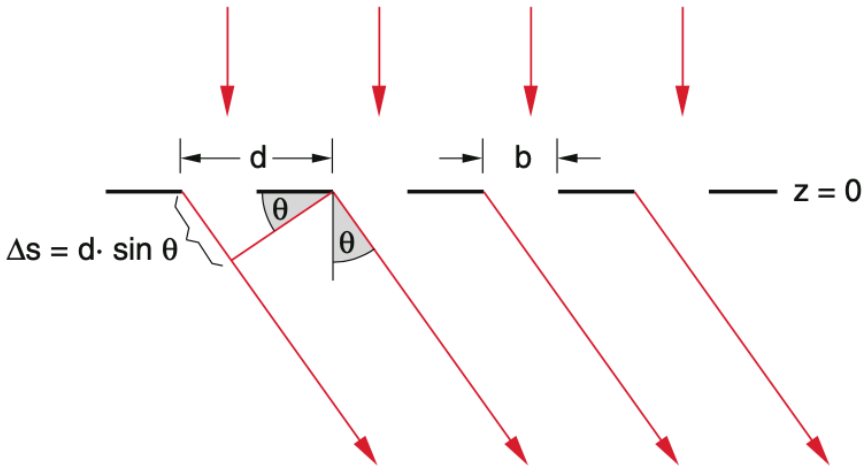
Experimental Physics 3 - Em-Waves,Optics, Quantum mechanics

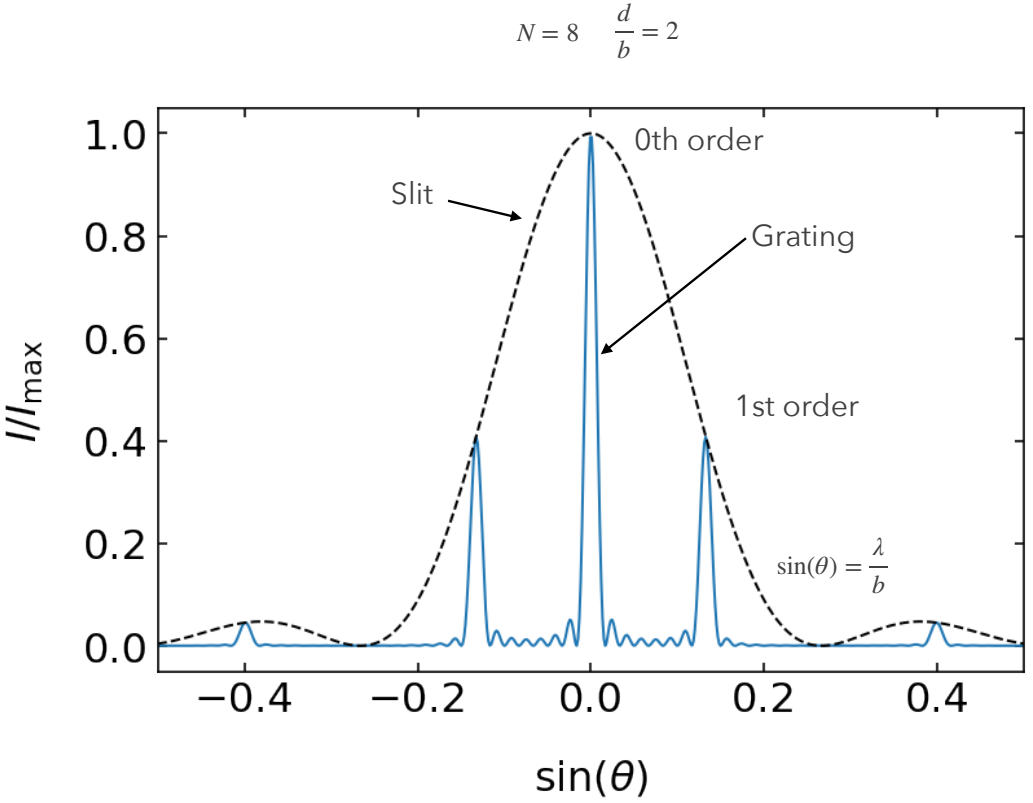
Lecture 14

Prof. Dr. Frank Cichos
WS 2020/21

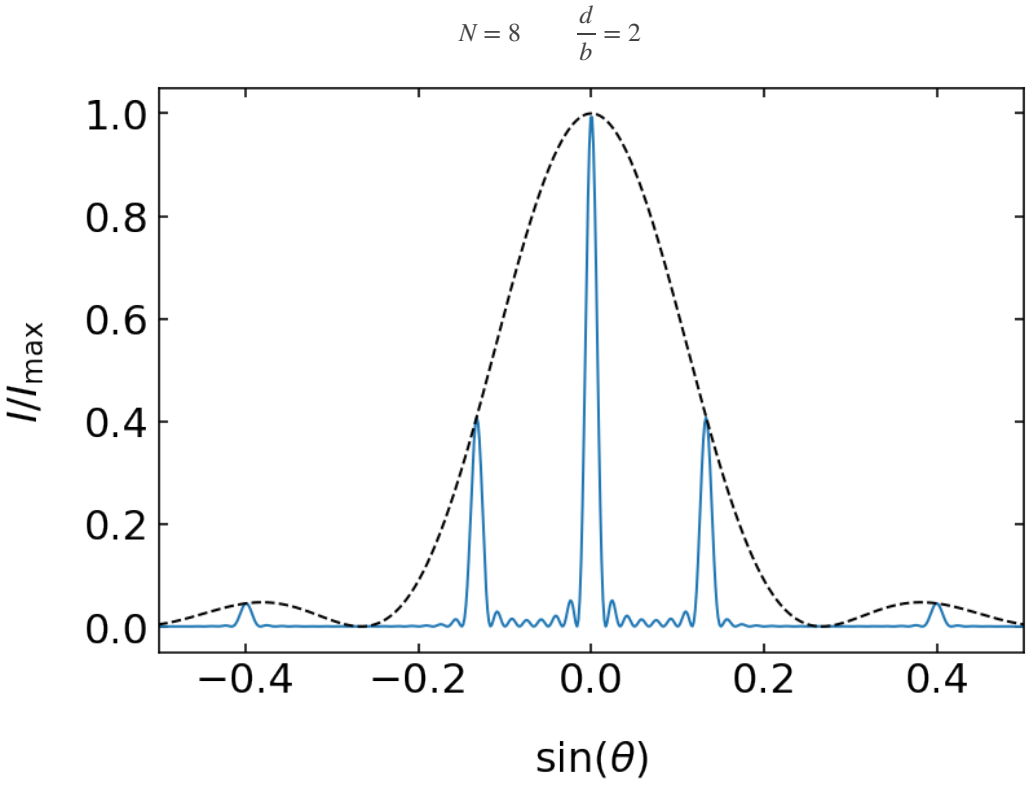
2.3 Diffraction

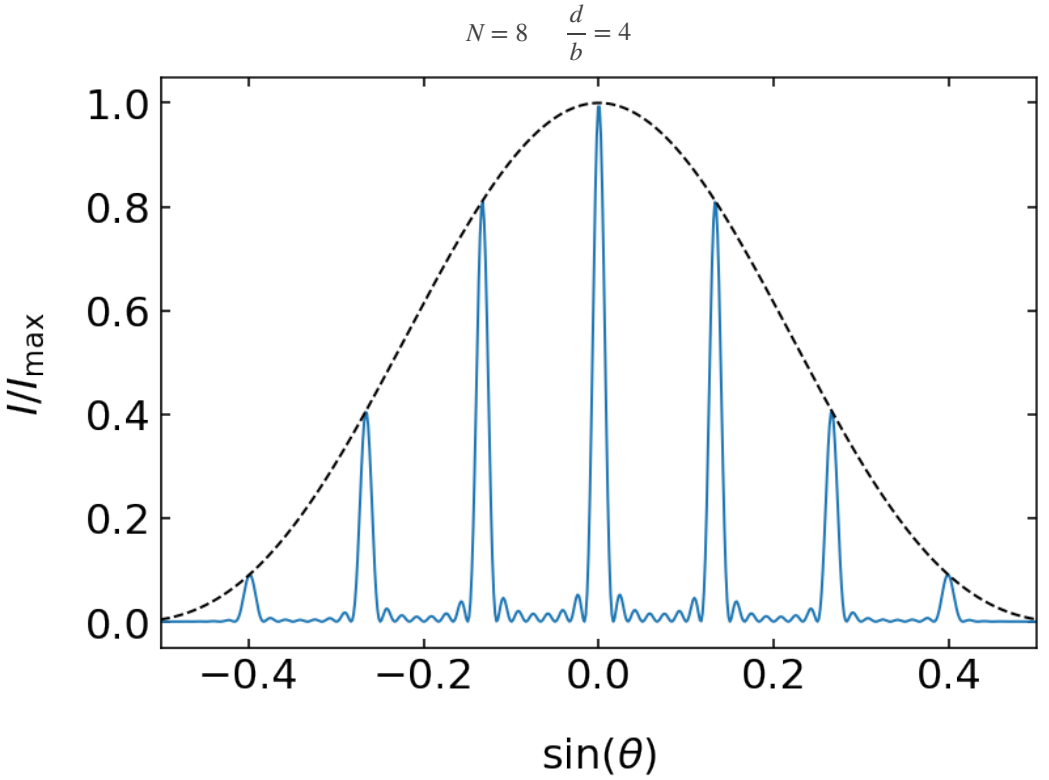
Diffraction Grating



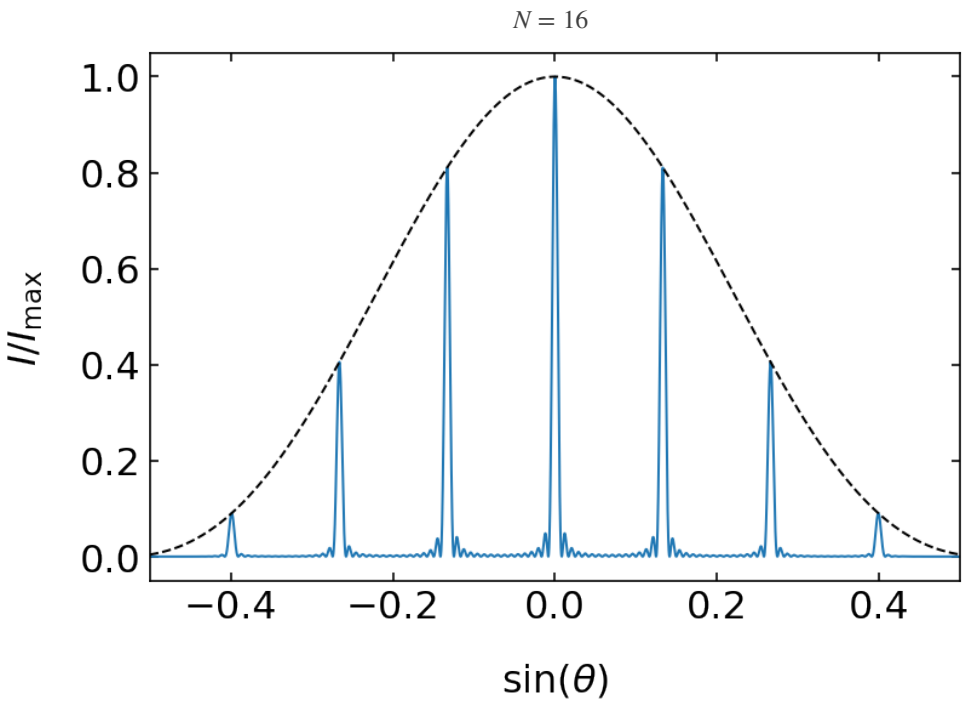


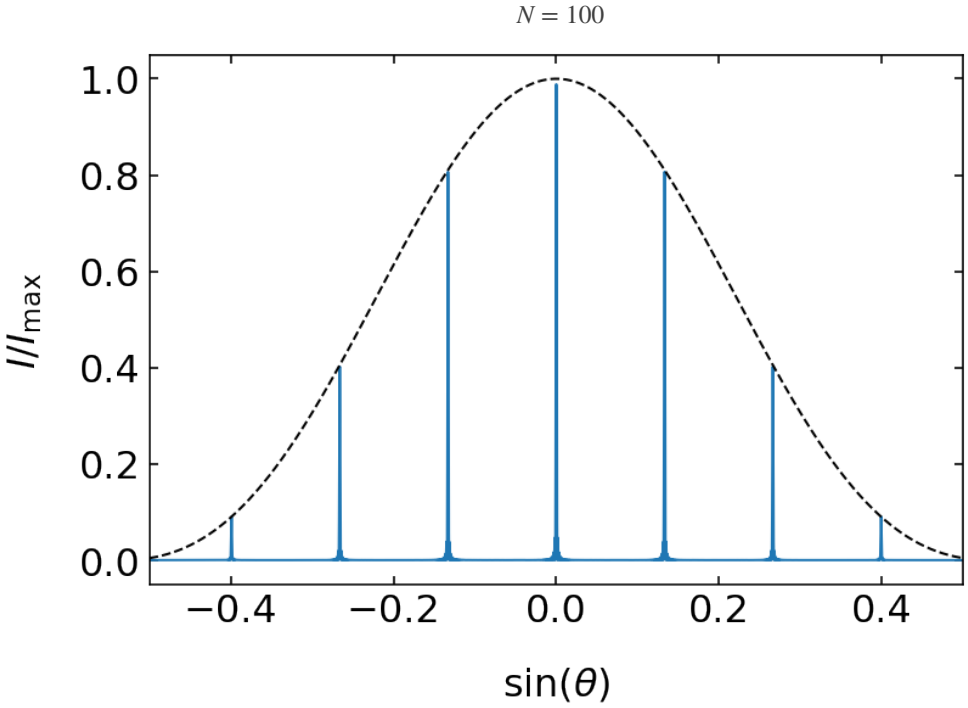
Diffraction Grating





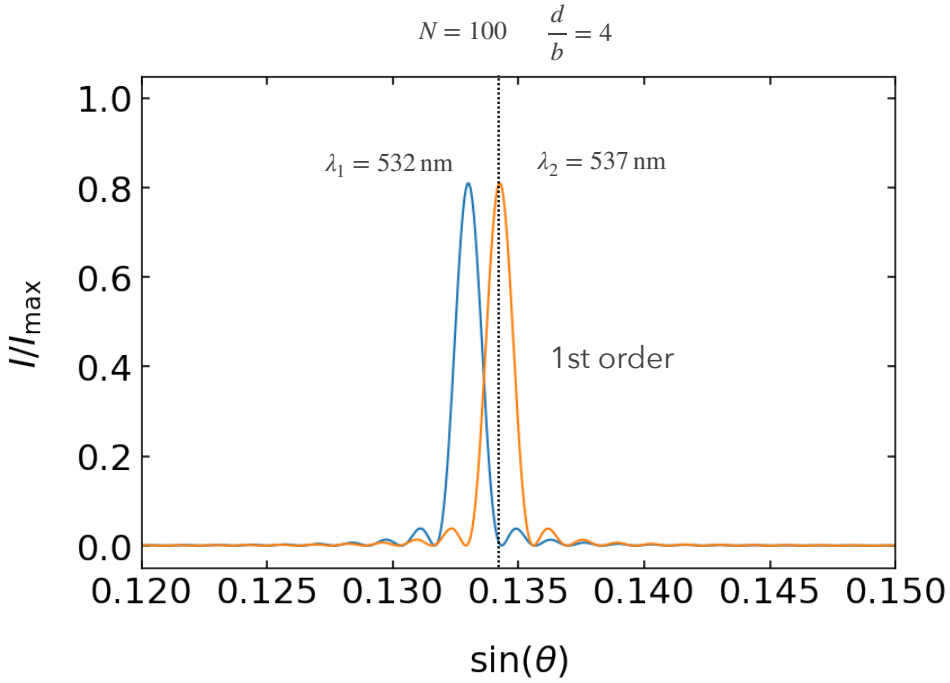
Diffraction Grating

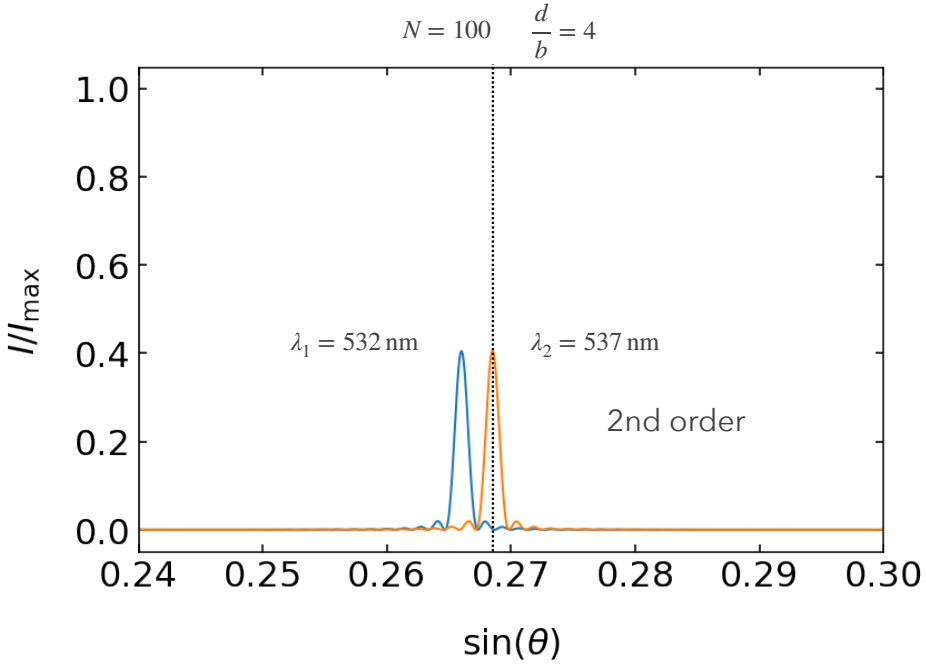




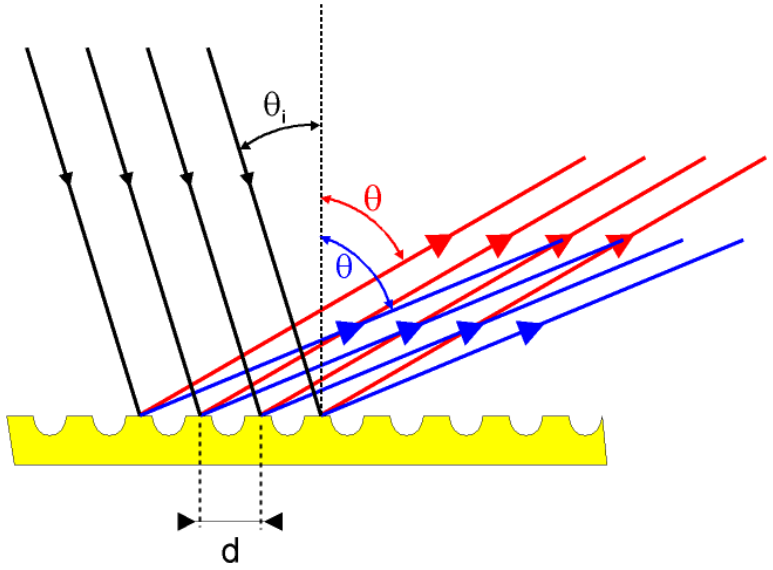
$$\sin(\theta) = \frac{\lambda}{Nd}$$

Diffraction Grating - Spectral Resolution

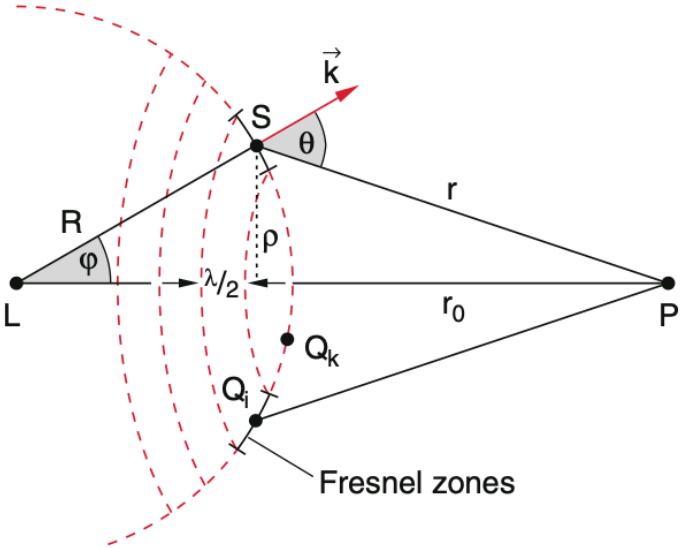


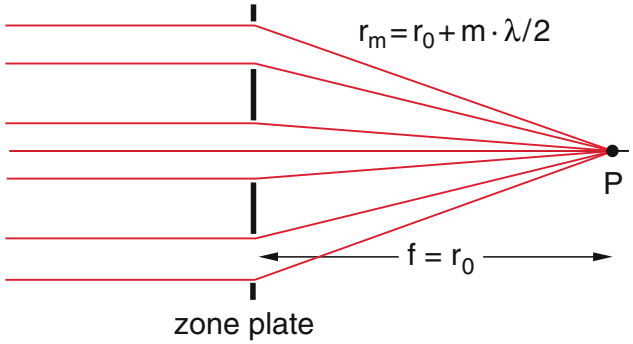


Gratings

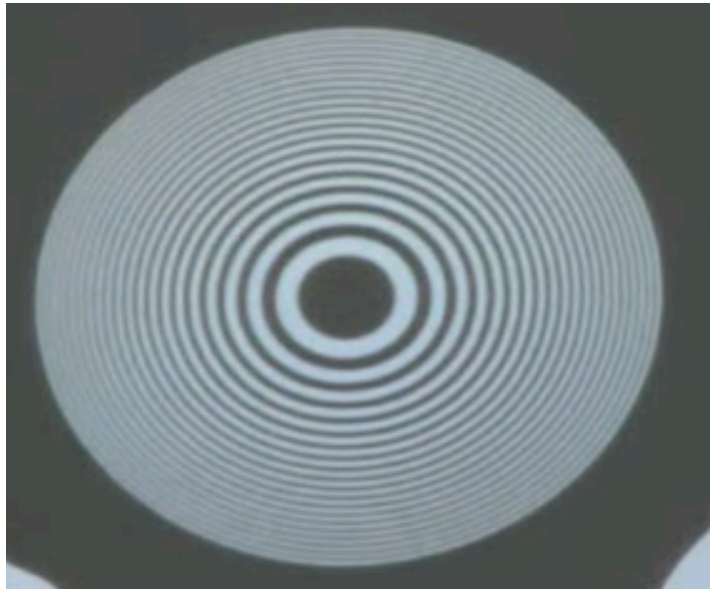


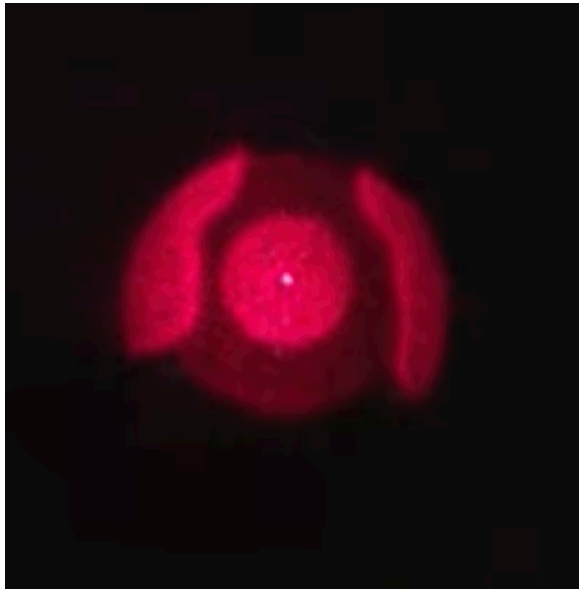
Fresnel Zones



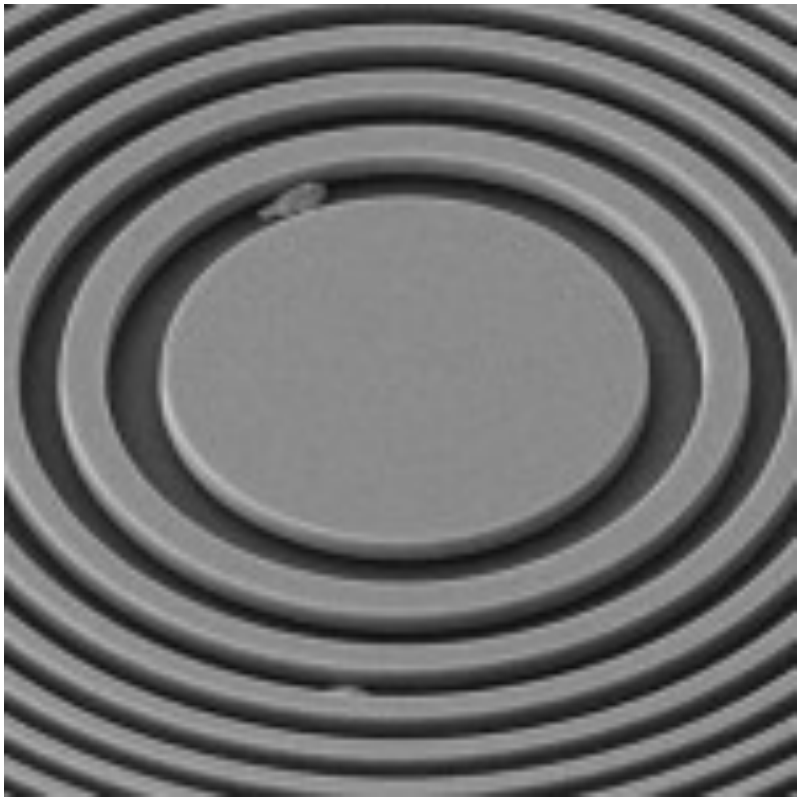


Fresnel Zone Plate



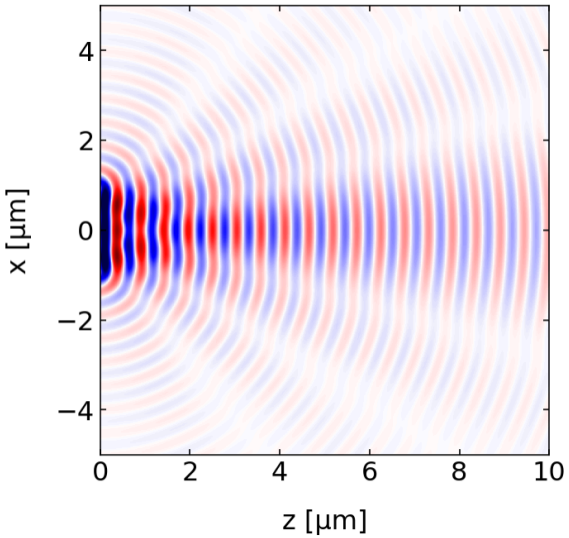


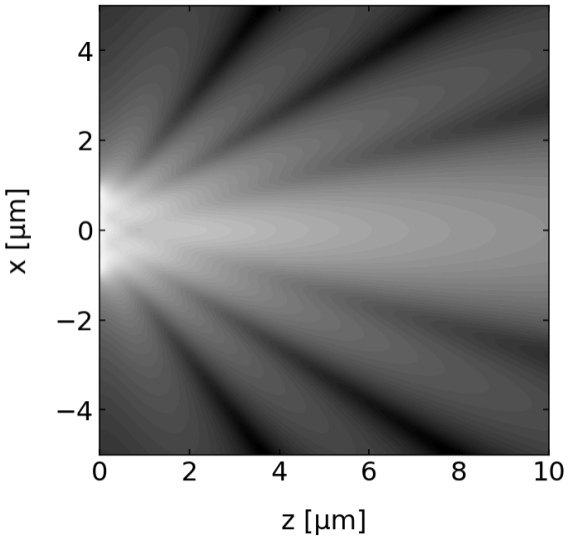
Fresnel Zone Plate

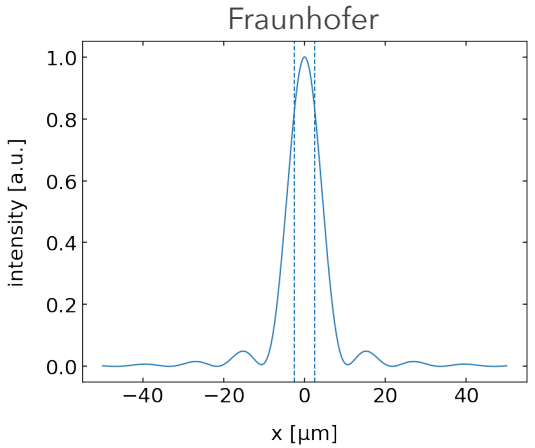


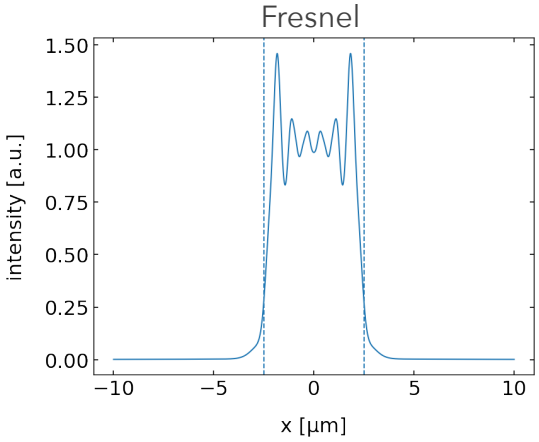
Optics Express, Vol. 21 Issue 10, pp.11747-11756 (2013).

Fraunhofer / Fresnel Diffraction





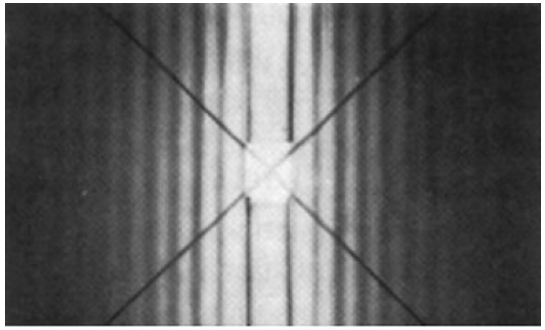




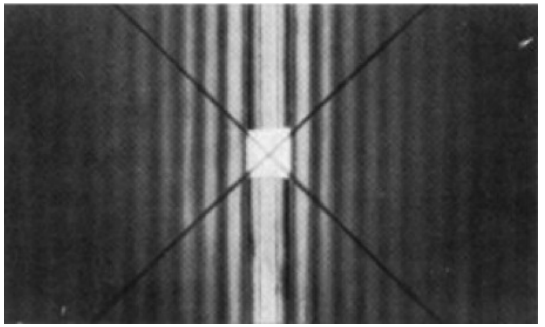
Babinet's Principle

Complementary diffraction objects
have the same far field diffraction pattern

Slit

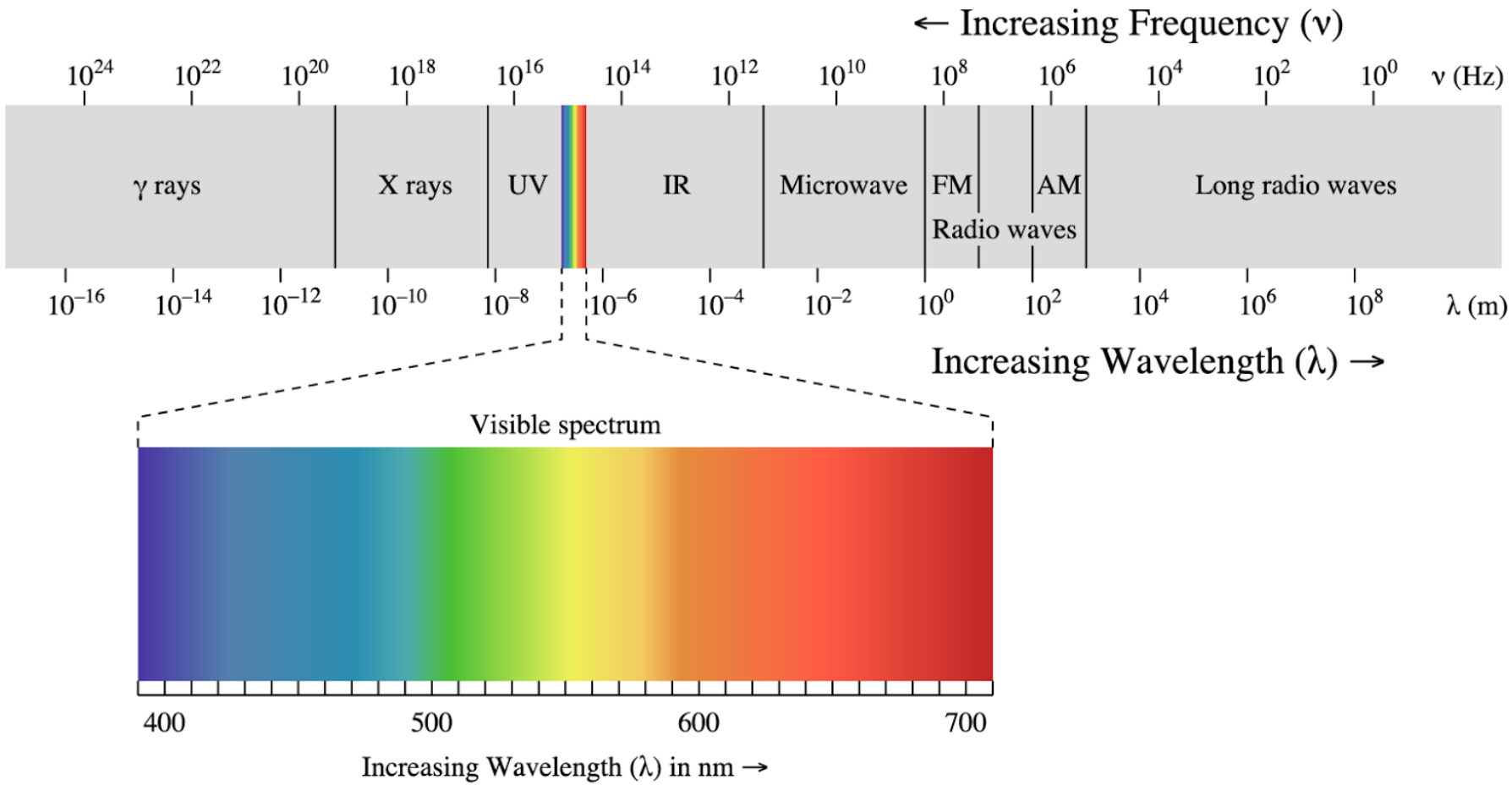


Wire

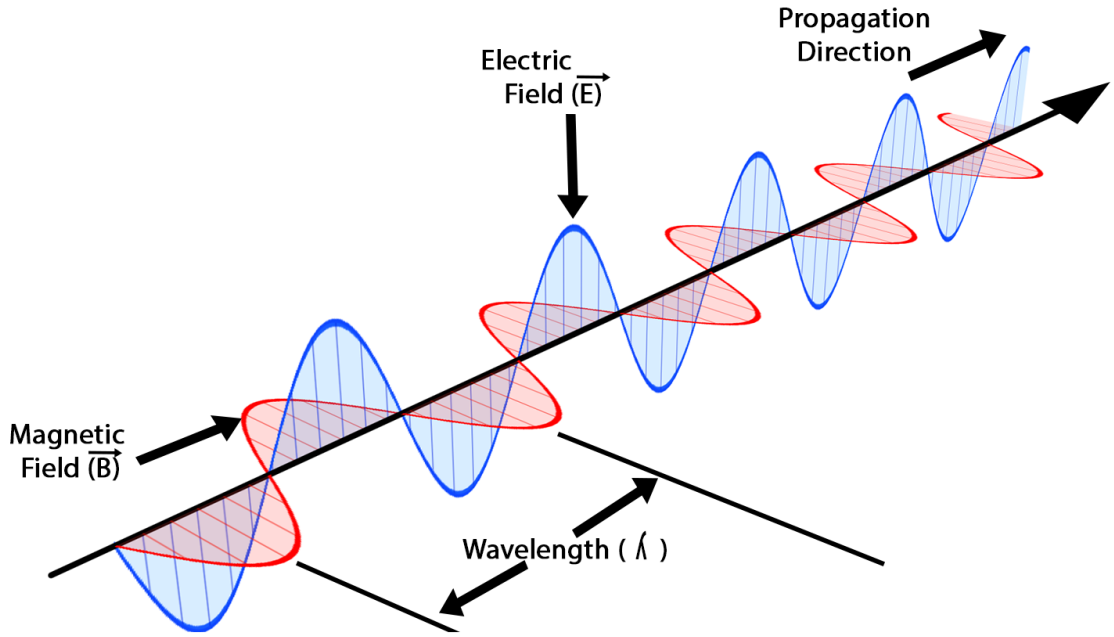


3. Electromagnetic Optics

Electromagnetic Spectrum



Electromagnetic Waves in Vacuum



vacuum

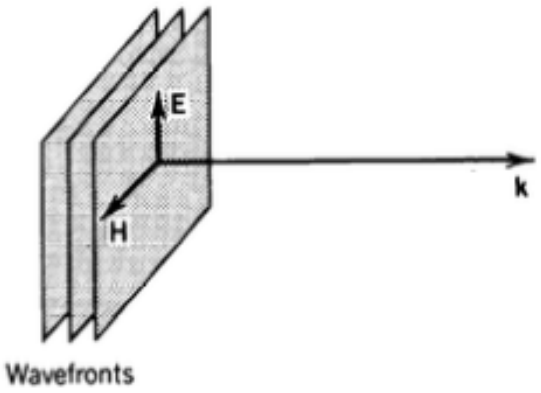
$$\rho = 0 \qquad \vec{j} = 0$$

$$\nabla \times \vec{E} = -\frac{\partial \vec{B}}{\partial t} \qquad \nabla \cdot \vec{E} = 0$$

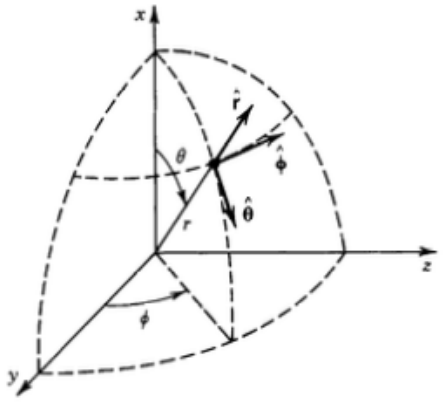
$$\nabla \times \vec{B} = \epsilon_0 \mu_0 \frac{\partial \vec{E}}{\partial t} \qquad \nabla \cdot \vec{B} = 0$$

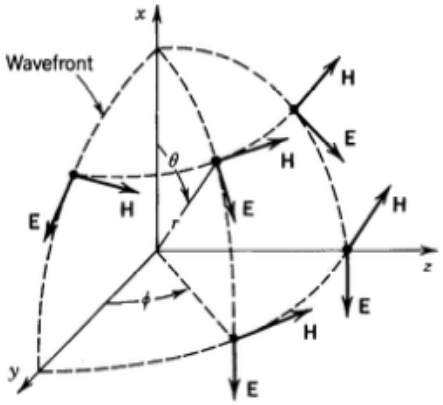
Electromagnetic Waves - Plane Waves, Spherical Waves

plane wave

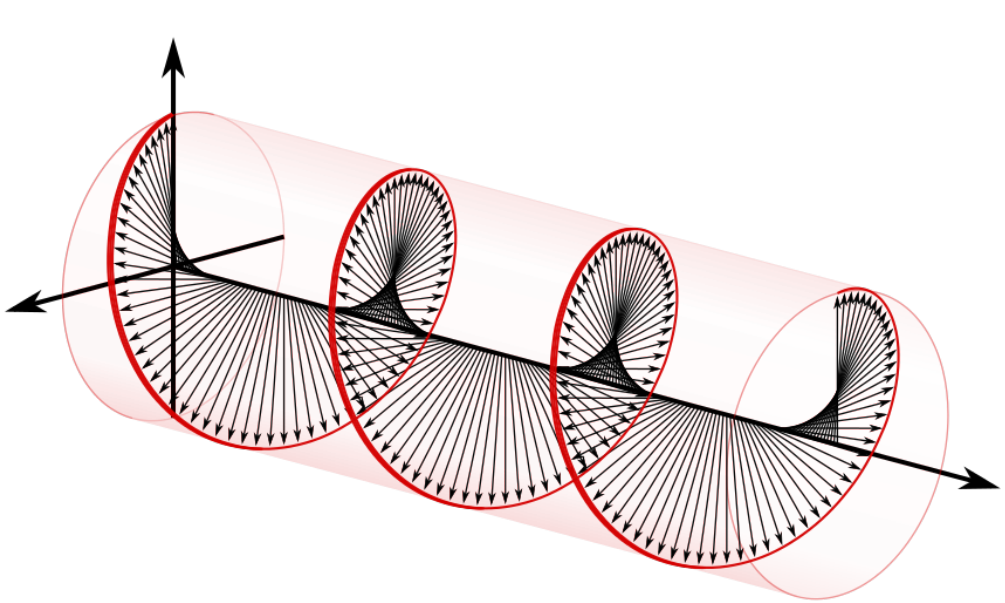


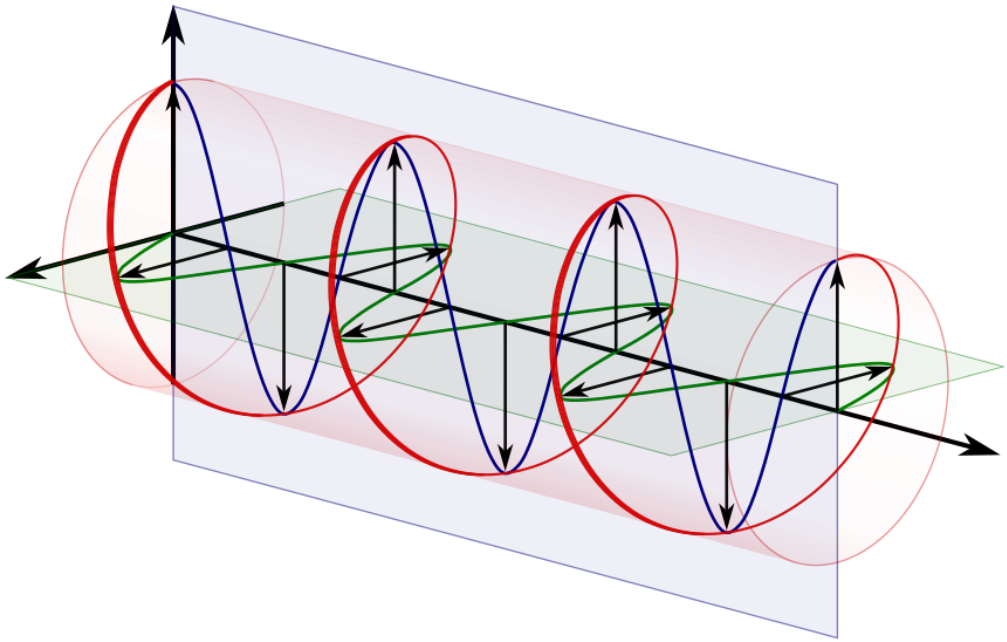
spherical wave



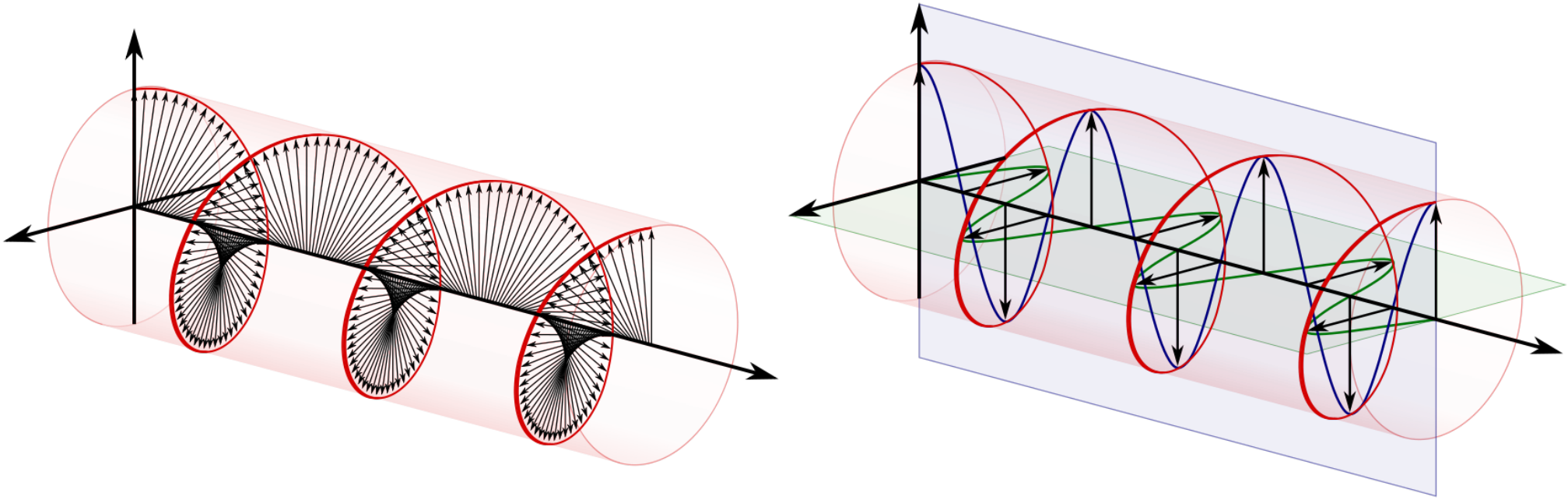


Right Circularly Polarized

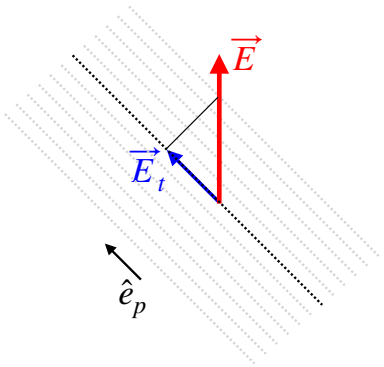


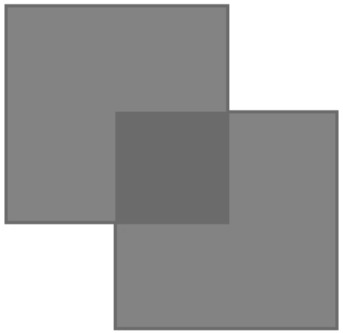


Left Circularly Polarized

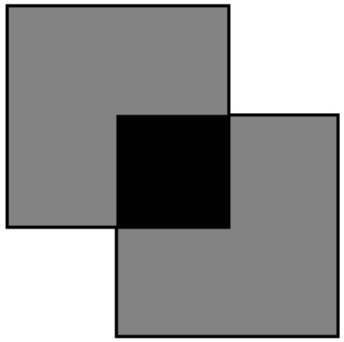


Malu's Law

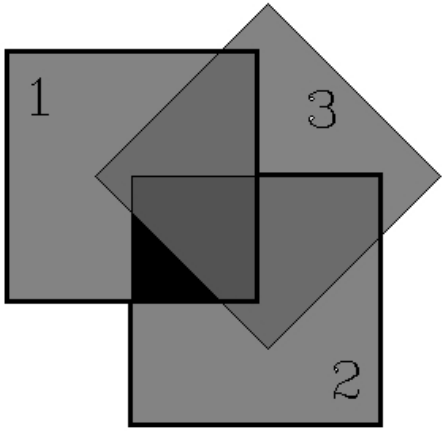




Two polarizers
Parallel orientation



Two polarizers
Orthogonal orientation



Three polarizers
1 and 2 orthogonal
3 between 1 and 2