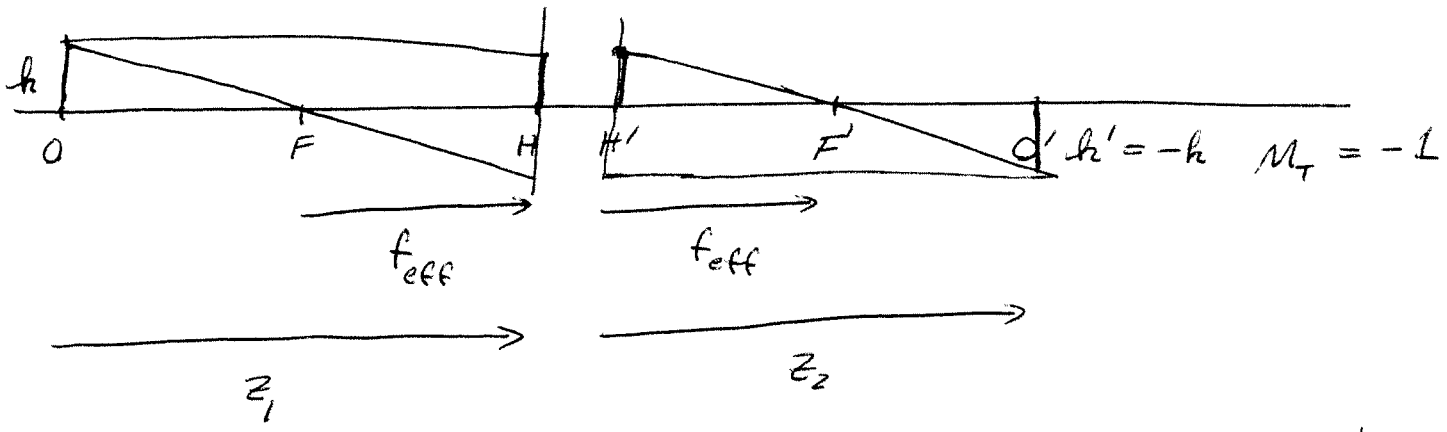
17 FEBRUARY 2010



$$z_1 = z_2 = 2 f_{eff} \qquad \frac{1}{z_1} + \frac{1}{z_2} = \frac{1}{f_{eff}}$$

$$M_T = -\frac{z_2}{z_1} = -1$$

STOP — ELEMENT THAT CONSTRAINS CONE OF RAYS ⇒ BRIGHTNESS

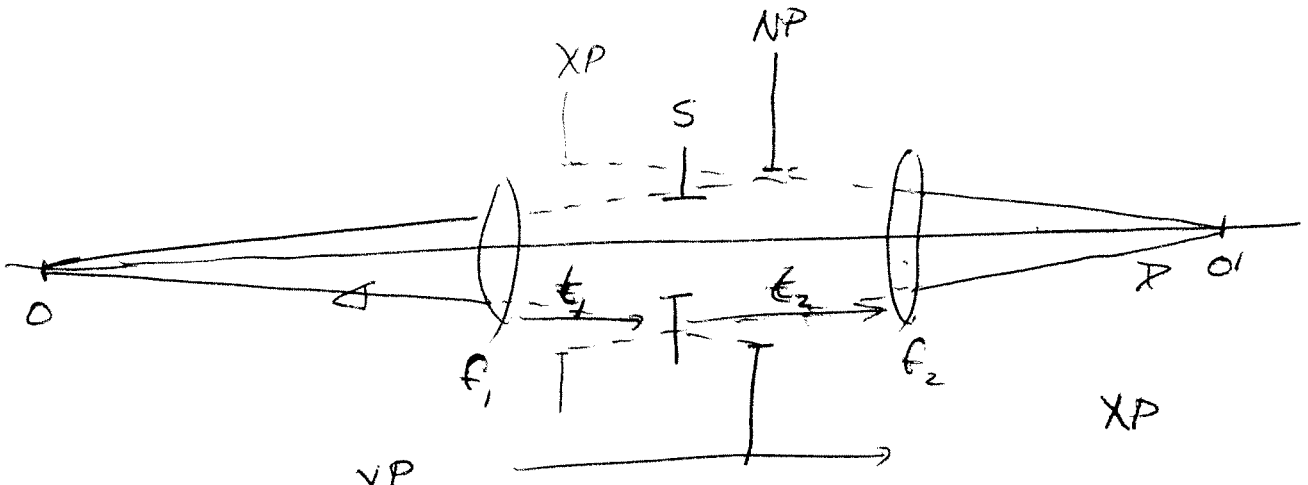
NP — IMAGE OF STOP IN OBJECT SPACE ←

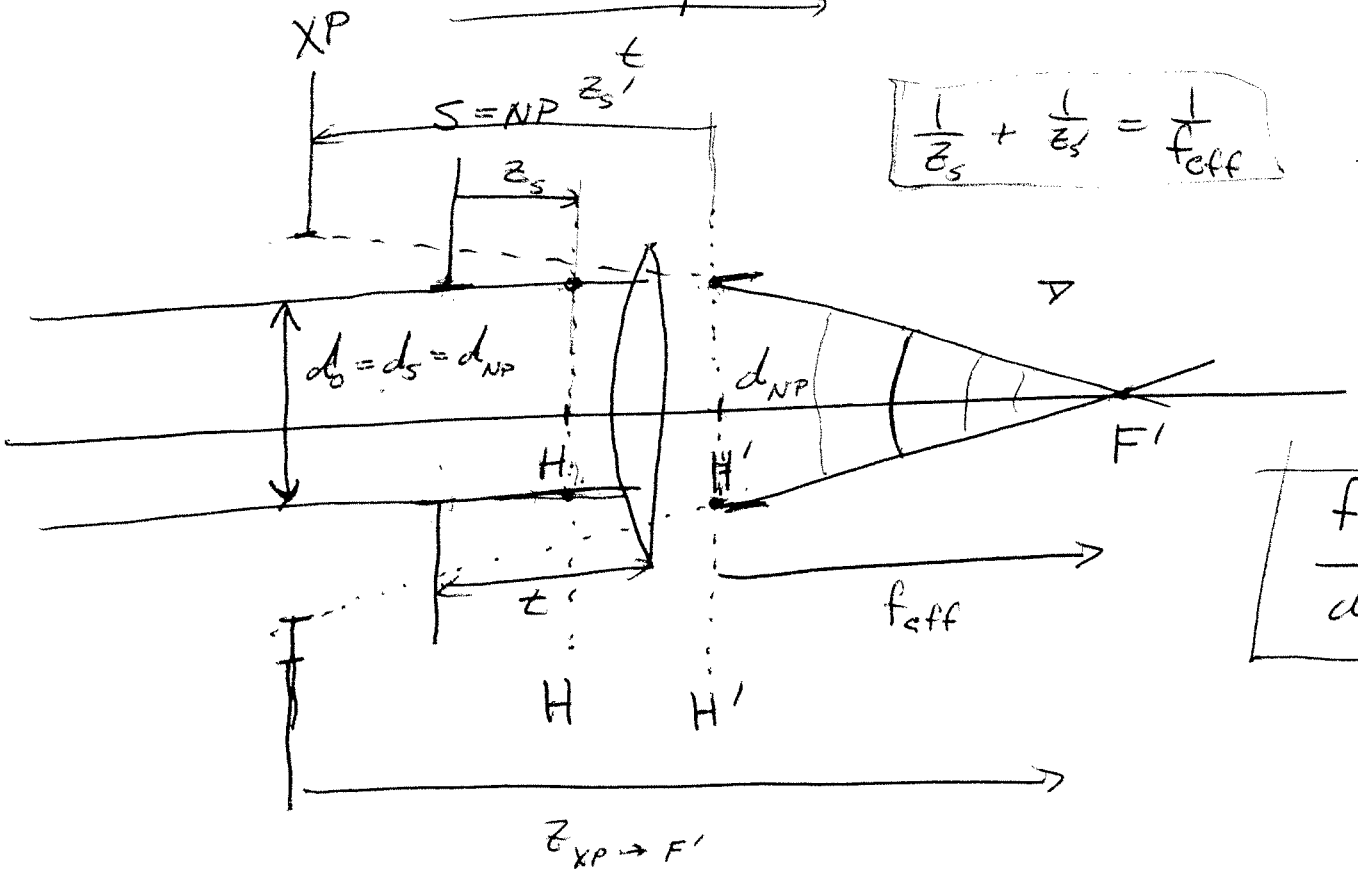
XP — " " " " IMAGE "

$$f/\# = \frac{f}{d_o} \longrightarrow \frac{f_{eff}}{d_{NP}}$$

$D_o \simeq 2.44\, \lambda_o\, f/\#$

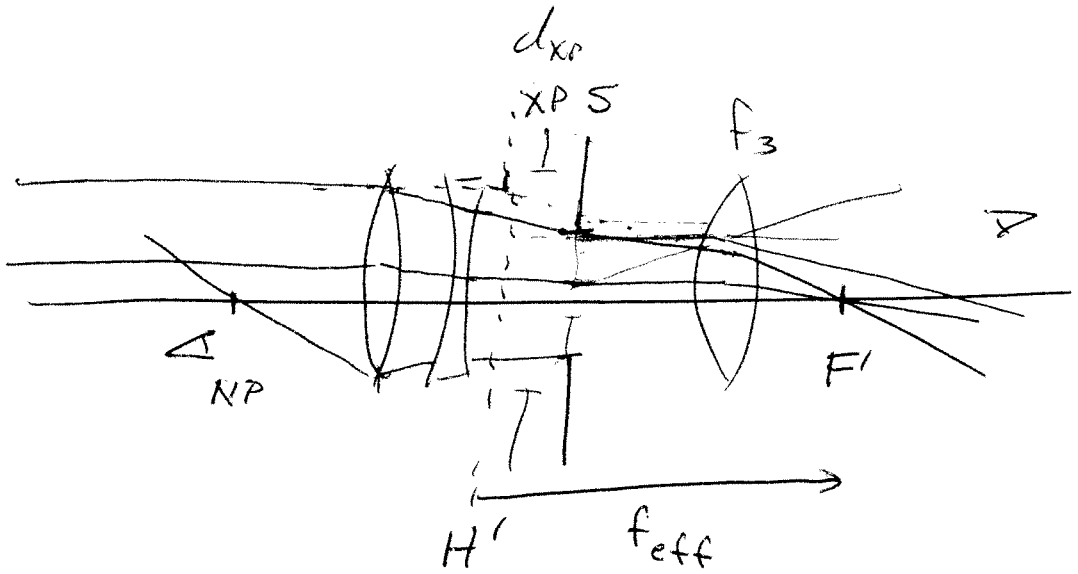
DEPTH OF FIELD + RESOLUTION





$$\frac{1}{z_s} + \frac{1}{z_s'} = \frac{1}{f_{eff}} \qquad M_T = -\frac{z_s'}{z_s}$$

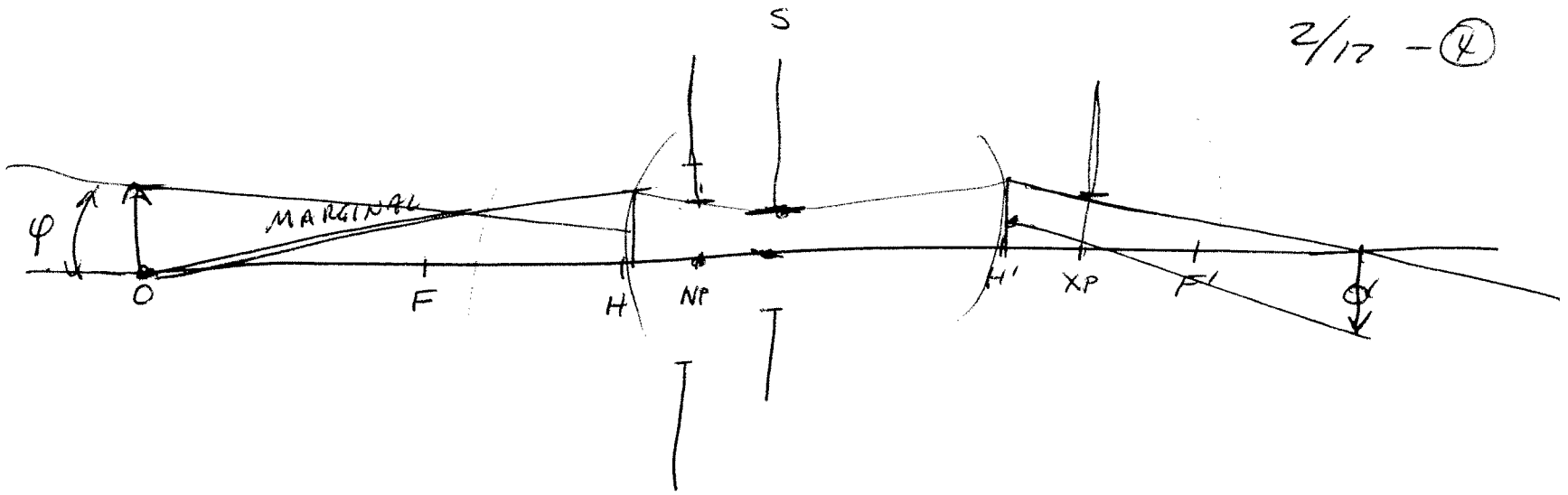
$$\frac{f_{eff}}{d_{NP}} = f/\#$$



$$\frac{1}{z_s} + \frac{1}{z_s'} = \frac{1}{f_3}$$

$$\frac{f_{eff}}{d_{NP}} = f/\# \implies D_0 \cong 2.44\,\lambda_0\,f/\#$$

$$DoF \propto (f/\#)^2$$



MARGINAL RAY – FROM CENTER OF OBJECT – EDGE OF STOP
IMAGE(S) NP, XP

CHIEF RAY (PRINCIPAL) EDGE OF OBJECT – CENTER OF STOP
IMAGE(S) NP, XP

$$(M_T)_{HH'} \equiv +1$$

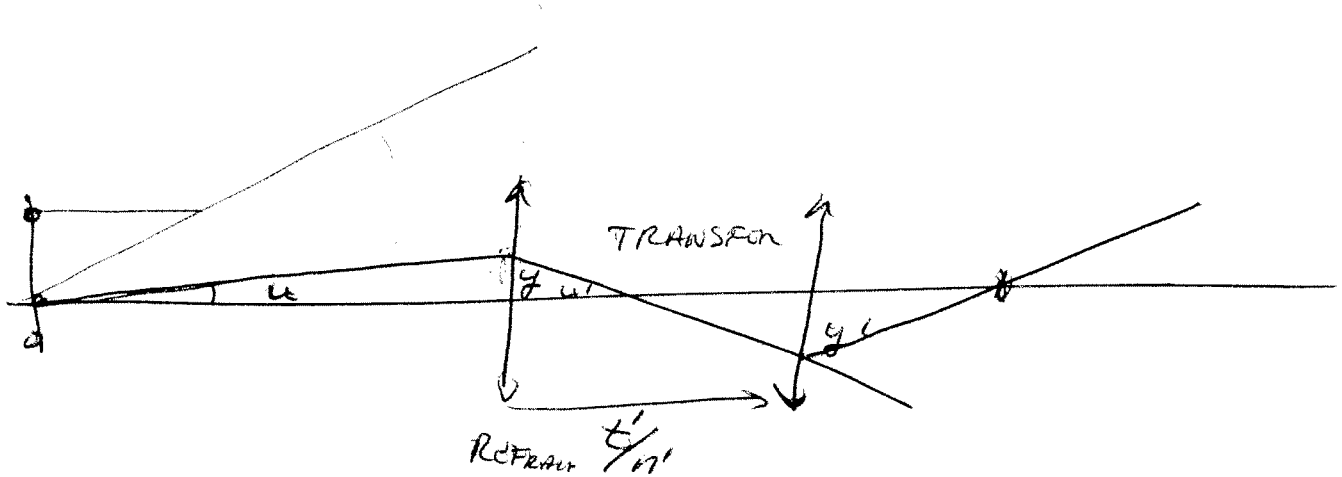
$$z_{OH} \Longleftrightarrow z_{H'O'} \Rightarrow \frac{1}{z_{OH}} + \frac{1}{z_{H'O'}} = \frac{1}{f_{eff}}$$

$$M_T = -\frac{z_{H'O'}}{z_{OH}}$$

$$z_1 = z_2 = 2f_{eff} \Rightarrow M_T = -1$$

PARAXIAL RAYS → ANGLES ≅ 0

SIN θ ≅ tan θ ≅ θ



MATRIX MULTIPLICATION

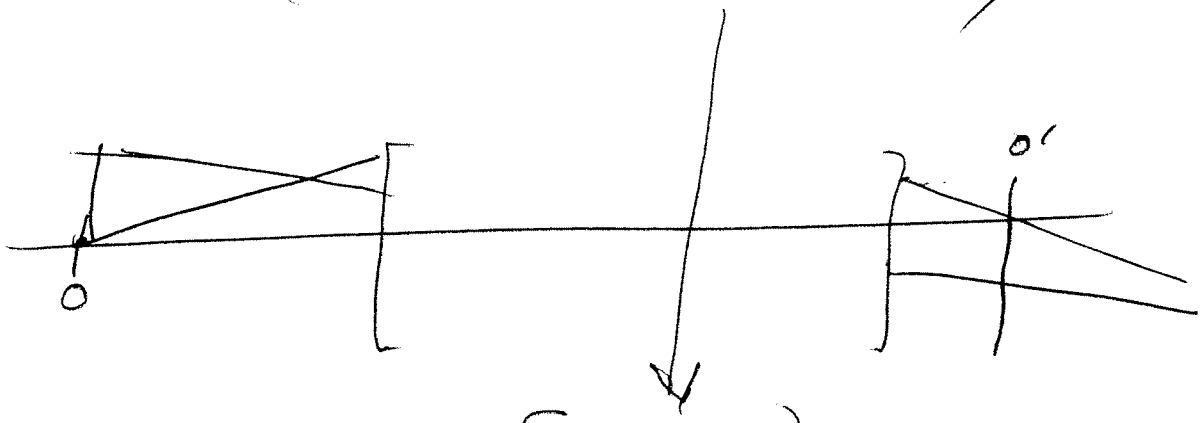
$$\begin{bmatrix} y \\ nu \end{bmatrix} \quad \begin{pmatrix} \bar{y} \\ n\bar{u} \end{pmatrix} \quad \begin{bmatrix} A & B \\ C & D \end{bmatrix}$$

$$\begin{bmatrix} y \\ nu \end{bmatrix} - \text{RAY} \qquad \begin{bmatrix} 0 \\ nu \end{bmatrix}$$

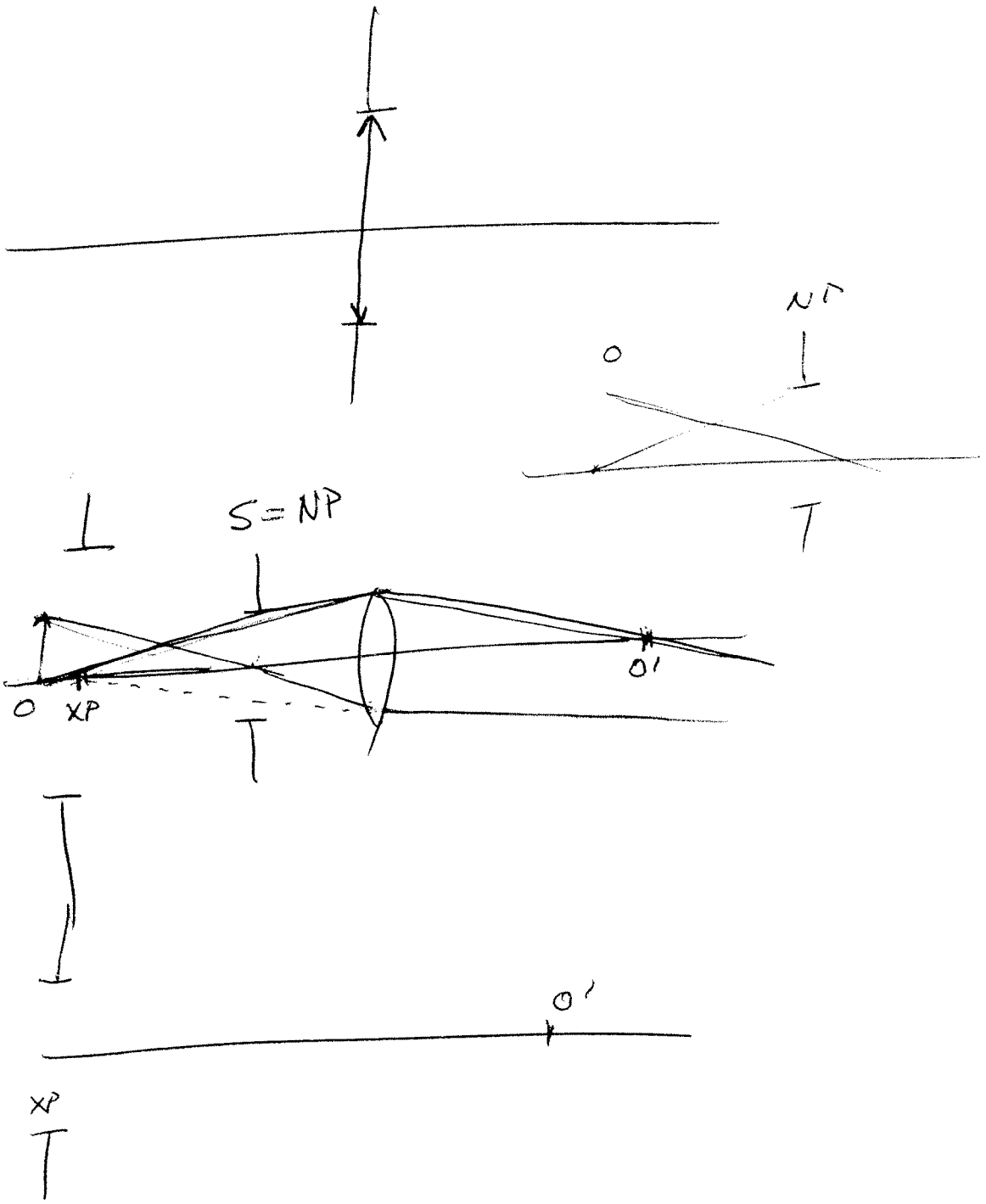
$$\begin{bmatrix} 1 \\ 0 \end{bmatrix} \qquad \begin{bmatrix} 0 \\ 1 \end{bmatrix}$$

$M_{VV'}$

$$\cdots \left(\begin{bmatrix} 1 & 0 \\ -\varphi_2 & 1 \end{bmatrix} \begin{bmatrix} 1 & \frac{t'}{n'} \\ 0 & 1 \end{bmatrix} \begin{bmatrix} 1 & 0 \\ -\varphi_1 & 1 \end{bmatrix} \right) \begin{bmatrix} y & \bar{y} \\ nu & n\bar{u} \end{bmatrix}_{IN} = \begin{bmatrix} y & \bar{y} \\ nu & n\bar{u} \end{bmatrix}_{OUT}$$



$$\begin{bmatrix} A & B \\ C & D \end{bmatrix}$$

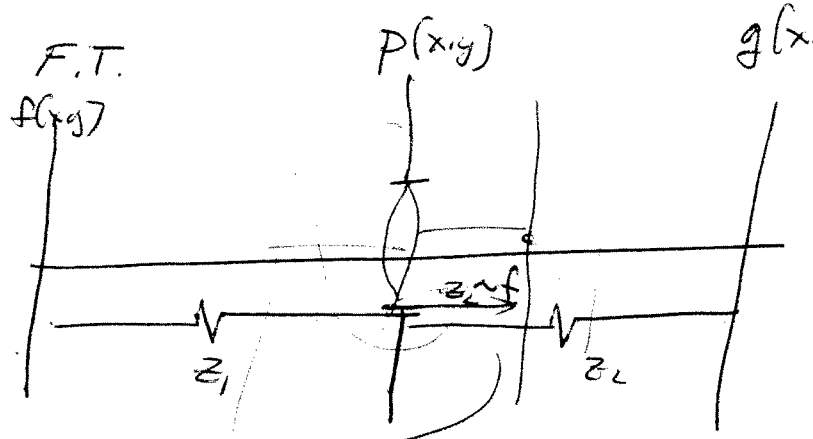

NP
O
L
S=NP
T
O'
O
XP
T
T
O'
XP
T

DIFFRACTION MONOCHROMATIC

FRESNEL LSI ⇒ h, H, QUADRATIC-PHASE

FRAUNHOFER LSV ⇒ F.T.

IMAGING



$$g(x,y) = f\left(\frac{x}{-\frac{z_2}{z_1}}, \frac{y}{-\frac{z_2}{z_1}}\right) * p\left[\frac{x}{\lambda_0 z_2}, \frac{y}{\lambda_0 z_2}\right]$$

$$\left(-\frac{z_2}{z_1}, -\frac{z_2}{z_1}\right)$$

$$\frac{1}{z_1} + \frac{1}{z_2} = \frac{1}{f}$$

$$p\left[\frac{x}{\lambda_0 z_2}, \frac{y}{\lambda_0 z_2}\right] = h(x,y; z_1, p, z_2, \lambda_0)$$

$$p[-\lambda_0 z_2 \xi, -\lambda_0 z_2 \eta] \propto H(\xi,\eta); \ldots$$

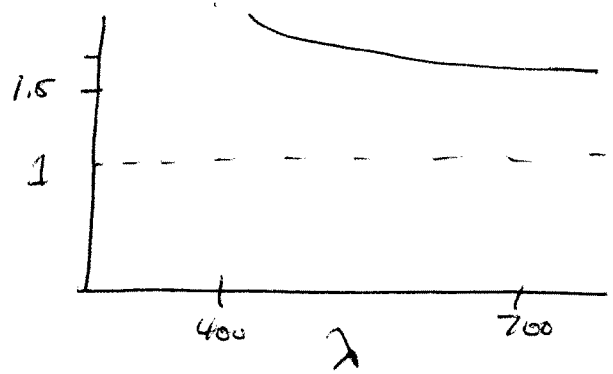
POLYCHROMATIC ⇒ ~~INCOHERENT~~

/INCOHERENT ⇒ NO PHASE RELATIONSHIP

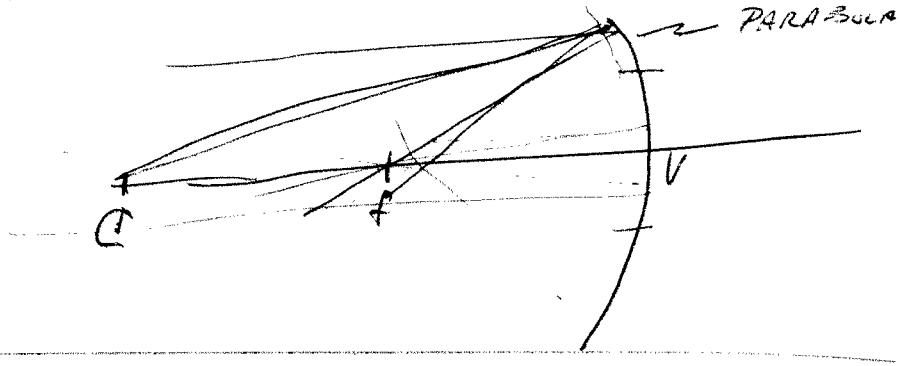
$$h[x,y] \propto |p|^2 \geq 0$$

$$p[-\lambda_0 z_2 \xi, -\lambda_0 z_2 \eta] * p[\quad]$$

INDEX OF REFRACTION → DISPERSION



$f_{RED} > f_{BLUE}$



FRESNEL EQUATIONS r_{TE} r_{TM}

POLARIZED LIGHT – LINEAR, ELLIPTICAL, CIRCULAR

INTERFERENCE DoA, DoW – ~~ABC~~ MICHELSON DoA

(YOUNG'S) DoW

RAY OPTICS