Phys 5B: Lenses III

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- Compound microscope (Not simple magnifier!)

  Object's image at foal point of eyepiece

  - Object is not at $d_0 = \infty$ (like for telescope)
  - Object is NEAR objective

    $\Rightarrow$image is not at f_0, but at $d_i > f_0$

    $d_i = l - f_e$

    $\frac{1}{d_i} = \frac{1}{f_0} - \frac{1}{d_0} \Rightarrow \frac{1}{l - f_e} = \frac{1}{f_0} - \frac{1}{d_0}$

  - Linear Magnification of Objective

    $m_0 = \frac{h_i}{h_0} = \frac{-d_i}{d_0} = \frac{-(l - f_e)}{d_0}$

    If the eyepiece magnification $M_e = \frac{N}{f_e}$

    Total magnification: $M = M_e m_0 \Rightarrow \frac{N}{f_e}\left(\frac{l - f_e}{d_0}\right)$

- Combo telescope/microscope

  Two lenses: $f_0 = 20\text{cm}$, $f_e = 2.0\text{cm}$

  for Telescope: $l = f_0 + f_e \Rightarrow 20 + 2.0 = 22\text{cm}$

  $M = \frac{-f_0}{f_e} \Rightarrow \frac{-20}{2} = -10$

  For Microscope: $M = \frac{-\text{Nl}}{f_e f_0} = \frac{-(2.5 \times 40\text{cm})}{2 \times 20} = 25X$

I. Light as a wave => Physical Optics

   Diffraction and Interference

   - Wavefront

     Huygen's Construction: distance $r = \text{vt}$

     Matches speed of wave v.

     Wavefront $\perp$V