

Everything Optical Is Two Waves Overlapping

Review of Eugene Hecht, *Optics*, 5th edition, Global Edition (Pearson, 725 pp.)

TLDR / 80-20

Polarization, interference and diffraction are one phenomenon, not three.

Hecht says so outright: they share a common conceptual basis — what happens when two or more lightwaves overlap in a region of space.

The Keys

- **Superposition is the spine.** The book's own framing: the three great wave topics differ only in the circumstances under which waves are made to overlap.
- **Waves come first, rays come later.** Wave motion, then electromagnetic theory, then photons. Geometrical optics arrives as a limiting case, not as the foundation.
- **Phase is what carries the information.** Amplitude, phase and frequency of each constituent wave determine the composite. Phase differences are what produce visible structure.
- **Coherence is a measurable duration, not a property.** Light stays sinusoidal for under ten nanoseconds before randomly changing phase; that interval is its temporal coherence.
- **Two kinds of coherence, both needed.** Temporal coherence concerns the same point over time; spatial coherence concerns different points at the same moment.
- **Polarization is superposition in two dimensions.** Two linearly polarized waves of the same frequency, combined with a phase offset, produce every polarization state.
- **The history is load-bearing.** The book opens with four centuries of argument, because the wave-versus-particle question shaped every formalism that followed.
- **It is a reference, not a course.** Seven hundred pages with problems at every chapter end. The structure assumes you arrive with a question.

AI's Take

- **The strongest thing here is the unification.** Most texts teach interference, diffraction and polarization as three chapters. Hecht teaches them as one idea seen from three angles.
- **That framing transfers.** Any field with several phenomena sharing a mechanism can be compressed the same way — the question is always what is actually overlapping.
- **The coherence numbers are the most useful concrete detail.** Ten nanoseconds is why ordinary light does not produce interference fringes without careful arrangement.
- **Its weakness is its size.** Comprehensiveness makes it a poor first book; the organising insight is easy to miss inside seven hundred pages of correct detail.
- **Read Chapter 2 and Chapter 7 first.** Wave motion and superposition carry the argument; everything after them is application.