

The Fresnel Lens



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Lighthouse of CAPO MISENO NAPOLI



Fresnel best known as the inventor of the Fresnel lens.



A Fresnel lens is a type of compact [lens](#) originally developed by [French physicist Augustin-Jean Fresnel](#) for [lighthouses](#).

The design allows the construction of lenses of large [aperture](#) and short [focal length](#) without the mass and volume of material that would be required by a lens of conventional design.

A Fresnel lens can be made much thinner than a comparable conventional lens, in some cases taking the form of a flat sheet.

A Fresnel lens can capture more oblique light from a light source, thus allowing the light from a lighthouse equipped with one to be visible over greater distances.

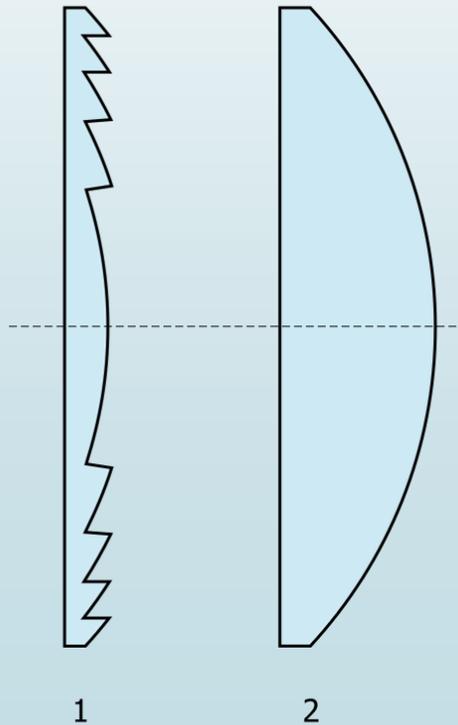
The Fresnel lens is invented in 1822 by the French physicist Augustine Fresnel. The lens could be as tall as twelve feet high with concentric rings of glass prisms above and a center drum section below to bend the light into a narrow beam.



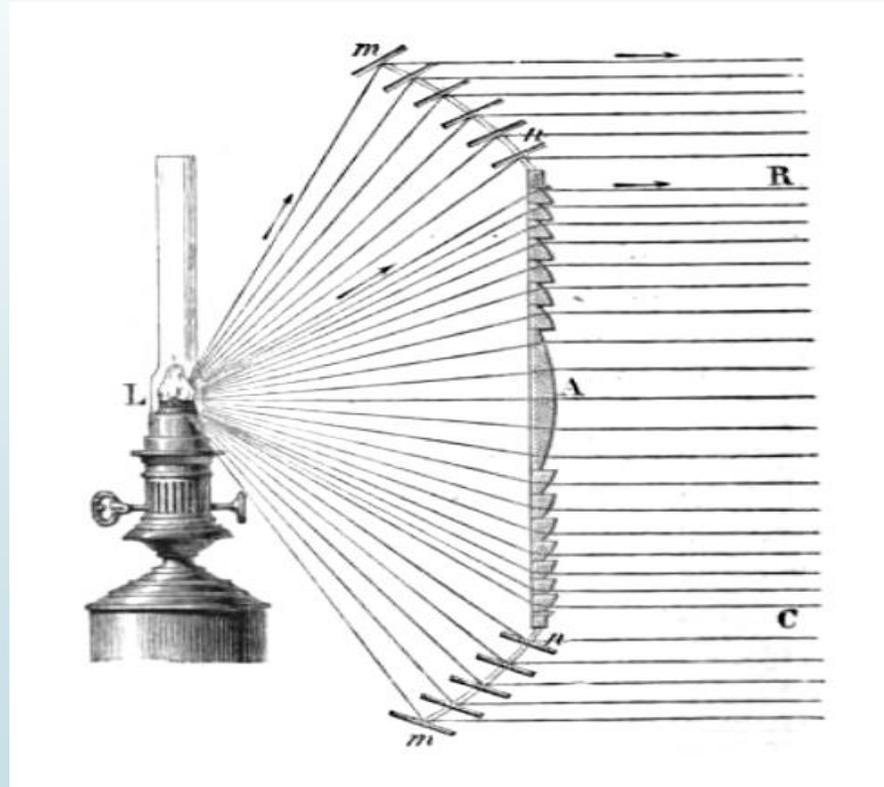
Because of its amazing efficiency, a Fresnel lens could easily throw its light 20 or more miles to the horizon. Lens designs resembled a giant glass beehive, with a light at the center .

The Fresnel lens reduces the amount of material required compared to a conventional lens by dividing the lens into a set of concentric annular sections. An ideal Fresnel lens would have an infinite number of sections. In each section, the overall thickness is decreased compared to an equivalent simple lens.

This effectively divides the continuous surface of a standard lens into a set of surfaces of the same curvature, with stepwise discontinuities between them.

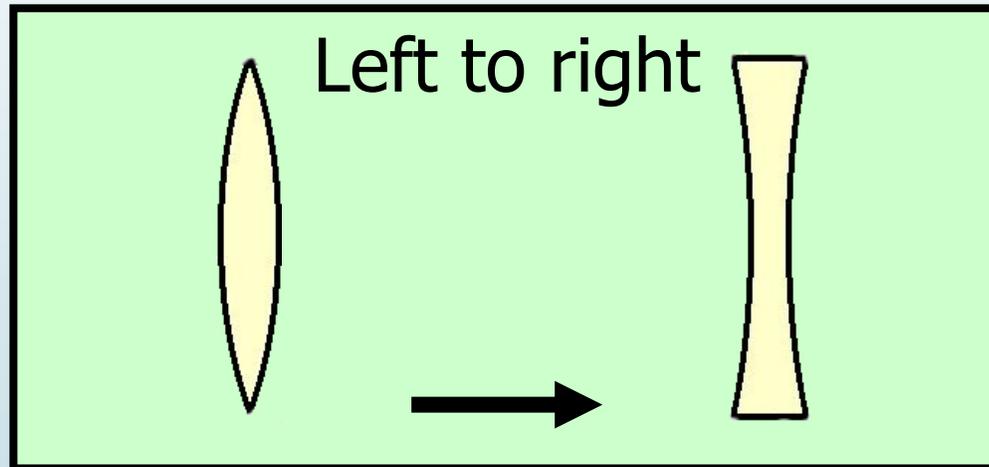


IN SOME lenses, the curved surfaces are replaced with flat surfaces, with a different angle in each section. Such a lens can be regarded as an array of prisms arranged in a circular fashion, with steeper prisms on the edges, and a flat or slightly convex center. In the first (and largest) Fresnel lenses, each section was actually a separate prism. 'Single-piece' Fresnel lenses were later produced, being used for automobile headlamps, brake, parking, and turn signal lenses, and so on.



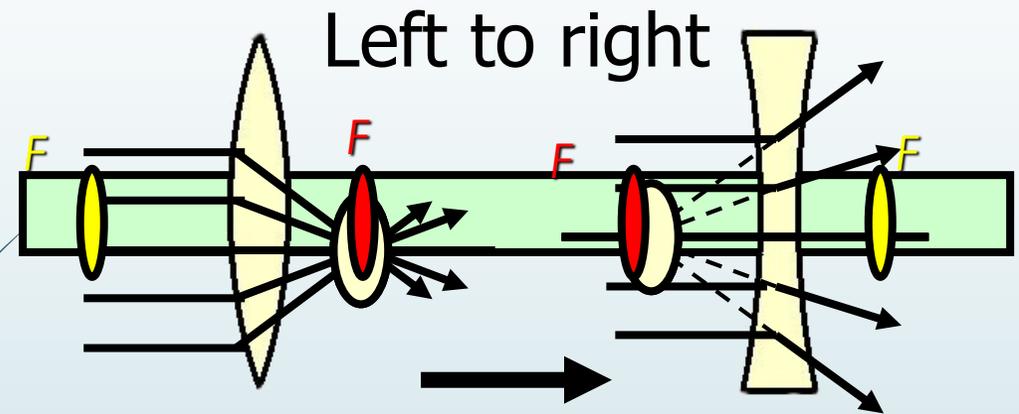
The Principal Focus

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- Since light can pass through a lens in both directions, there are two focal points for each lens.



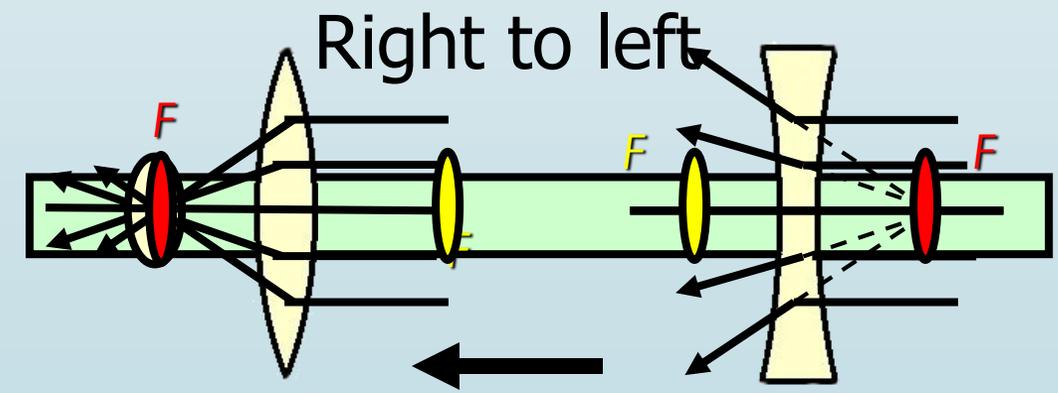
The Principal Focus

Since light can pass through a lens in both direction, there are two focal points for each lens.



The **principal** focal point F is shown here. Yellow F is the other one.

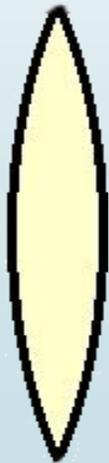
Now suppose light moves from right to left instead.



Types of Converging Lenses

In order to converge light a lens must be thicker at the the midpoint to allow more bend.

Double-convex lens



Plano-convex lens



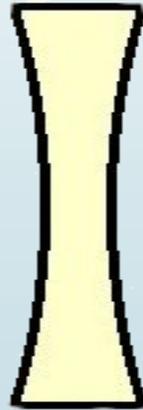
Converging meniscus lens



Types of Diverging Lenses

In order to diverge light, lens must be thinner at the midpoint to allow more bend.

Double-concave
lens



Plano-concave
lens



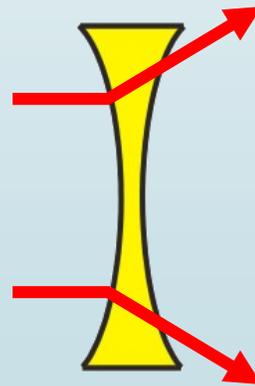
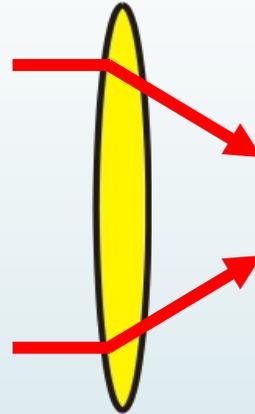
diverging meniscus
lens



REMEMBER

CONVEX LENSES ARE THICKER IN THE MIDDLE AND THUS CONVERGE LIGHT RAYS

CONCAVE LENS ARE THINNER IN THE MIDDLE AND THUS DIVERGE LIGHT RAYS





Generally Fresnel lenses are divided into 7 classes (called "orders").

The order is determined by the distance of the flame from the lens.

The "First Order Fresnel lens" is the largest lens widely used, and was installed in many of the largest "sea coast lights". Two larger sizes were built in limited quantity and they are of special installations. Smaller Fresnel lenses, such as the sixth-order lens, were common in the Great Lakes lighthouses.



ORDER-HEIGHT

Order	Height	Inside Diameter
First	7' 10"	6' 1"
Second	6' 1"	4' 7"
Third	4' 8"	3' 3"
Third and 1/2	3' 0"	2' 5 1/2"
Fourth	2' 4"	1' 8"
Fifth	1' 8"	1' 3"
Sixth	1' 5"	1' 0"

The Characteristics of the lighthouse

A **characteristic** of light is a graphic and text description of a navigational light sequence or of a colour displayed on a [nautical chart](#) or in a [light List](#) with the chart symbol for a [lighthouse](#) ,[light vessel](#) a [buoy](#) or [sea mark](#) with a [light](#) on it.

The instants of bright light are arranged to create a [light characteristic](#) or, a specific pattern for a lighthouse

The graphic indicates how the real light may be identified, looking at its actual light output type or sequence.

Different lights use different colours, frequencies and light patterns, so sailors can identify which light they see.

	luce lampeggiante FLASHING light	luce intermittente FLICKER light	luce isofase ISOPHASE light	luce scintillante SPARKLING light	luce fissa FIXED light
segnale					
descrizione	daylight < darkness	Daylight > darkness	Daylight = darkness	sequenza di brevi lampi	No darkness
simbolo nazionale	lam	int	iso	sc	F
simbolo internazionale	Fl	Oc	Iso	Q	F

Thank you for your kind attention



Progetto a cura delle professoresse

Cervo Matilde e De Vico Eva

