Physics 102

Lecture 24.

Friday, Nov. 5, 2004

- Refraction.

  Snell's Law.

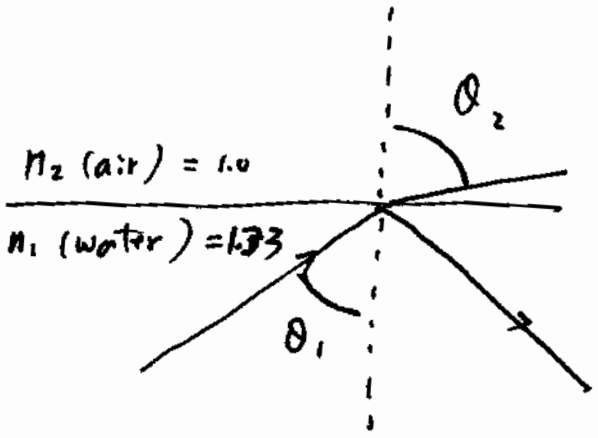
$$n_1 \sin\theta_1 = n_2 \sin\theta_2$$

- Total internal reflection.

  When light is going from a medium with a higher index of refraction to a medium with a lower index of refraction. (e.g., water to air).

  There exist a critical angle:

$$\theta_c = \sin^{-1}\left(\frac{n_2}{n_1}\right)$$

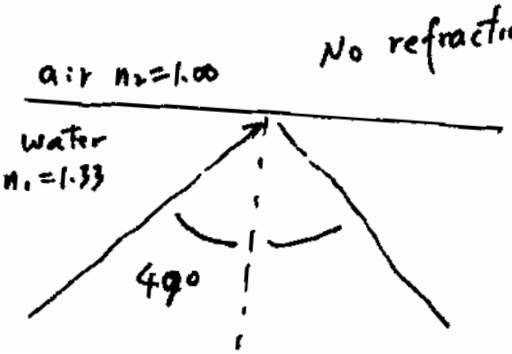


when $\theta_i > \theta_c$.

Then, total internal reflection!

No refraction anymore!

e.g: $\theta_c = \sin^{-1}\left(\frac{1.0}{1.33}\right) \approx 48.8°$.



- Image

Demo.

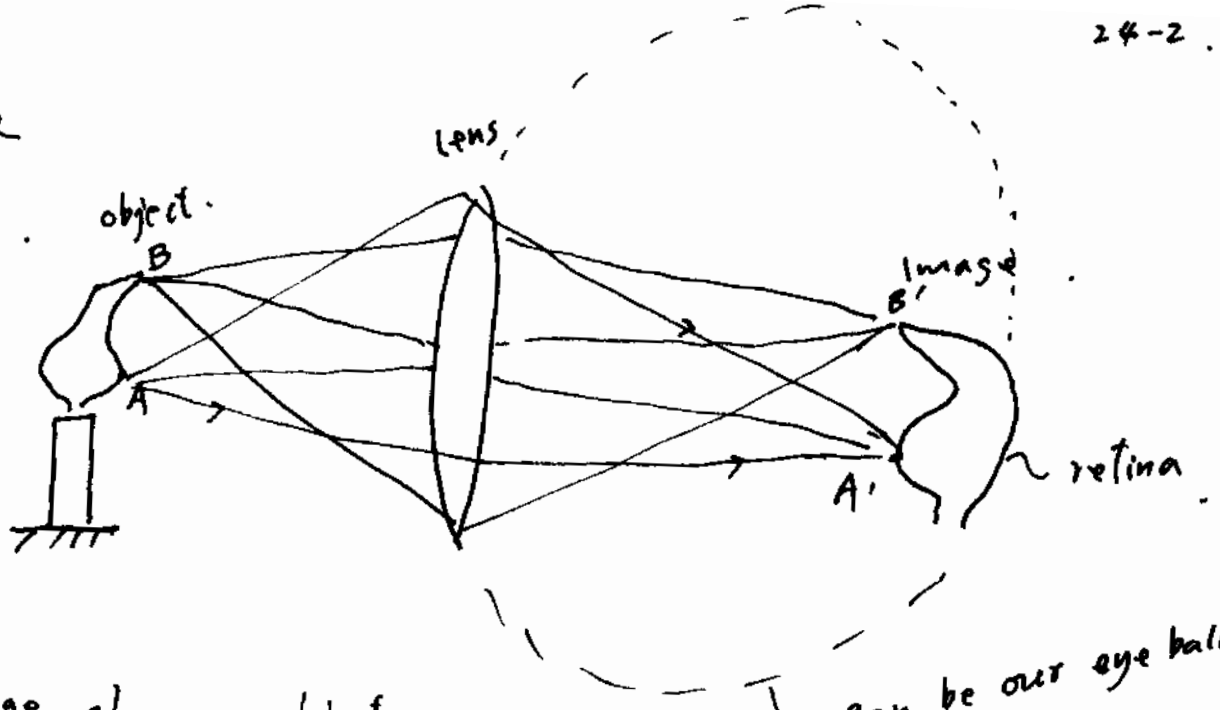


Image of an object : ↳ can be our eye ball.

One-To-one mapping of point sources of light.

$A \longrightarrow A'$

$B \longrightarrow B'$

.....

- Real image on the screen.

When the image is formed on the screen, light is reflected (scattered, emitted) at every point of the image, to all the directions.

(Real : light rays actually cross there) ↖ image.

- Questions :

Can we see the image without the screen ?

- Demo.

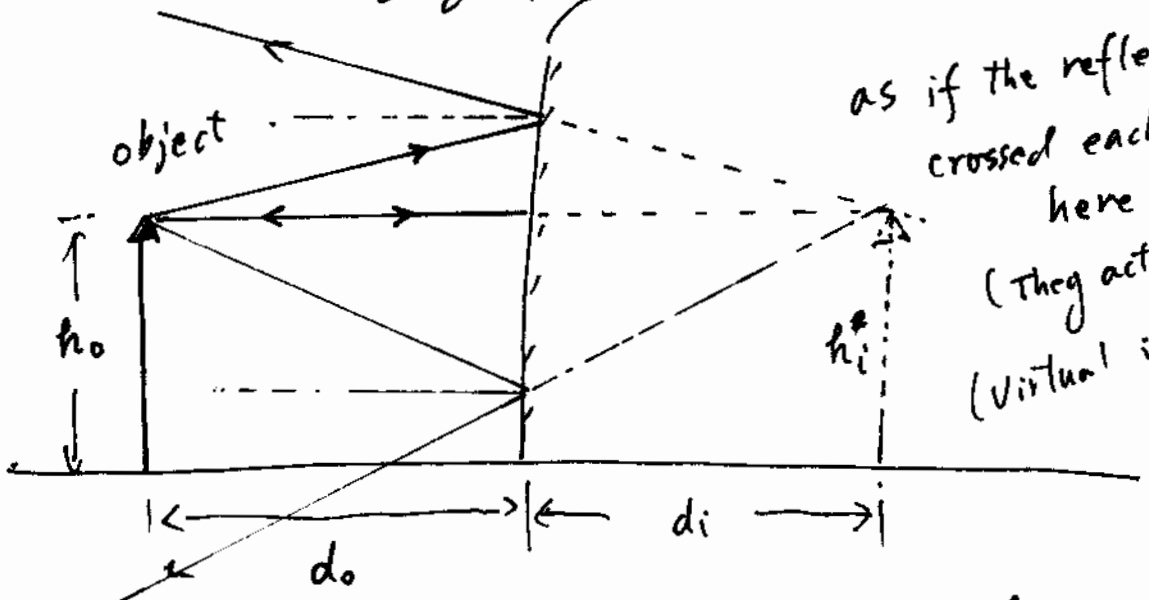
Screen.
(removed later.

Why do we need a screen when seeing a movie?

(More people can see it).

Images on the screen are sending lights to all directions.

- Plane-mirror Imaging.



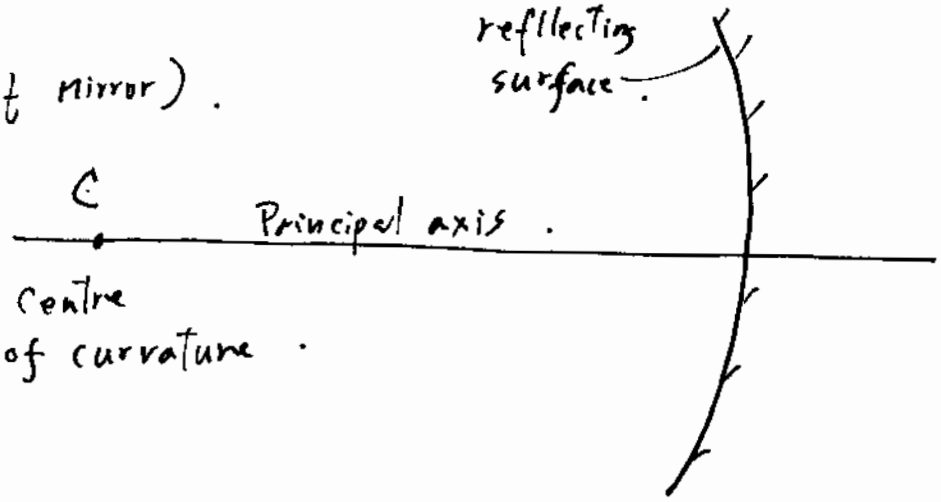
as if the reflected rays crossed each other here.
(They actually don't!)
(Virtual image.

Use two or three rays to locate the image of a point object.

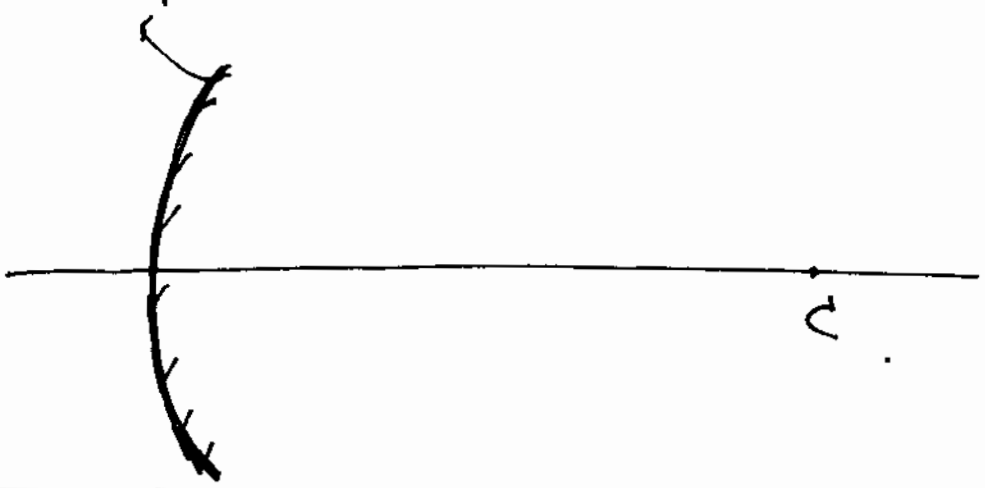
$h_o = h_i$, (upright). $\quad d_o = -d_i$. $\quad \begin{cases} + & \text{— in front of mirror} \\ - & \text{— behind the mirror.} \end{cases}$

- Spherical Mirrors.

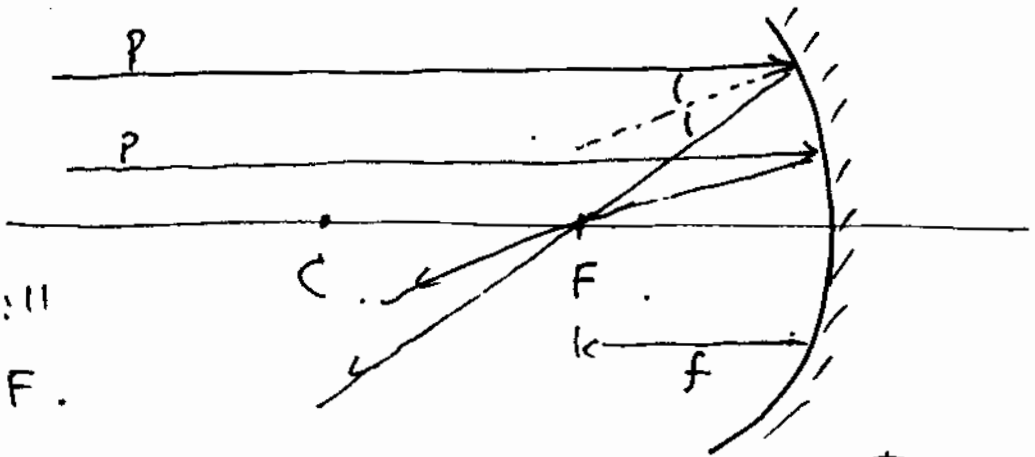
— Concave.
(C is in front of Mirror).



— Convex.
C is behiold the Mirror.



- Small angle approximation. ($\sin\theta \approx \theta \approx \tan\theta$.)

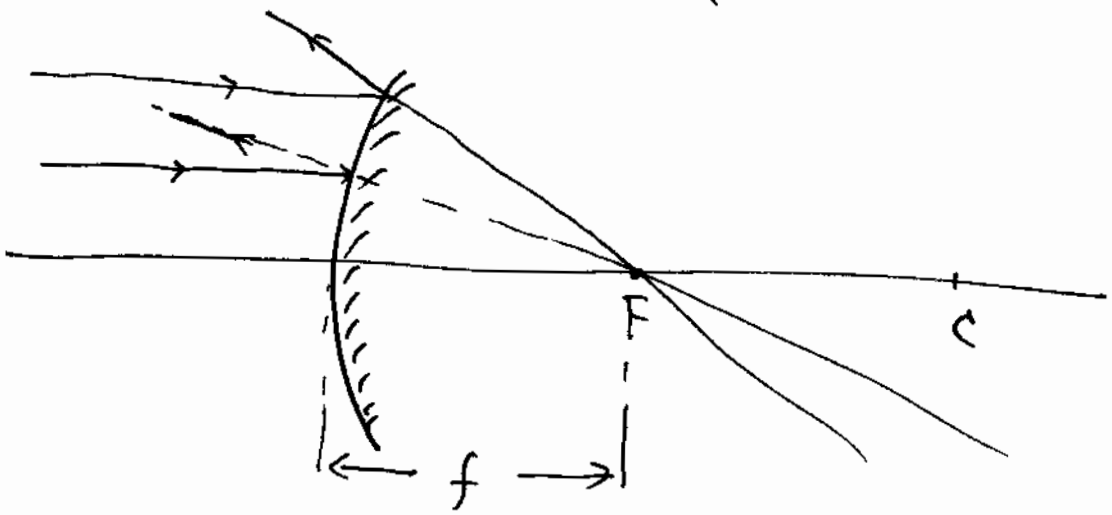


P rays will cross at F.

$f = \frac{1}{2}R$. R — radius of curvature.

All the rays parallel to the principal axis will cross (after reflecting from the mirror) a point ∧—— Focal point. (F).
(Focus).

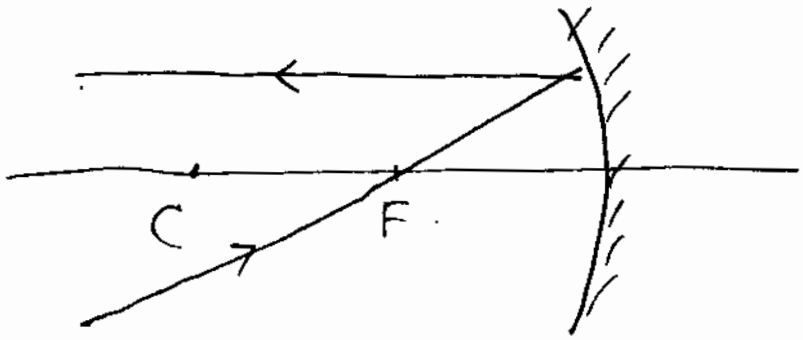
For a convex mirror, The ~~refled~~ extension of reflected rays will meet at F.

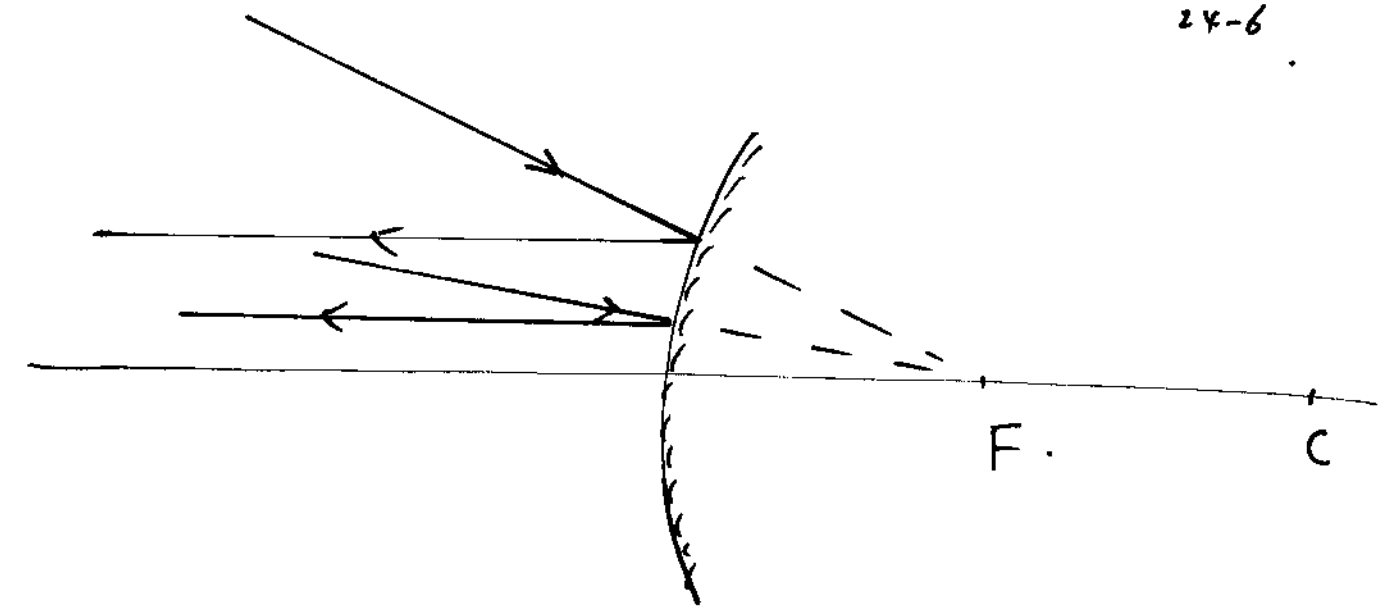


$f = -\frac{1}{2}R$. (−) — behind the mirror.

- Light Rays are reversable.

If a ray passes through the focus of a mirror, the ~~reflect~~ reflected Ray will be parallel ~~to~~ to the principal axis





• Find the image of an object by Ray Tracing.

↑ location, size, orientation.

- Representative rays. (Principal rays).

① P ray : The parallel ray reflects through the focal point.

② F ray : The focal ray reflects parallel to the axis.

③ C ray : The centre-~~of~~-curvature ray reflects back along its incoming path.

Any two of them will determine the image.

We can use the third as a check.