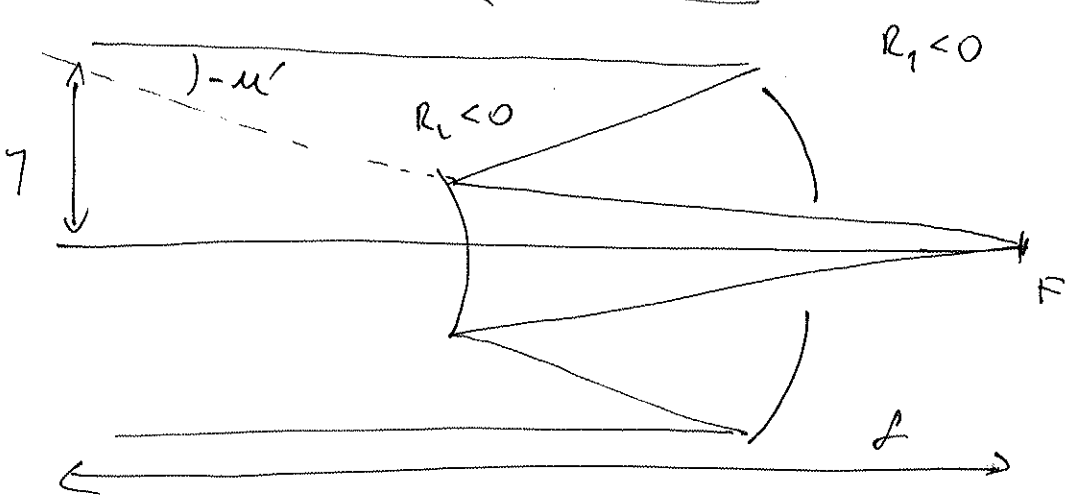
Cassegrain

$t = -|d| = -d$, $d > 0$



$$\begin{pmatrix} 1 & 0 \\ -\phi_2 & 1 \end{pmatrix}\begin{pmatrix} 1 & \frac{+1}{-1} \\ 0 & 1 \end{pmatrix}\begin{pmatrix} 1 & 0 \\ -\phi_1 & 1 \end{pmatrix} = \begin{pmatrix} 1 & 0 \\ -\phi_2 & 1 \end{pmatrix}\begin{pmatrix} 1-d\phi_1 & d \\ -\phi_1 & 1 \end{pmatrix}$$

$$= \begin{pmatrix} 1-d\phi_1 & d \\ -\phi_1-\phi_2+d\phi_1\phi_2 & 1-d\phi_2 \end{pmatrix}\begin{pmatrix} y \\ 0 \end{pmatrix}$$

$$\frac{y}{f} = -u' = (\phi_1+\phi_2-d\phi_1\phi_2)\,y$$

$$\frac{1}{f} = -\frac{2}{R_1} + \frac{2}{R_2} - d\left(\frac{-2}{R_1}\right)\left(\frac{2}{R_2}\right)$$

$$\frac{1}{f} = \frac{1}{f_1} + \frac{1}{f_2} - \frac{d}{f_1 f_2}$$

$$\frac{1}{f} = \frac{f_1+f_2-d}{f_1 f_2}$$

$$f = f_1\frac{f_2}{f_1+f_2-d}$$

$$\phi_1 = \frac{-1-1}{R_1} = -\frac{2}{R_1}$$

$$\phi_2 = \frac{1-(-1)}{R_2} = \frac{2}{R_2}$$

$$f_1 = -\frac{R_1}{2} > 0$$

$$f_2 = \frac{R_2}{2} < 0$$

$|f_1| - |f_2| > d \Rightarrow f < 0$

$|f_1| - |f_2| < d \Rightarrow f > 0$ ✓

$|f_1| - |f_2| = d \Rightarrow f = \infty$

↗

Afokální soustava

CASSEGRAIN

ALTERNATIVNÍ ODVOZENÍ (podobnost Δ)

$$f = M f_1$$

$$\frac{D_1}{f} = \frac{D_2}{b+d} \quad | \quad \frac{D_1}{f_1} = \frac{D_2}{f_1 - d}$$

$$\frac{D_1}{D_2} = \frac{f}{b+d} = \frac{f_1}{f_1 - d} \Rightarrow \boxed{M = \frac{f}{f_1} = \frac{b+d}{f_1 - d}}$$

Zobr. rovnice pro sek. zrcadlo (virtuální předmět)

$$-\frac{1}{|s|} + \frac{1}{|s'|} = \frac{1}{f_2}$$

$$-\frac{1}{f_1 - d} + \frac{1}{b+d} = \frac{1}{f_2} \quad / \times (f_1 - d)$$

$$\frac{f_1 - d}{b+d} = \frac{f_1 - d}{f_2} + 1 = \frac{f_1 + f_2 - d}{f_2} = \frac{1}{M}$$

$$\boxed{f = \frac{f_1 f_2}{f_1 + f_2 - d}}$$

Parametry Cassegrainu z m, f_1, b

$$f = f_1 \frac{f_2}{f_1 + f_2 - d} \Rightarrow \quad m = \frac{f_2}{f_1 + f_2 - d} \quad (1)$$

z podobnosti: $m = \frac{b + d}{f_1 - d}$ (2)

(1) $\Rightarrow$ $m(f_1 + f_2 - d) = f_2$

(2) $\Rightarrow$

$$f_2(m-1) - dm = -mf_1$$
$$-(m+1)d = -mf_1 + b$$

řeším pro d, f_2 jako fce m, f_1, b

$$d = \frac{mf_1 - b}{m+1}$$

$$(m-1)f_2 = md - mf_1 = \frac{m^2 f_1 - mb}{m+1} - mf_1 = \frac{\cancel{m^2 f_1} - mb - \cancel{m^2 f_1} - mf_1}{m+1}$$

$$f_2 = -\frac{m}{m^2 - 1}(f_1 + b)$$

tvarování zrcadel

$$z_1 = \frac{r_1^2}{2R_1}, \quad z_2 = \frac{r_2^2}{2R_2} + \left[1 - \left(\frac{m+1}{m-1}\right)^2\right] \frac{r_2^4}{8R_2^3} \qquad \text{(klas.)}$$

$$z_1' = \frac{r_1^2}{2R_1} + (1+K_1)\frac{r_1^4}{8R_1^3}, \quad z_2' = \frac{r_2^2}{2R_2} + (1+K_2)\frac{r_2^4}{8R_2^3} \qquad \text{(obec.)}$$

$$\Delta z_1 = (1+K_1)\frac{r_1^4}{8R_1^3}$$

$$\Delta z_2 = \left[K_2 + \left(\frac{m+1}{m-1}\right)^2\right]\frac{r_2^4}{8R_2^3}$$

$$K_1 + 1 = \left[K_2 + \left(\frac{m+1}{m-1}\right)^2\right] \underbrace{\frac{r_2^4}{r_1^4}\frac{R_1^3}{R_2^3}}_{\alpha > 0}$$

$$\alpha = \left(\frac{f_1 - d}{f_1}\right)^4 \left(\frac{f_1}{f_2}\right)^3 = \frac{f_1 - d}{f_1}\left(\frac{f_1 - d}{f_2}\right)^3 < 1$$

$\rightarrow |f_1 - d| < |f_2|$

jinak divergovaný za M2