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# Thomas Young and the Wave Nature of Light

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One of the milestones of the science of light commemorated during this [International Year of Light and Light-based Technologies](#) is «the notion of light as a wave proposed by Fresnel in 1815» that is, the celebration of the second centenary of the presentation of Augustin Fresnel's paper titled [Premier Mémoire sur la Diffraction de la Lumière](#) before the Academy of Sciences in Paris on October 15, 1815 and which was published the following year. Fresnel contributed significantly to the establishment of the wave theory of light and thereafter this theory was very successful and resulted in a flood of new discoveries.

However, it was a British erudite and physician called Thomas Young who convincingly demonstrated the wave nature of light –contrary to the ideas of Newton who believed light was composed of a stream of particles– through the **double-slit experiment**, known today as Young's light-interference experiment.

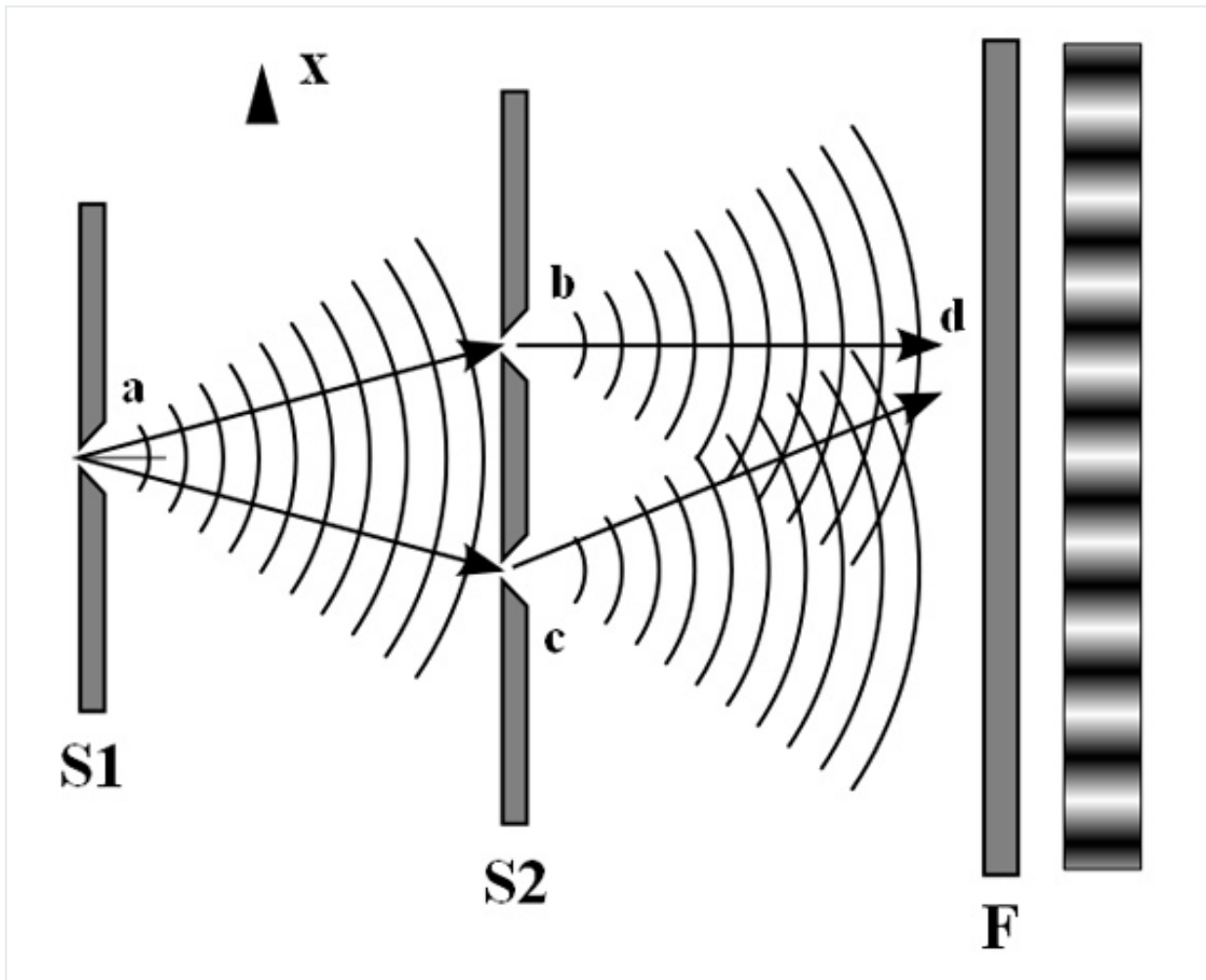
**Thomas Young** was born on **June 13<sup>th</sup>, 1773** in Milverton, in southwest England, into a Quaker family. He was the eldest of ten children and received a strict upbringing. He was a child prodigy. When he was two years old he was able to read and at six he had read the Bible twice from beginning to end. He knew a dozen languages including Latin and ancient Greek. Young studied medicine, but ultimately he did not succeed as a doctor, partly because of **his inability to comfort patients**. When he was 28, Young abandoned the medical practice to join the [Royal Institution](#) of London. In two years he delivered 91 lectures. He was one of the first people to **decipher Egyptian hieroglyphics** and played a key role in decoding the [Rosetta stone](#). He was also a great linguist, the first in identifying numerous similarities between languages that he himself called **Indo-European languages**.



Thomas Young (1773-1829) / Credits: Wikipedia

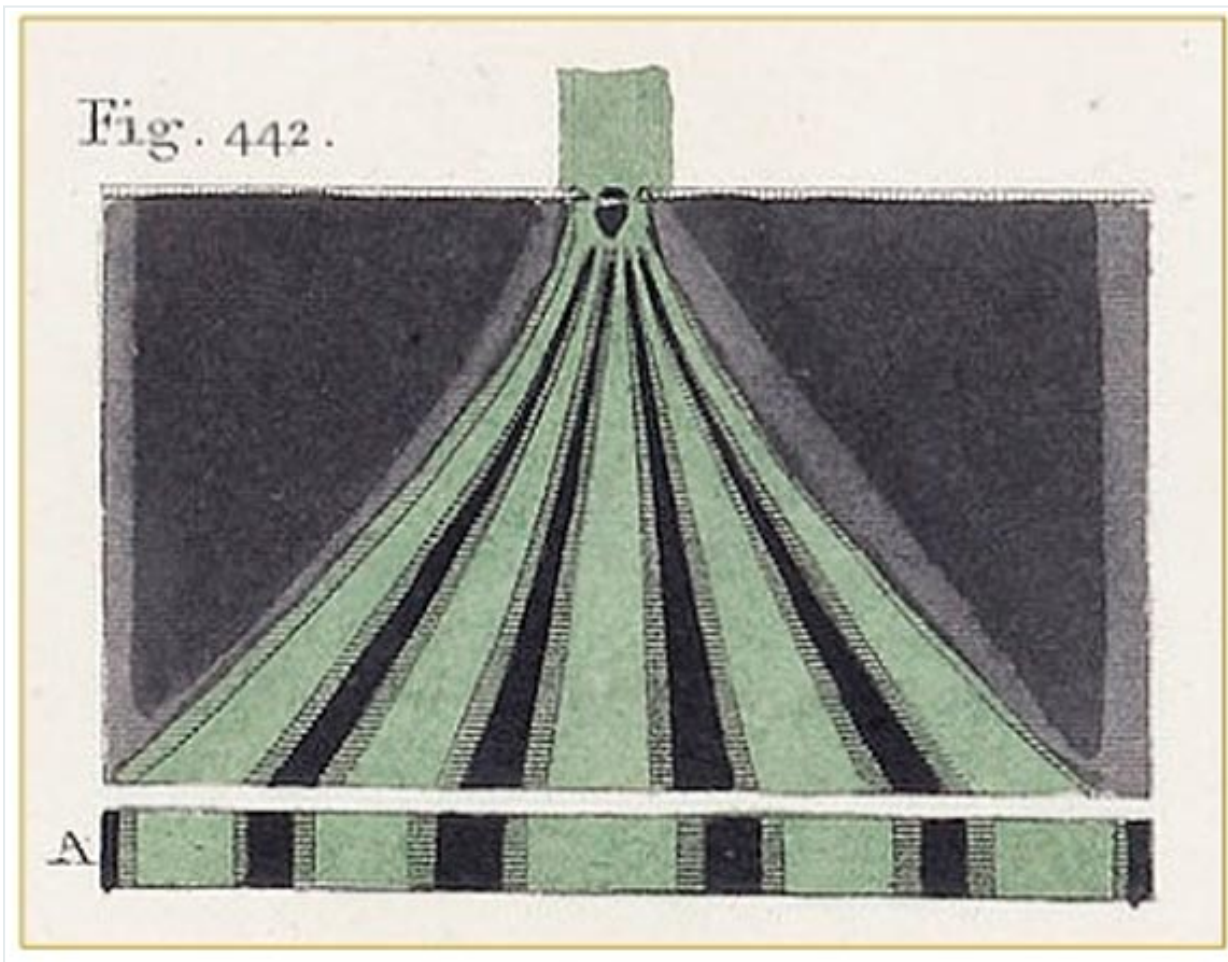
Young conducted studies on vision and the human eye and he proposed the three-colour theory of vision, only confirmed one hundred and fifty years later. He also conducted research on sound, on hearing and on the human voice and that was when he wondered if the sound and light would have the same wave nature. The [Encyclopædia Britannica](#) summarizes Young as «English physician and physicist who established the principle of interference of light and thus resurrected the century-old wave theory of light. He was also an Egyptologist who helped decipher the Rosetta Stone.» In fact, Young held discoveries in virtually every field that he studied, including physics (the wave theory of light), engineering (the modulus of elasticity), physiology (the mechanism of vision), Egyptology, Linguistics and so on. For many people, Young is «[the last man who knew everything](#).»

His major contribution to the field of light is the double-slit experiment, which has been considered not only «one of the [most beautiful experiments in physics](#)», but also «[the favourite experiment with light](#).» With this experiment Young challenged the theories of Isaac Newton and proved that light is a wave, because light suffers the phenomenon of interference that is typical of the waves. Between 1801 and 1803, Young delivered a series of lectures to the [Royal Society](#) underlining the wave theory of light and adding to it a new fundamental concept, the so-called principle of interference. The double-slit experiment is a wonderfully simple experiment, which allowed Thomas Young to demonstrate convincingly the wave nature of light for the first time. When the waves emerging from two narrow slits are superimposed on a screen placed at some distance parallel to the line connecting these slits, a pattern of bright and dark fringes regularly spaced appears on the screen (**interference pattern**). This is the first clear proof that light added to light can produce darkness. Interference is accompanied by a spatial redistribution of the optical intensity without violation of power conservation. This phenomenon is known as interference and thanks to this experiment the intuitive ideas of Huygens regarding the wave nature of light were confirmed. Thomas Young had expected it because he believed in the wave theory of light and in his own judgment this was the most important of his many achievements.



Double-slit experiment showing light interference. / Credits: Wikipedia

On November 12, 1801, Young gave the [Bakerian Lecture](#) titled [On the Theory of Light and Colours](#) to the Royal Society, and on November 24, 1803, also the Bakerian Lecture titled [Experiments and Calculations relative to Physical Optics](#). In the latter he was able to proffer more than speculations presenting the «experimental demonstration of the general law of light interference» and an «argumentative inference respecting the nature of light», concluding that light is a wave. As all waves known at that period needed a material medium for their propagation, as happens with sound waves and water waves. Due to this, in his Lecture of 1801, Young pointed out that light propagated in a medium, the luminiferous ether, concluding that «A luminiferous Ether pervades Universe, rare and elastic in high degree» and he didn't have a doubt that «Radiant light Consist in Undulations of the luminiferous Ether.» He also stated that «The Sensation of different Colours depends on the different frequency of Vibrations, excited by light in the Retina.»



The interference pattern observed by Young (Plate XXX, Fig. 442, A Course of Lectures on Natural Philosophy and the Mechanical Arts. Thomas Young, 1807). / Credits: Wikipedia

In 1803, however, almost nobody accepted immediately Young's radical ideas about the nature of light. Young published in 1807 his *magnus opus*, [A Course of Lectures on Natural Philosophy and the Mechanical Arts](#), consisting of two quarto volumes running to more than fifteen hundred pages, which was described by the physicist [Joseph Larmor](#) (1857-1942) as «the greatest and most original of all general lecture courses.» The double-slit experiment is described in Lecture 39 on this book including a series of diagrams about the experiment in [Plate XXX](#).

Thanks to the contributions made by Augustin Fresnel, the wave theory of light -experimentally demonstrated by Young in his famous experiment- was finally accepted.

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