

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

From corpuscles to waves

- Newton's corpuscular theory made light hard, elastic, massless particles
- a denser medium was thought to attract them more strongly, so it predicted light should travel faster there, contradicted by experiment
- the wave theory gets refraction right, and alone explains interference, diffraction and polarisation
- a primary source emits its own light (Sun, flame, bulb)
- a secondary source only reflects light it receives (moon, a page)
- refractive index depends on wavelength: a prism bends violet more than red into a spectrum

Wavefront same phase

every point on it
becomes a fresh
source of secondary
wavelets

Huygens' construction

Secondary wavelets speed v

spread out as
hemispheres, radius vT
after time T

Huygens' construction

New wavefront common tangent

the envelope of all the
wavelets, one time-step
later

a wavefront is the locus of points in the same phase; the ray, energy's direction, is always perpendicular to it

Wavelength across a boundary *

frequency never changes crossing a medium $v_1 = v_2$

wavelength in medium of index n , vacuum
wavelength λ_0 $\lambda = \frac{\lambda_0}{n}$

wave speed $v = v\lambda$

speed and wavelength both shrink in a denser
medium, in exact proportion; frequency alone stays
fixed