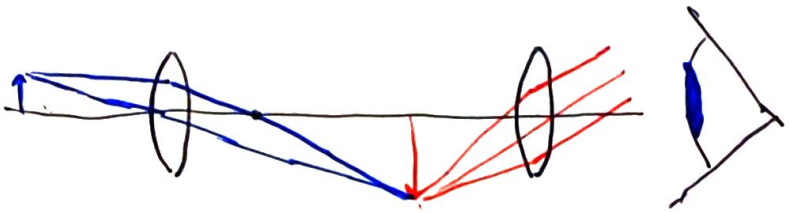
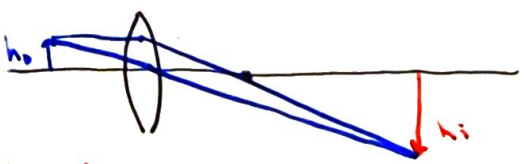
Week 4

Compound microscope



Objective

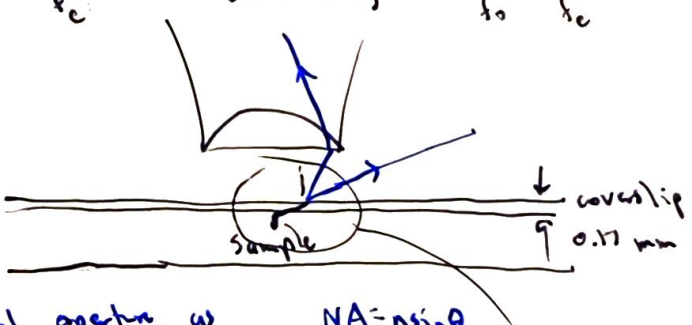


$$\frac{h_i}{L} = \frac{h_o}{f}$$

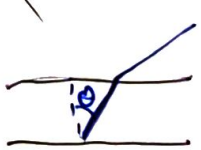
$$\frac{h_i}{h_o} = \frac{L}{f_o}$$

eyepiece: $m_e = \frac{25}{f_e}$ overall mag: $= \frac{-L}{f_o} \cdot \frac{25}{f_e}$

Numerical aperture



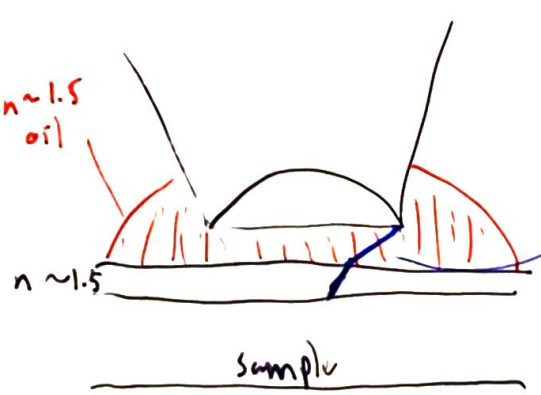
define numerical aperture as $NA = n\sin\theta$



when the light is just barely caught

up to ~0.6 for air, n=1

less refraction happening



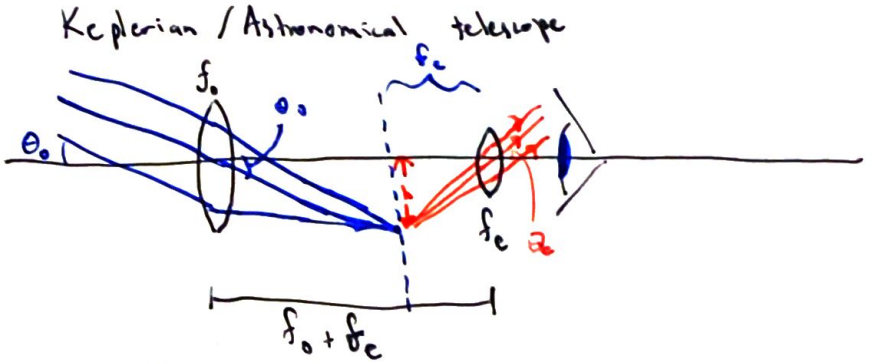
- brighten the image
- also increases the resolution
  ability to separate point objects

in this case $NA = 1.5 \sin\theta$

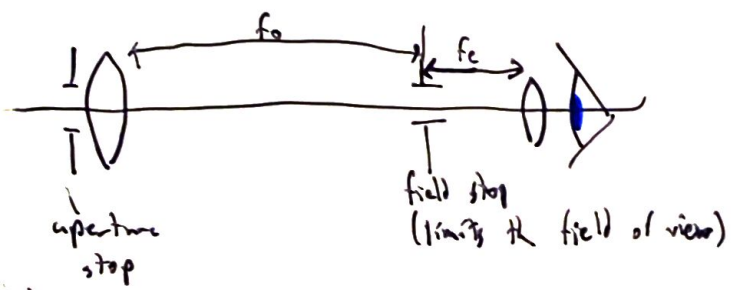
now can go up to ~1.3 to 1.6

$$R = \frac{\lambda}{2(NA)} \quad \text{(Abbé's result)}$$

Telescope



$$\theta_o = \frac{h}{f_o} \qquad \theta_e = \frac{h}{f_e} \qquad m_\theta = \frac{\theta_e}{\theta_o} = \frac{-f_o}{f_e}$$



determines the cone of rays entering the telescope

in this case this AS is also the entrance pupil

the entrance pupil is the image of the aperture stop in any lens that precedes it

the exit pupil is the image of the aperture stop in the lens following