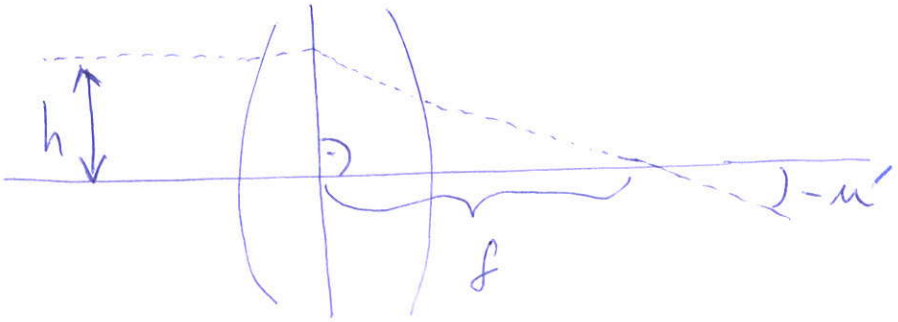
Tenká čočka



vstup $\begin{pmatrix} h \\ 0 \end{pmatrix}$

výstup
$$\begin{pmatrix} h' \\ u' \end{pmatrix} = \underbrace{\begin{pmatrix} 1 & 0 \\ -\phi_2 & 1 \end{pmatrix} \begin{pmatrix} 1 & 0 \\ -\phi_1 & 1 \end{pmatrix}}_{\begin{pmatrix} 1 & 0 \\ -\phi_1-\phi_2 & 1 \end{pmatrix}} \begin{pmatrix} h \\ 0 \end{pmatrix}$$

$$f = \frac{h}{-u'} = \frac{h}{h(\phi_1+\phi_2)} , \quad \phi_1 = (n-1)\frac{1}{R_1}, \quad \phi_2 = -(n-1)\frac{1}{R_2}$$

$$\frac{1}{f} = \phi_1 + \phi_2$$

$$\boxed{\frac{1}{f} = (n-1)\left(\frac{1}{R_1} - \frac{1}{R_2}\right)}$$

ACHROMÁT

① jednoduchá čočka

$$\frac{1}{f} = \underset{\substack{|||\\ n_c}}{(n-1)} \underbrace{\left(\frac{1}{R_1} - \frac{1}{R_2}\right)}_{A}$$

$$\frac{1}{f_F} - \frac{1}{f_C} = (n_F - n_C)\, A$$

$$\frac{1}{f_F} - \frac{1}{f_C} = \frac{n_F - n_C}{(n-1) f} = \frac{1}{V f}$$

$$V = \frac{n-1}{n_F - n_C}$$

$$\boxed{\frac{\Delta f}{f} \simeq \frac{1}{V}}$$

(2) dublet

$$\frac{1}{f} = \frac{1}{f_1} + \frac{1}{f_2} = (n_1 - 1) A_1 + (n_2 - 1) A_2$$

$$\frac{1}{f_F} = (n_{F1} - 1) A_1 + (n_{F2} - 1) A_2$$

$$\frac{1}{f_C} = (n_{C1} - 1) A_1 + (n_{C2} - 1) A_2$$

$$\frac{1}{f_F} - \frac{1}{f_C} = \frac{1}{f_1 V_1} + \frac{1}{f_2 V_2} = 0$$

$$\frac{1}{f_1 V_1} + \frac{1}{V_2}\left(\frac{1}{f} - \frac{1}{f_1}\right) = 0$$

$$\frac{1}{f_1}\left(\frac{1}{V_1} - \frac{1}{V_2}\right) = -\frac{1}{V_2 f}$$

$$\boxed{\frac{1}{f_1} = \frac{1}{f}\frac{V_1}{V_1 - V_2}}$$

pozn. malý rozdíl $V_1 - V_2$ $\Rightarrow$ velká mohutnost $\frac{1}{f_1}$

$\Rightarrow$ velké monochr. aberace

sekundární spektrum

za podmínky $\frac{1}{f_F} = \frac{1}{f_C}$ vypočteme

$$\frac{1}{f_F} - \frac{1}{f} = (n_{F_1} - n_1) A_1 + (n_{F_2} - n_2) A_2$$

$$= \frac{n_{F_1} - n_1}{n_1 - 1} \frac{1}{f_1} + \frac{n_{F_2} - n_2}{n_2 - 1} \frac{1}{f_2} \quad \Big/ \quad V = \frac{n-1}{n_F - n_C}$$

$$= \frac{n_{F1} - n_1}{n_{F1} - n_{C1}} \frac{1}{V_1 f_1} + \frac{n_{F_2} - n_2}{n_{F2} - n_{C2}} \frac{1}{V_2 f_2}$$

$$= \frac{P_1}{V_1 f_1} + \frac{P_2}{V_2 f_2}$$

$$= \frac{P_1}{V_1 f} \frac{V_1}{V_1 - V_2} + \frac{P_2}{V_2 f} \frac{V_2}{V_2 - V_1}$$

$$= \frac{P_1 - P_2}{V_1 - V_2} \frac{1}{f}$$

$$\boxed{\frac{\Delta_2 f}{f} \simeq \frac{P_1 - P_2}{V_1 - V_2}}$$

př.

$V_1 = 64{,}4 \quad V_2 = 37{,}27$

$$\underbrace{P_1 = 0{,}4532 \quad P_2 = 0{,}4689}$$

$$\frac{\Delta_2 f}{f} \sim \frac{1}{2000}$$

(3) triplet

$$\frac{1}{f} = \frac{1}{f_1} + \frac{1}{f_2} + \frac{1}{f_3} \qquad (1)$$

$$\frac{1}{f_F} = \frac{1}{f_{F1}} + \frac{1}{f_{F2}} + \frac{1}{f_{F3}} \qquad (2)$$

$$\frac{1}{f_C} = \frac{1}{f_{C1}} + \frac{1}{f_{C2}} + \frac{1}{f_{C3}} \qquad (3)$$

z (2) = (3)

$$\frac{1}{f_1 V_1} + \frac{1}{f_2 V_2} + \frac{1}{f_3 V_3} = 0 \qquad (4)$$

z (1) = (2)

$$\frac{P_1}{f_1 V_1} + \frac{P_2}{f_2 V_2} + \frac{P_3}{f_3 V_3} = 0 \qquad (5)$$

řeším (1), (4) a (5)

pro f_1, f_2, f_3 jako funkce f, V_j, P_j