

Tentative titles:

1. **Science for the Curious Photographer**
2. **Science in Photography: From Quantum Mechanics to Art Appreciation**
3. **Digital Photography for Smarties**

Table of Contents

1. **What is photography? (Definition and history)**
2. **What is light? (History, waves and photons)**
3. **The camera - an introduction (lenses, film, sensors, focal length, F-stop)**
4. **Images: What is perspective? (Perspective point, field of view, normal lens)**
5. **Why does a camera need a lens? (Pinhole camera analysis, diffraction, lens advantages)**
6. **Elementary optics. How do lenses work? (Hero's law - reflection, Snell's law - refraction, refractive index, and Fermat's principle of least time)**
7. **What is behind the laws of optics? (QED made easy with illustrations)**
8. **How to Make Lenses That Are Good Enough for Photography? Why Are Basic, High Quality Lenses So Complicated? (Aberations, dispersion, reflection)**
9. **The optics of real compound lenses. (principal points, nodal points, focal length, “no-parallax points”, entrance and exit pupils, stops)**
10. All types of lenses. Brief introduction to wide angle, telephoto, and zoom lenses. More complete treatment of macro, fisheye, and tilt lenses, and MTF tests.
11. **Lens Equivalents: Depth of field, diffraction, optimum resolution *etc.***
12. Closeup photography (macro lenses, add-on lenses, effective F-numbers)
13. Filters: Absorption, polarization and infrared photography.
14. Capturing Images. (Film vs. digital, sampling problems, grain vs. noise, exposure, film and sensors CCD, CMOS, and Foveon, color filter arrays, definition of ISO sensitivity)
15. **The Limits of Human Vision: (The eye, acuity, detection of color)**
16. Colors and perception. (Psychophysics, trichromacy, opponent theory, the primary colors, the chromaticity CIE color space)
17. Perception of patterns, color, *etc.* What is pleasing?
18. Optical illusions and how they can be used in art and photography (patterns that appear to move, luminance matching, *etc.*)
19. Computer enhancement and manipulation of images:
Panorama, Helical focus, Sharpening, Noise reduction, HDR, Super-resolution through combining serial images, *etc.*
20. New Technology: What is on the horizon – sensors, motion detection, *etc.*
Plenoptic cameras
Negative index of refraction for diffractionless images
Motion deblurring
High-resolution video capture (merging of digicams and camcorders)