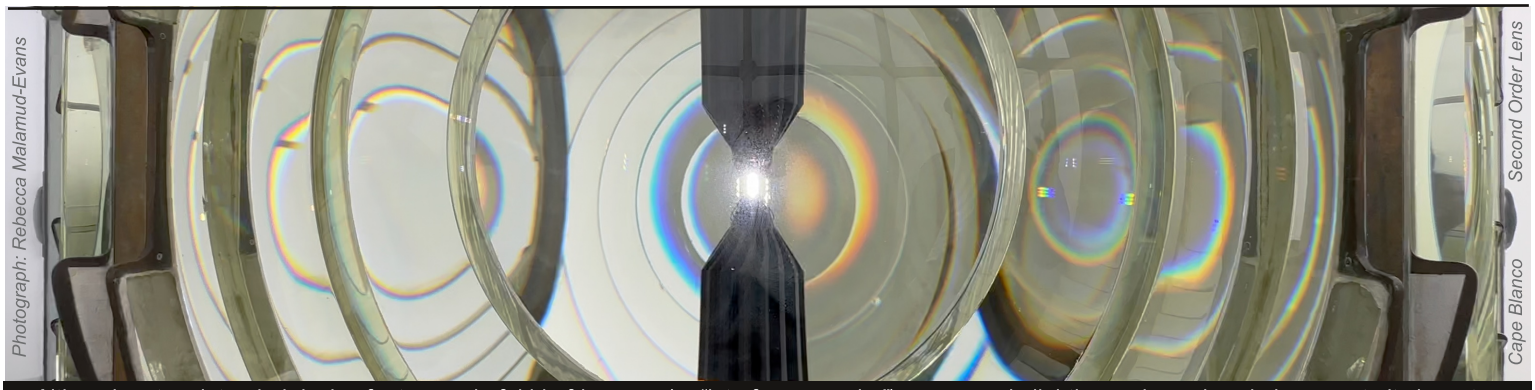
CBHS NEWS of NOTE ~ APR 2026

CAPE BLANCO LIGHTHOUSE ~ 1870

A MONTHLY PUBLICATION
of the
CAPE BLANCO
HERITAGE SOCIETY

CBHS BOARD MEETINGS: Currently held at Point.B Studio at 10:00 AM on the 2nd Tuesday of every month.
PLEASE NOTE: Our meetings are open to everyone who would like to attend. We invite and encourage anyone interested in CBHS to participate!

The Optical Artistry of Augustin-Jean Fresnel



Although not an intended design feature, colorful birefringence (or "interference color") can occur in lighthouse lens glass in homage to its inventor.

The Fresnel lens has been capturing the imagination of artists and engineers since 1822 when it was first developed by French civil engineer and physicist Augustin-Jean Fresnel. His research in optics led to the almost unanimous acceptance of the wave theory of light, temporary supplanting Isaac Newton's corpuscular theory that states that light is made up of small discrete particles which travel in a straight line *(modern physics recognizes wave-particle duality)*. His findings were published in his 1818 *Memoir on the Diffraction of Light*. Fresnel submitted that work to the French Academy of Sciences in 1819 when he learned that the Grand Prix for that year would be given for the best work on diffraction *(which fascinated the brilliant physicist)*. This fateful event would lead to a collaboration with François Arago, the namesake of the Cape Arago Lighthouse. Fresnel and Arago formed a crucial partnership that established the wave theory of light. Together, they studied the polarization of light, developed the Fresnel–Arago laws of interference, and worked on lighthouse lens improvements, with Arago championing Fresnel's mathematical work.

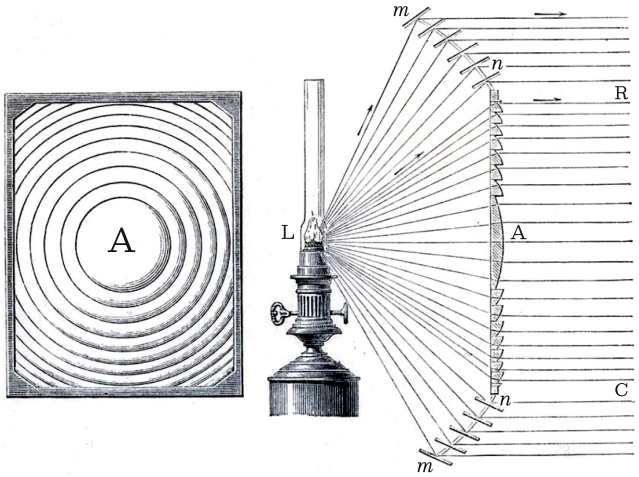
Isaac Newton's 1704 book, *Opticks*, document his findings of refracting white sunlight through a prism into the familiar ROYGBIV spectrum of colors including red, orange, yellow, green, blue, indigo, and violet. Fresnel became passionate about a related concept of double refraction, known as *birefringence*, and its relationship to polarization which was a critical part of his development of the wave theory of light between 1816 and 1826.

In addition to his work on optics, Fresnel's civil engineering led to an appointment to the *Commission des Phares (Lighthouse Commission)* in 1819. He was appointed at the behest of François Arago to improve lighthouse illumination, eventually becoming the commission's secretary in 1824 and revolutionizing maritime safety with the invention of the Fresnel lens. He worked with the Commission from 1819 until his death in 1827 at the young age of 39.

The first diagram at right illustrates the working principle of the lens that Fresnel invented *(specifically a catadioptric lighthouse lens)*, The primary innovation of the Fresnel lens is its "stepped" design. Instead of one massive, heavy piece of glass, it uses a series of concentric rings. Each ring acts as a prism, bent at a specific angle to ensure all light passing through it exits in parallel lines. The labels are described as follows:

Source (L): The central light source, typically an oil lamp with multiple wicks in early lighthouses.

Central Lens (A): The front-view *(left)* and cross-section *(right)* show a "bullseye" lens. This is a dioptric *(refractive)* element that bends the



Cape Blanco's second order fresnel lens is an eight panel, rotating beehive lens with similar bulls-eye prisms as shown.

Blanco Birefringence ~
Photo: Jack Pruitt

central rays of light into parallel lines.

The collimated light rays (R & C): The lens and surrounding prisms take light that would naturally scatter in all directions and refract *(bend)* it into parallel, horizontal beams that can be seen for 20 miles or more.

Prisms (m & n): The upper and lower elements are catadioptric prisms mounted above and below the main lens. They capture light that would otherwise escape toward the sky or the lighthouse base and redirect it into the primary horizontal beam.

The second diagram is a technical illustration of a lighthouse lantern room featuring a large Fresnel lens assembly and its rotating mechanism. It represents a lighthouse lens of the largest size, constructed by M. Souter, and exhibited at the Paris Universal Exhibition in 1855. The system of mirrors and lenses alone is 10 feet high.

Optical System (Top): *A & B (Lens Panels)*: These are the individual panels of the Fresnel lens. These dioptric lenses use a series of concentric glass prisms to capture light from a central lamp and focus it into a powerful, horizontal beam. In a "flashing" lighthouse, these panels revolve around the light source.

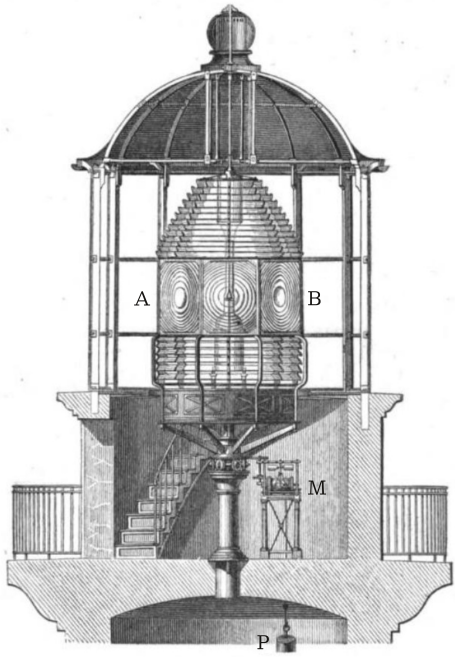
Central Lantern Room: The glass-enclosed structure at the top protects the lens and lamp from the elements while allowing the light to shine out to the horizon.

Mechanical System (Bottom): *M (Clockwork Mechanism):* This represents the clockwork motor used to rotate the lens. Before electricity, lighthouse keepers would wind this mechanism *(similar to a grandfather clock)* to keep the lens turning at a consistent speed, which created the specific "flash" pattern unique to that lighthouse.

P (Weight): This is the drive weight. It is connected to the clockwork mechanism by a cable. As the weight slowly descends through a central shaft in the lighthouse tower, it provides the gravitational energy needed to power the rotation of the lens assembly.

Service Gallery & Stairs: The stairs and platform below the lens allowed the lighthouse keeper to clean the glass, trim the lamp's wick, and maintain the machinery.

Technical illustrations are from Adolphe Ganot (1872) "Natural Philosophy for General Readers and Young Persons", D. Appleton & Co., New York, p.328 and 329. Arago and Fresnel are two of 72 prominent French scientists, engineers, and mathematicians with names engraved around the first floor balcony of the Eiffel Tower.



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OUR MISSION: To provide interpretative and educational services for the Cape Blanco Light Station, Historic Hughes House and Ranch and the Port Orford Lifeboat Station. We are a 501(c)(3) non-profit organization and your donation is tax-deductible.

Mail this portion of the form with your check made out to:
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