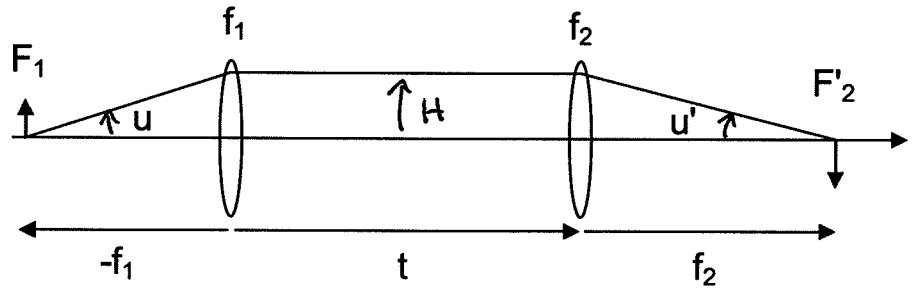
Lenses with Separation t



a) Magnification

$$u = \frac{H}{f_1} \qquad u' = -\frac{H}{f_2}$$

$$m = \frac{u}{u'} = -\frac{f_2}{f_1}$$

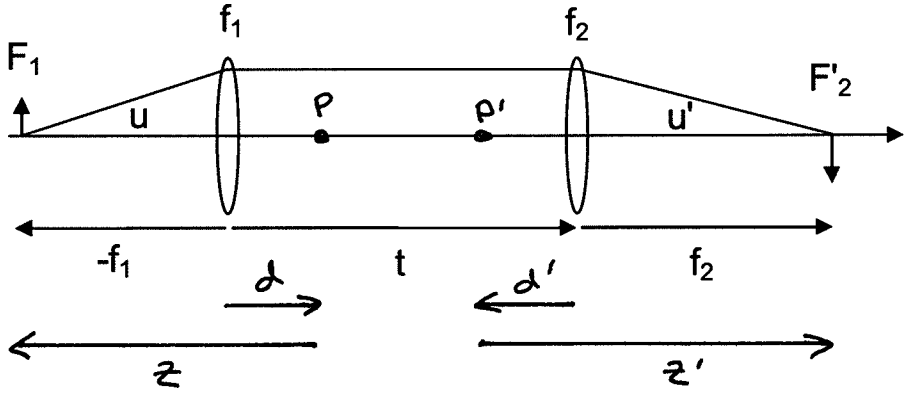
b) Power

$$\phi = \phi_1 + \phi_2 - \phi_1 \phi_2 t$$

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

A function of t!

c)



$$z = -d - f_1 \qquad z' = f_2 - d'$$

$$m = z'/z$$

$$d = \frac{\phi_2}{\phi} t \qquad d' = -\frac{\phi_1}{\phi} t$$

$$d = \frac{\phi_2 t}{\phi_1 + \phi_2 - \phi_1 \phi_2 t} \qquad d' = \frac{-\phi_1 t}{\phi_1 + \phi_2 - \phi_1 \phi_2 t}$$

$$z = -d - f_1 = \frac{-\phi_2 t - f_1(\phi_1 + \phi_2 - \phi_1 \phi_2 t)}{\phi_1 + \phi_2 - \phi_1 \phi_2 t}$$

$$z' = f_2 - d' = \frac{f_2(\phi_1 + \phi_2 - \phi_1 \phi_2 t) + \phi_1 t}{\phi_1 + \phi_2 - \phi_1 \phi_2 t}$$

$$m = \frac{z'}{z} = \frac{f_2(\phi_1 + \phi_2 - \phi_1 \phi_2 t) + \phi_1 t}{-f_1(\phi_1 + \phi_2 - \phi_1 \phi_2 t) - \phi_2 t}$$

$$m = \frac{f_2/f_1 + 1 - t/f_1 + t/f_1}{-1 - f_1/f_2 + t/f_2 - t/f_2} = \frac{f_2/f_1 + 1}{-f_1/f_2 - 1}$$

$$m = \frac{\frac{f_2 + f_1}{f_1}}{\frac{f_1 + f_2}{-f_2}} = -\frac{f_2}{f_1}$$

Independent of t.

As t varies, both the focal length and principal plane locations move.