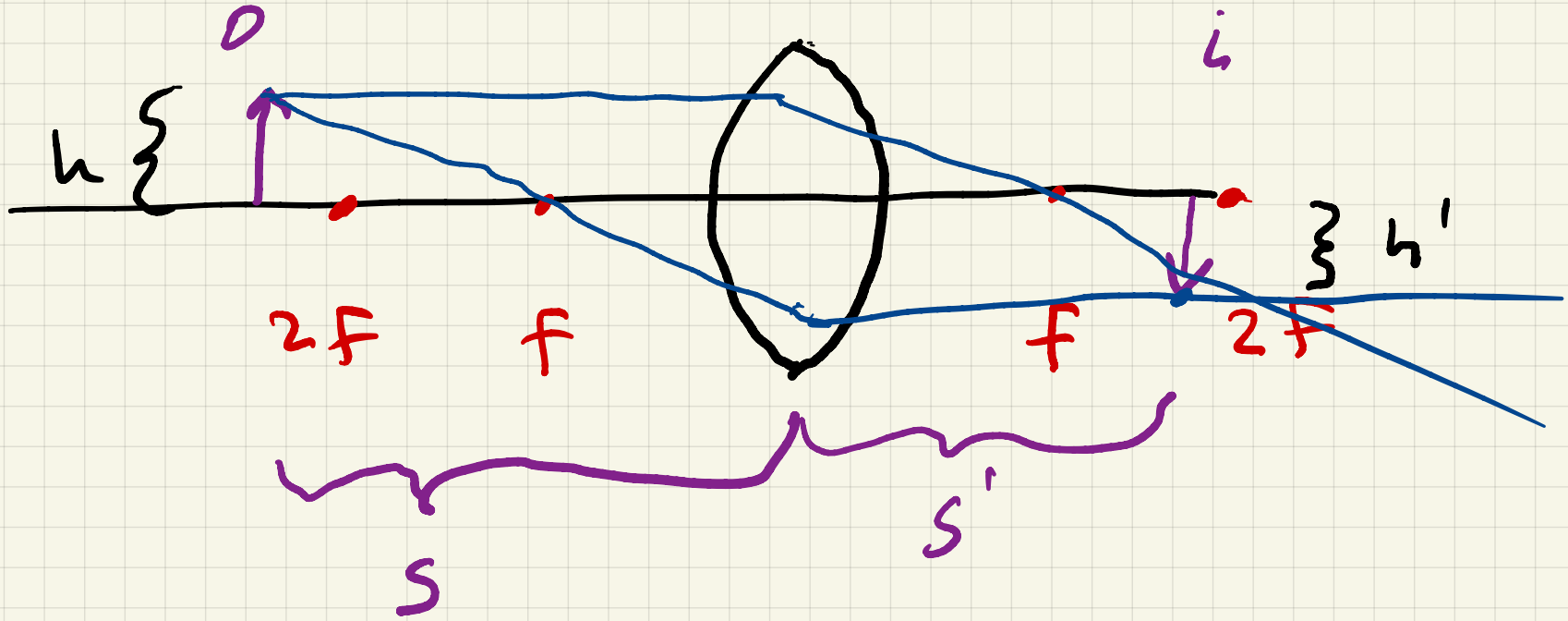
Phys 213 lecture 9

Phys 213 Lecture 9 9/13/21

- Quiz #3 Friday
- Lab ⇒ Thin lenses
- HW 2 - posted soon (but not due this week)
- Zoom (rest of week)
- record Cameras on if possible please

Today: Thin lenses & ray tracing, optical instruments



thin lens formula

$$\frac{1}{f} = \frac{1}{s} + \frac{1}{s'}$$

$$M = \frac{h'}{h} = -\frac{s'}{s}$$

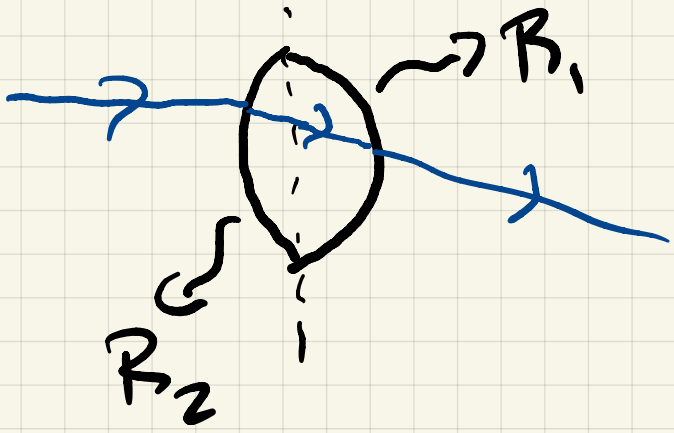
if $s = 25$ cm & $f = 10$ cm

find s' & M $\Rightarrow$ $\frac{1}{10} = \frac{1}{25} + \frac{1}{s'}$

$$\frac{1}{25} - \frac{1}{10} = -\frac{1}{s'} \qquad s' = -\left(\frac{1}{25} - \frac{1}{10}\right)^{-1}$$

then $M = -\frac{s'}{s}$

Lens makers Formula



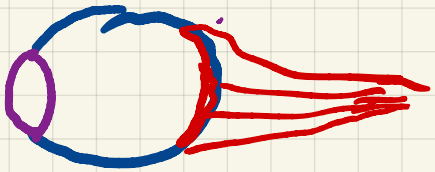
$$\frac{1}{f} = (n-1)\left(\frac{1}{R_1} - \frac{1}{R_2}\right)$$

n = index of refraction

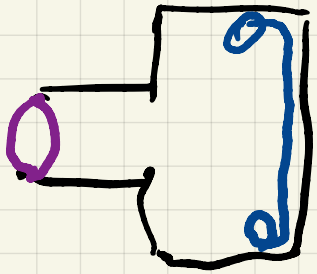
R is positive if convex toward the object

Chapter 35 optical instruments

1) the eye



2) camera



3) microscope

4) telescopes

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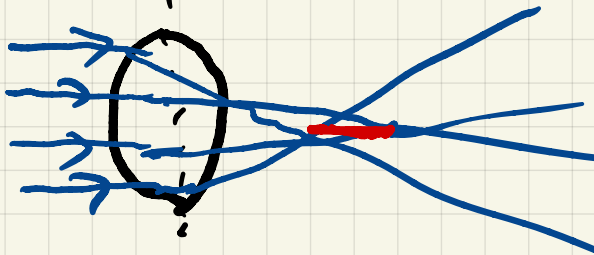
2 types of thin lens aberrations

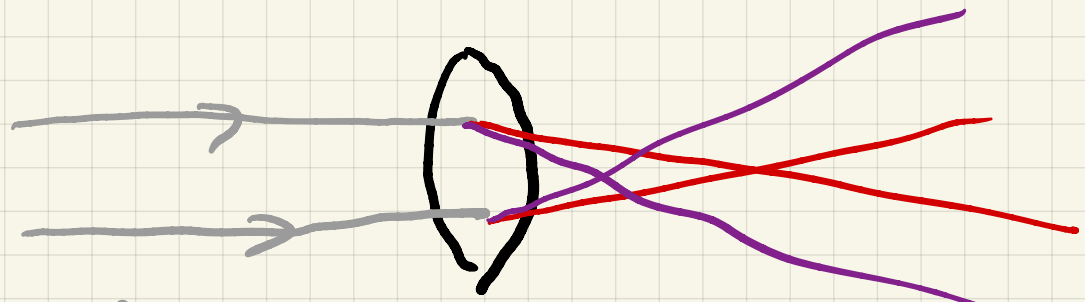
1) spherical -



can cause blurry image
can be fixed with thin lens or non-spherical lens

2) chromatic

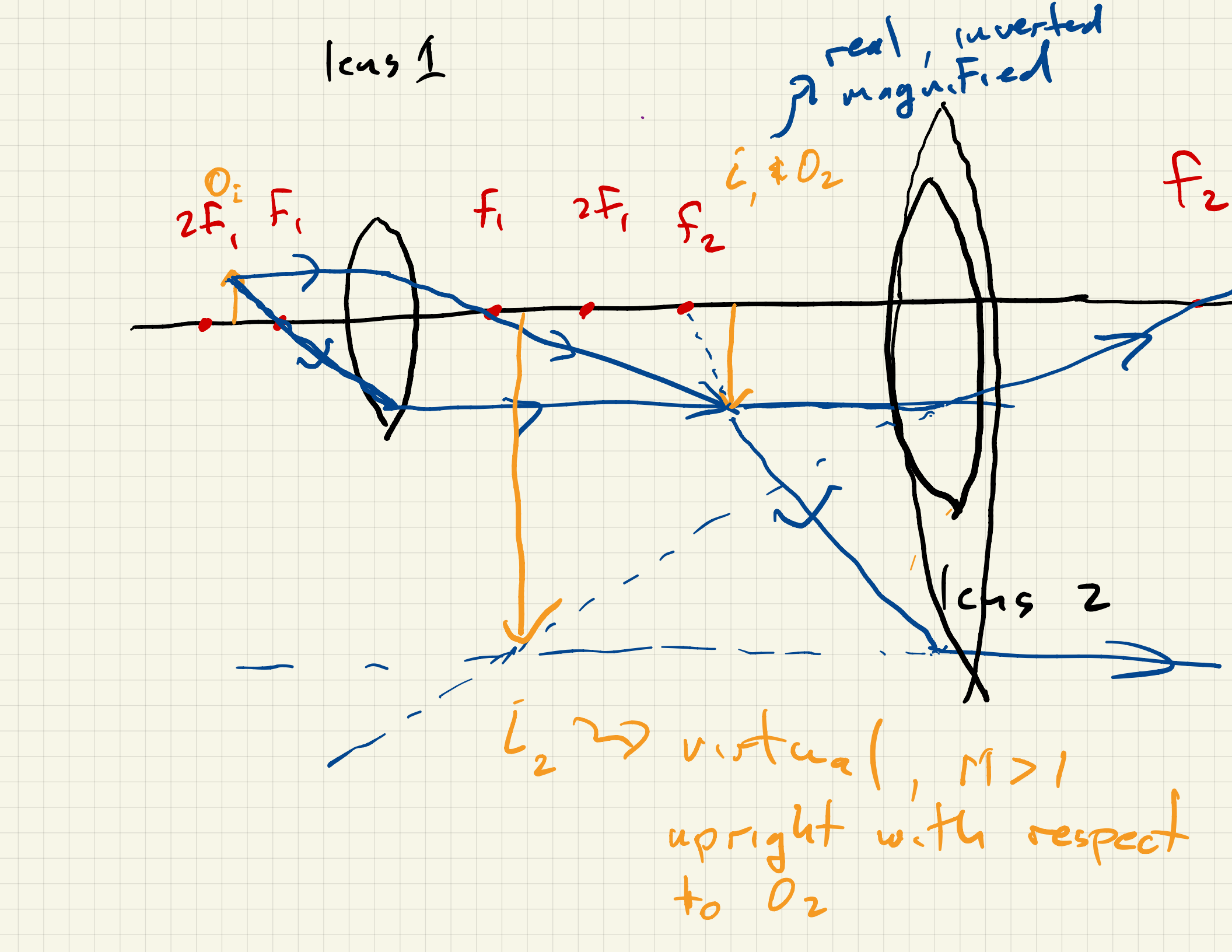
chromatic aberation



↳ white light

different colors get focused at different locations

correct using multiple lenses and using coatings on the lenses


Lens 1
real, inverted
magnified
O_i
$2F_1$
F_1
f_1
$2F_1$
f_2
$i_1 \& O_2$
f_2
Lens 2
i_2 → virtual, $M > 1$
upright with respect
to O_2