

light interferes, diffracts and polarises: the wave picture ray optics never needed

Wavefront λ

every point on it is a fresh source of secondary wavelets

Huygens' construction →

Envelope $v = v\lambda$

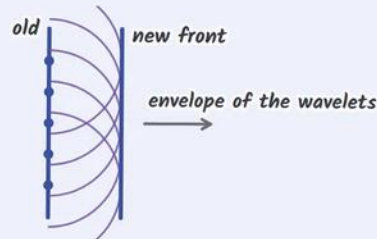
the common tangent to all the wavelets, one time-step later

Huygens' construction →

New wavefront $\perp$ ray

always perpendicular to the ray direction

a plane wave stays plane, a spherical wave stays spherical: refraction only bends the ray, Huygens' construction is what shows why

Huygens' construction

every point on a front sends a wavelet; their envelope is the new front

Coherence, the condition for a stable pattern

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- two sources are coherent when they keep a constant phase difference, never drifting apart
- two independent bulbs are never coherent: interference washes out too fast to see
- Young's setup gets coherence for free by splitting one wavefront into two, with a double slit

Young's double slit

path difference at a point on the screen

$$\Delta = d \sin \theta \approx \frac{dy}{D}$$

bright fringe, constructive

$$\Delta = n\lambda, n = 0, \pm 1, \pm 2, \dots$$

dark fringe, destructive

$$\Delta = (n + \frac{1}{2})\lambda$$

fringe width

$$\beta = \frac{\lambda D}{d}$$



fringe width grows in direct proportion to wavelength, slit spacing and screen distance fixed

d = slit separation, D = slit-to-screen distance, y = distance of the point from the centre