x + \frac{\sqrt{3}}{2}pf_y\right)m + \sqrt{3}pn f_y\right\}}$

$= \sum \delta\left(f_y - \frac{n}{\sqrt{3}p}\right) \delta\left(\frac{p}{2} f_x + \frac{\sqrt{3}p}{2} f_y - m\right)$



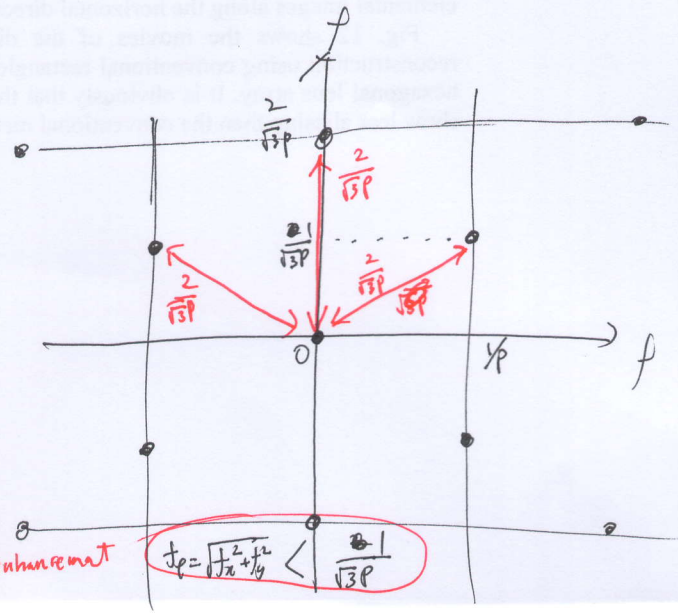


2. frequency cut off by finite hologram area



⇒ max BW w/o aliasing $f_p = \sqrt{f_x^2 + f_y^2} < \frac{1}{2p}$

$\therefore \frac{\frac{1}{\sqrt{3}p}}{\frac{1}{2p}} = \frac{2}{\sqrt{3}}$ enhancement



$f_p = \sqrt{f_x^2 + f_y^2} < \frac{1}{\sqrt{3}p}$