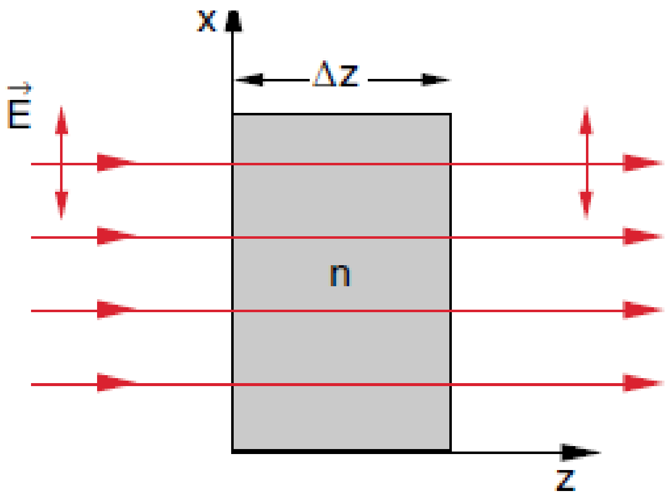
Ch. 8 EM Wellen in Materie

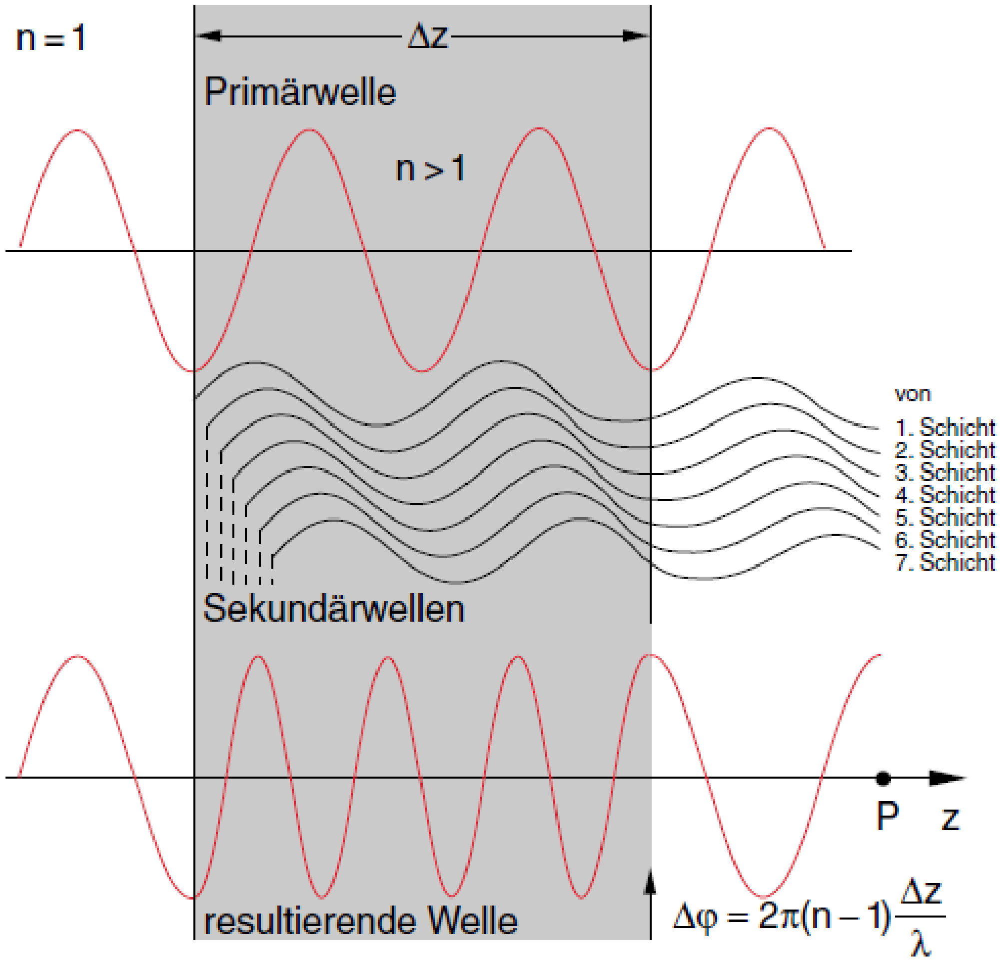
- Wellengleichung in Materie

- Grenzflächen zwischen Medien

- Reflexion, total Reflexion
- Brechung, Doppelbrechung
- Brewster Winkel

Ebene Welle durch Medium





Ebene Welle durch Medium

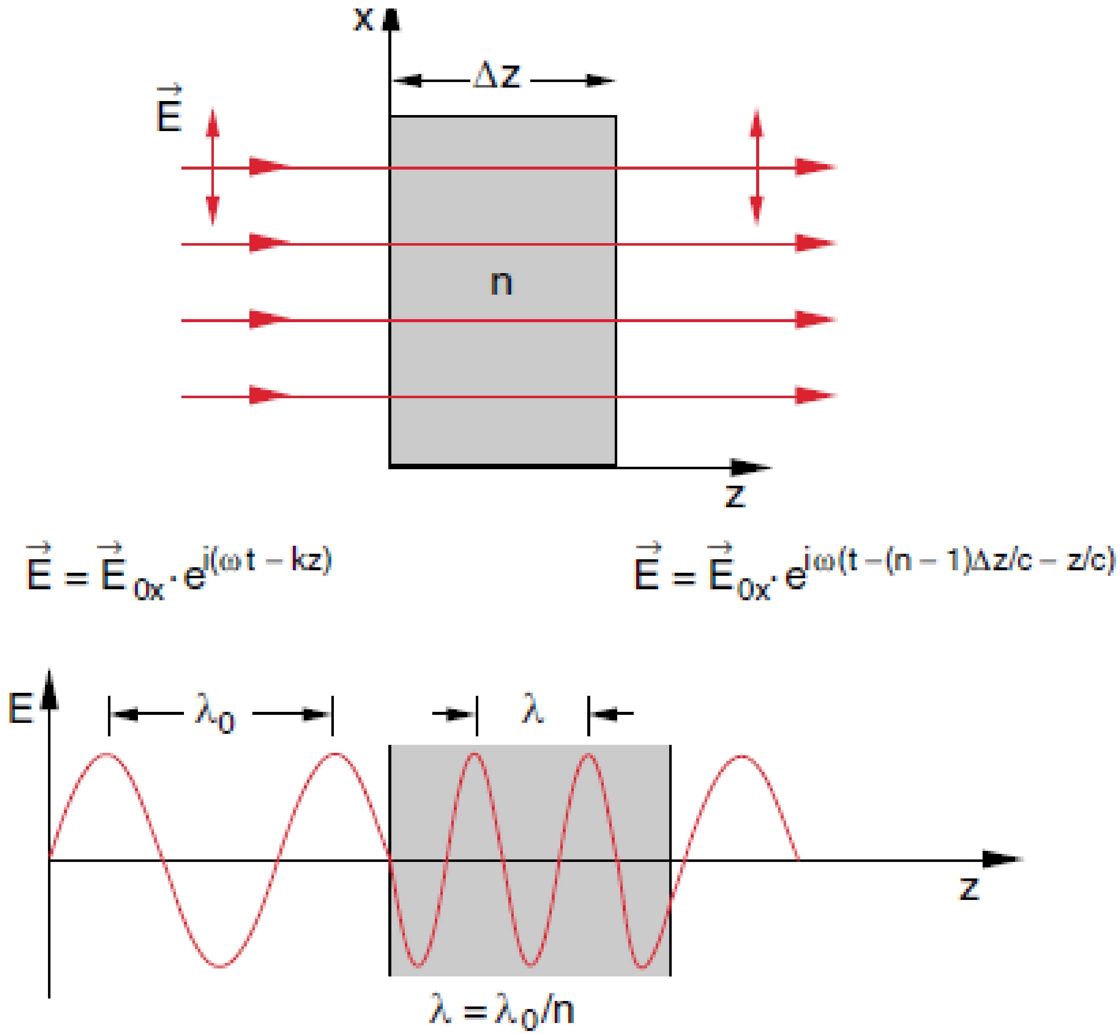
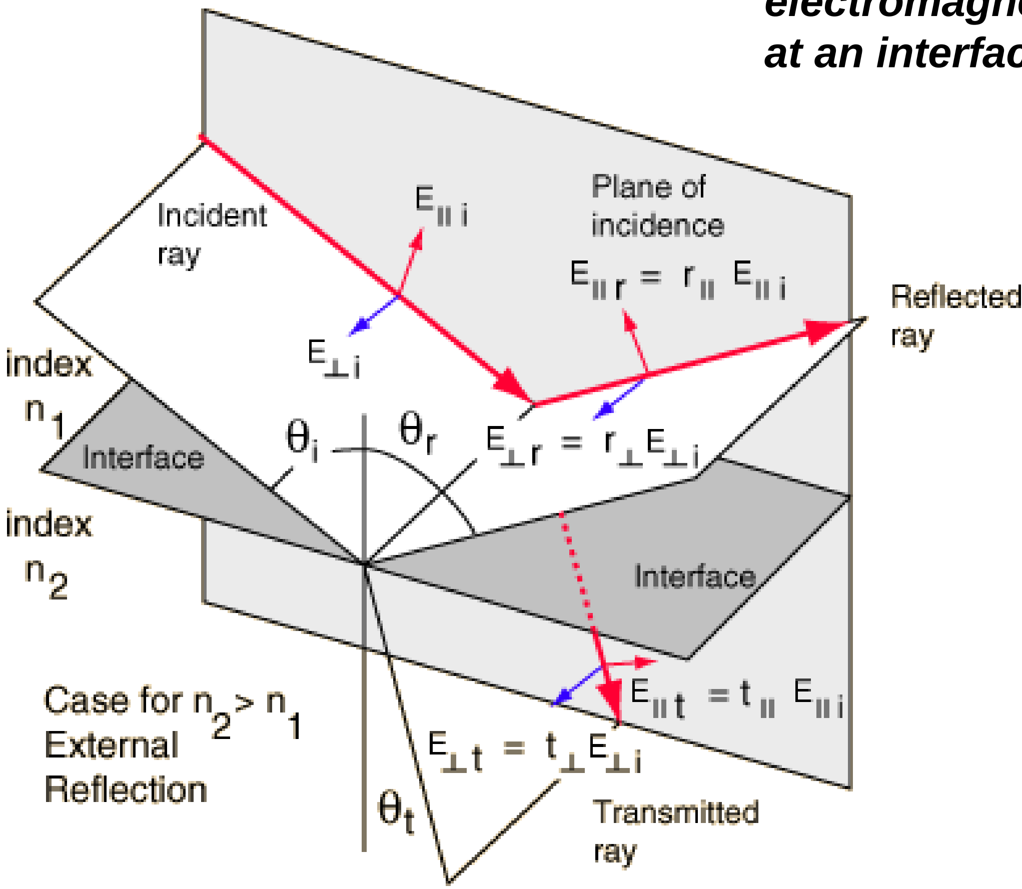


Abb. 8.1. Durchgang einer ebenen Welle durch ein Medium mit Brechungsindex n. Die Reflexion an den Grenzflächen ist hier nicht berücksichtigt

propagation of light: em picture

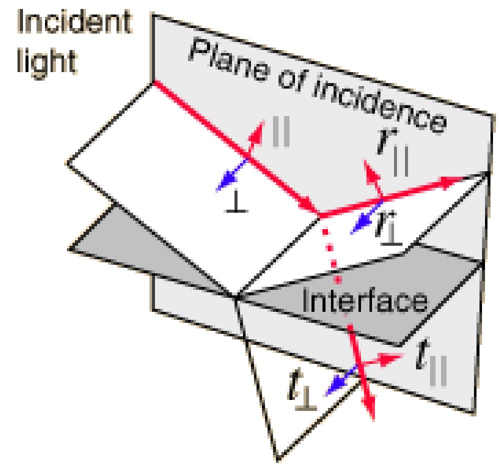
electromagnetic (em) wave at an interface



reflection $\theta_r = \theta_i$

refraction $n_t \cdot \sin(\theta_t) = n_i \cdot \sin(\theta_i)$
(Snell's law)

propagation of light: em picture



Fresnel equations

reflection and transmission coefficients **r** and **t**
*(**amplitude** coefficients; intensity $\propto$ amplitude^2)*

NB: signs refer to the specific fields directions choosen here

$$r_{\parallel} = \frac{\tan(\theta_i - \theta_t)}{\tan(\theta_i + \theta_t)} \qquad t_{\parallel} = \frac{2\sin\theta_t \cos\theta_i}{\sin(\theta_i + \theta_t)\cos(\theta_i - \theta_t)}$$

$$r_{\perp} = -\frac{\sin(\theta_i - \theta_t)}{\sin(\theta_i + \theta_t)} \qquad t_{\perp} = \frac{2\sin\theta_t \cos\theta_i}{\sin(\theta_i + \theta_t)}$$

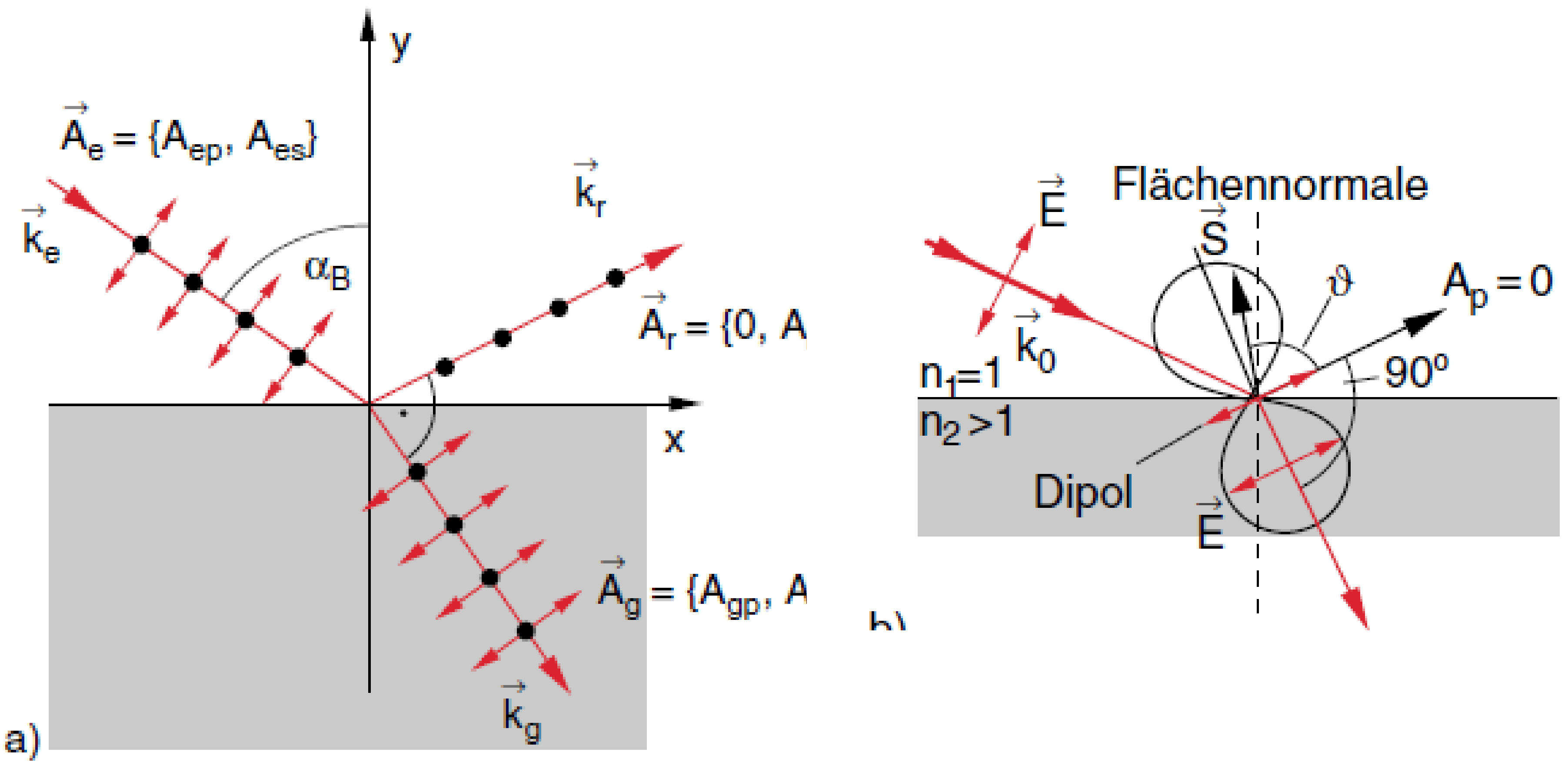
energy conservation:

$$r^2 + t^2 \underbrace{\frac{n_2 \cos\theta_t}{n_1 \cos\theta_i}} = 1$$

for $\perp$ and // cases

reflectance (r^2) **transmittance** ($t^2 \frac{n_2 \cos\theta_t}{n_1 \cos\theta_i}$)

Brewster Winkel



Earthshine

doi:10.1038/nature10778

Biosignatures as revealed by spectropolarimetry of Earthshine

Michael F. Sterzik[1], Stefano Bagnulo[2] & Enric Palle[3]

Table 1 | Earth observations

	Observing date	
Observations	25 April 2011, 09:00 UT	10 June 2011, 01:00 UT
View of Earth as seen from the Moon		
Sun–Earth–Moon phase (degrees)	87	102
Ocean fraction in Earthshine (%)	18	46
Vegetation fraction in Earthshine (%)	7	3

Doppelbrechung

birefringence
(double refraction)

Doppelbrechung

birefringence
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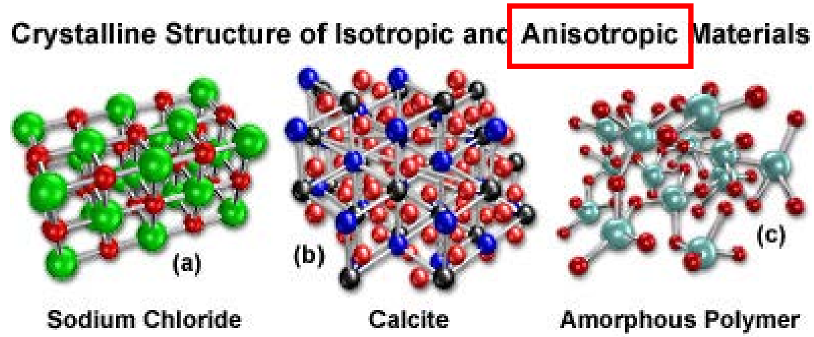
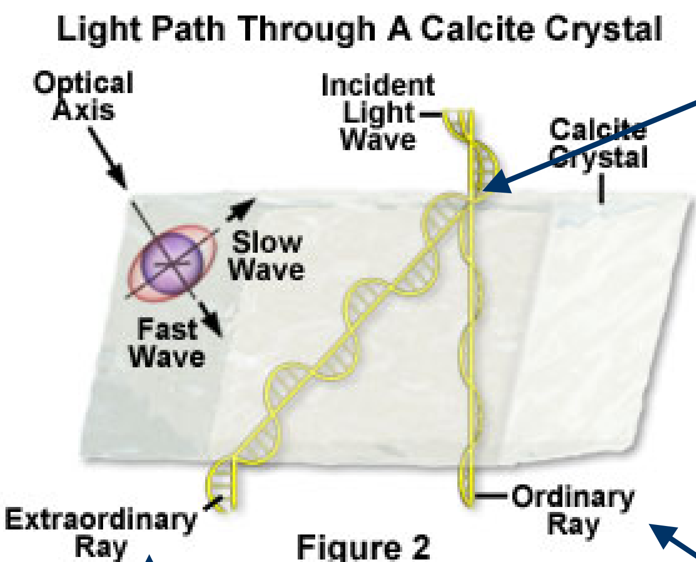
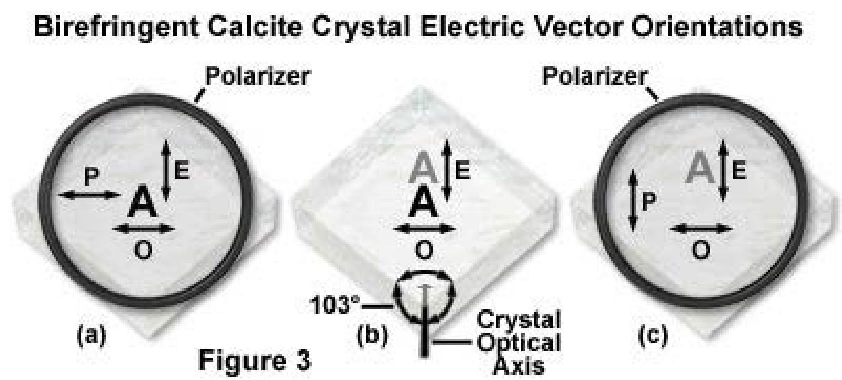


Figure 1



splitting of incident beam in 2 rays

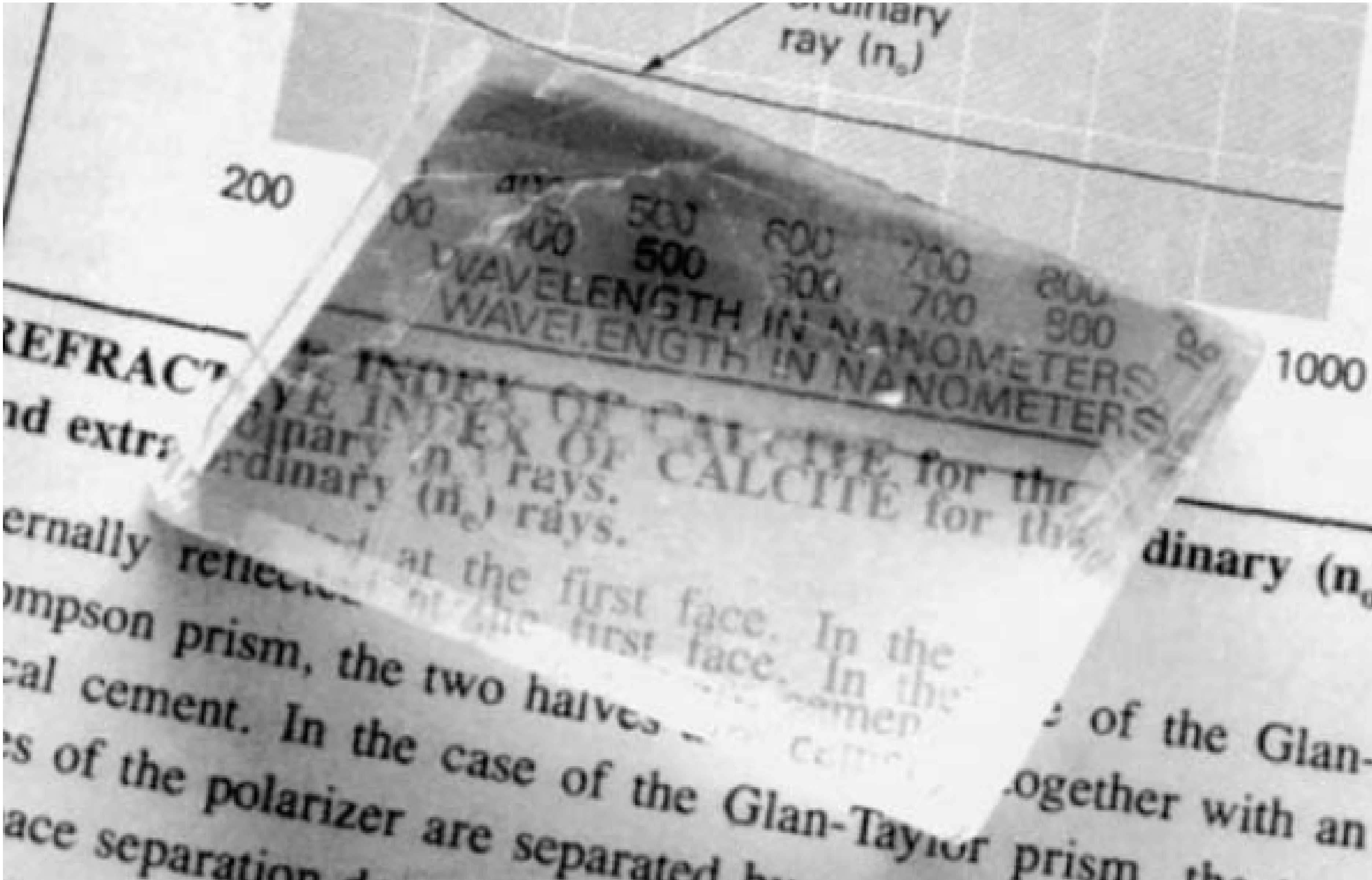


⊥ polarisation

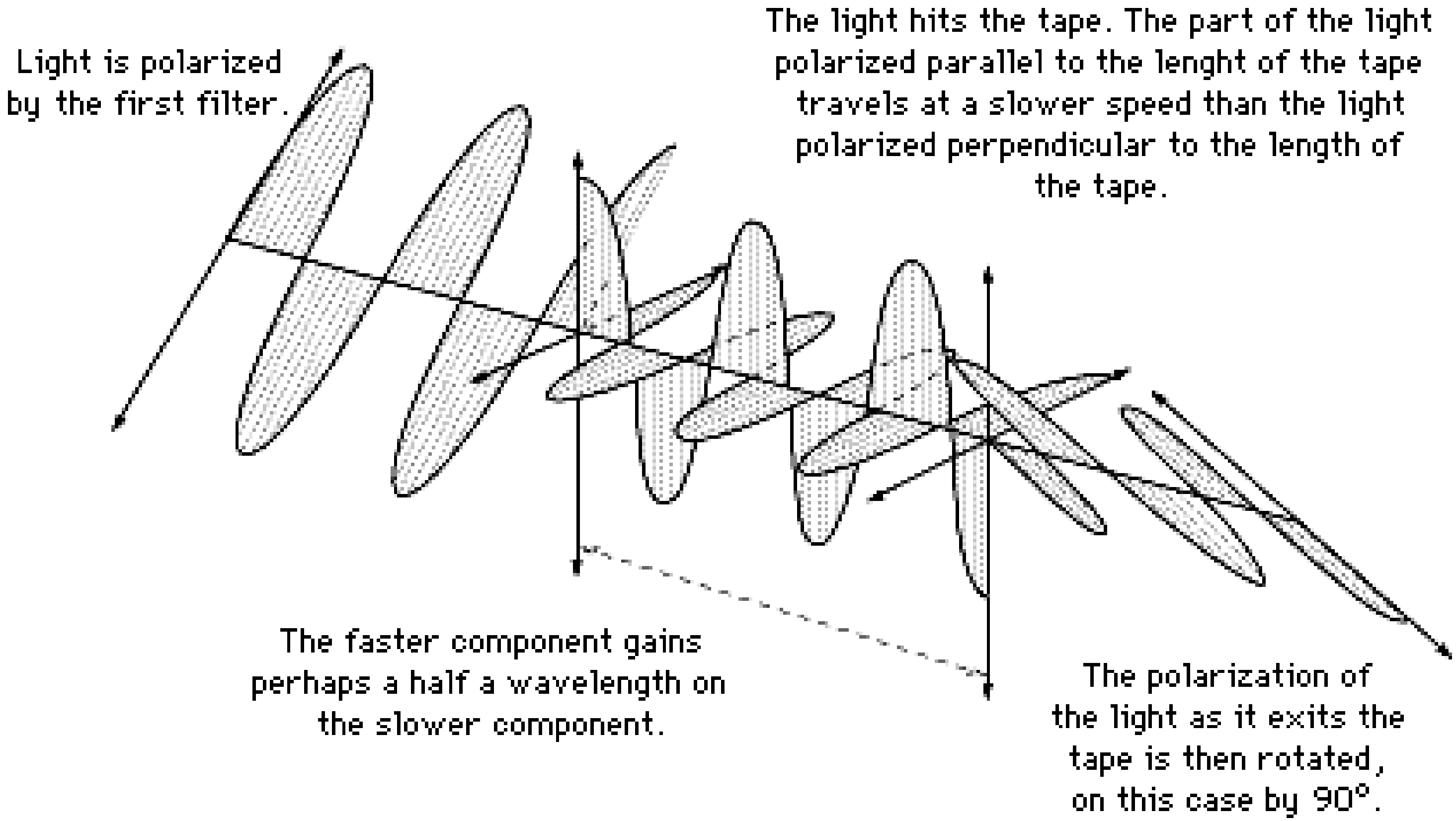
normally refracted ray

slow refracted ray
(dep. on cristalline direction)

Doppelbrechung



Polarized light mosaic: scotch tape sandwich



A wave diagram of polarized light passing through a birefringent tape.

Polarisation Rotationswinkel $\alpha=\alpha(\lambda,d)$

λ: Wellenlänge

d: Scotch tape Dicke

http://www.exploratorium.edu/snacks/polarized_mosaic/