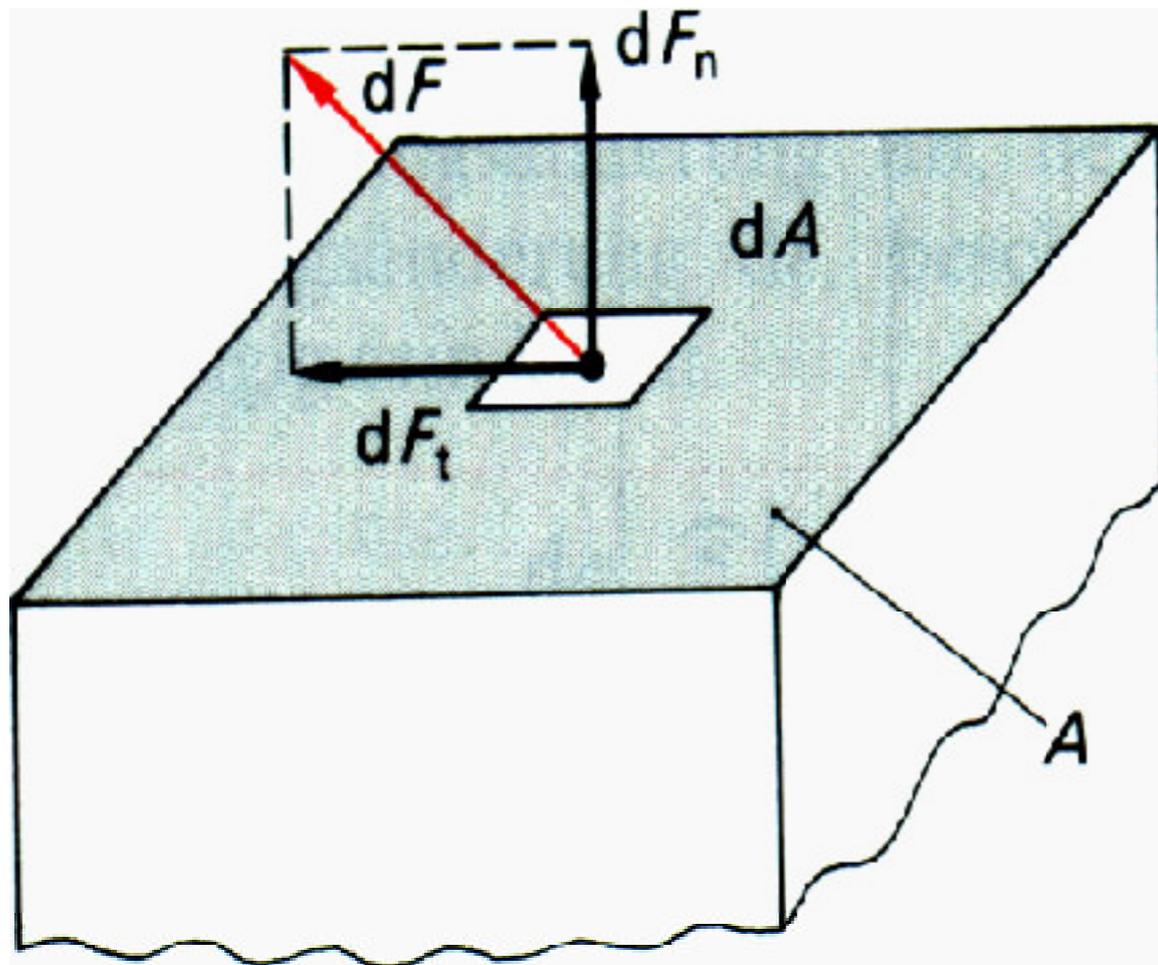
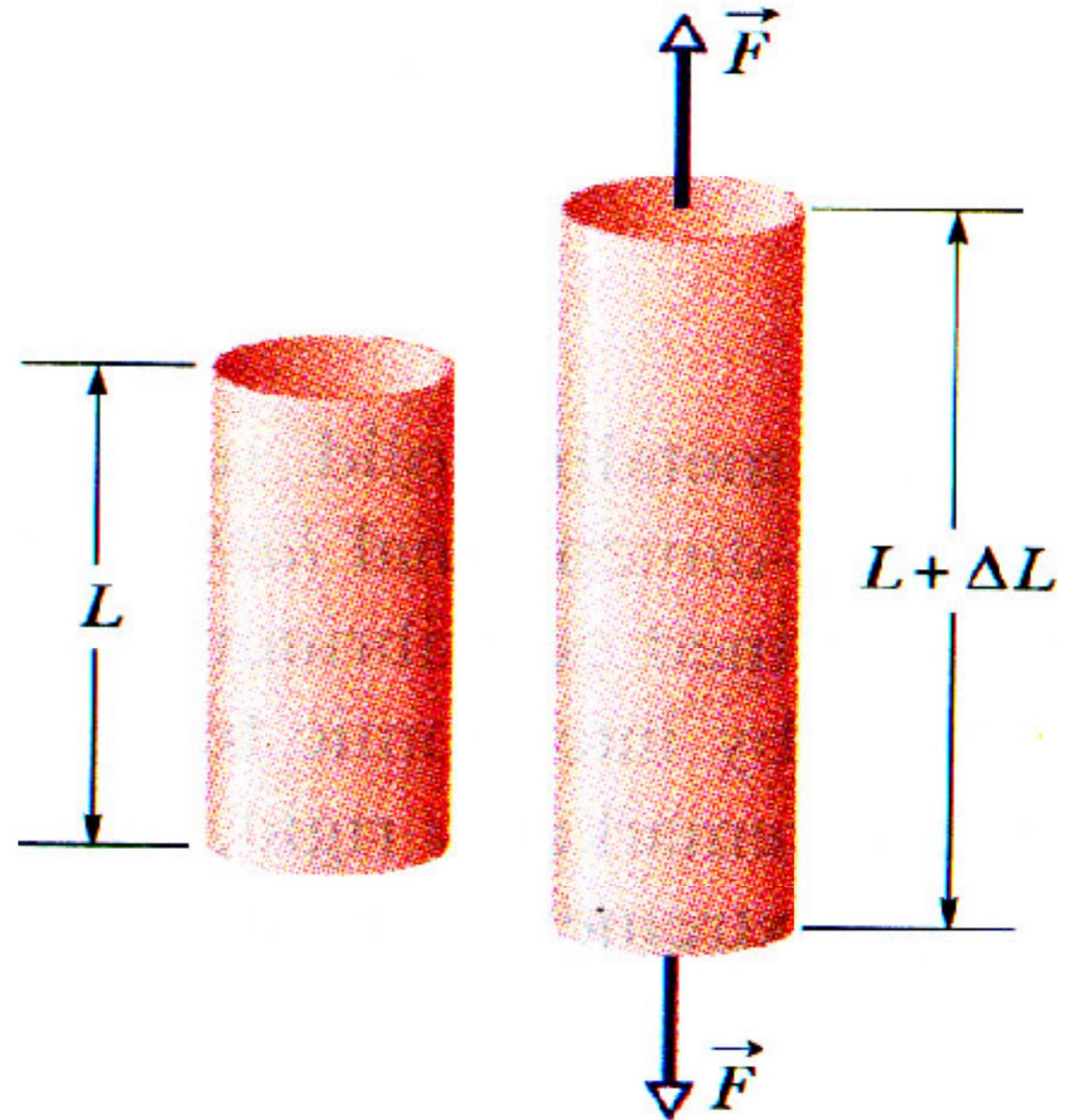


# Spannung und Dehnung

$$\text{Spannung} = \frac{\text{Kraft}}{\text{Fläche}}$$

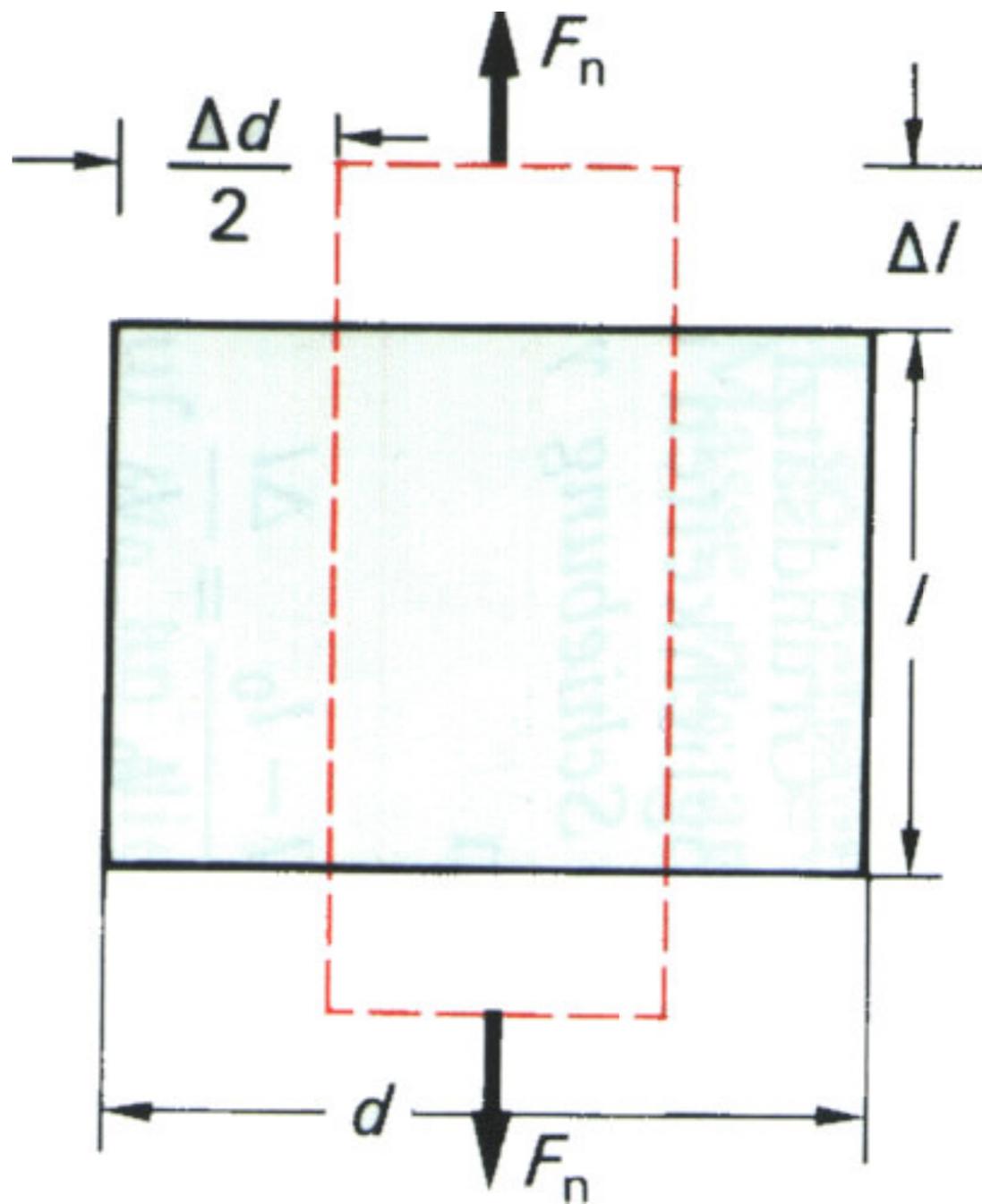


$$\text{Dehnung} = \frac{\text{Längenänderung}}{\text{Länge}}$$

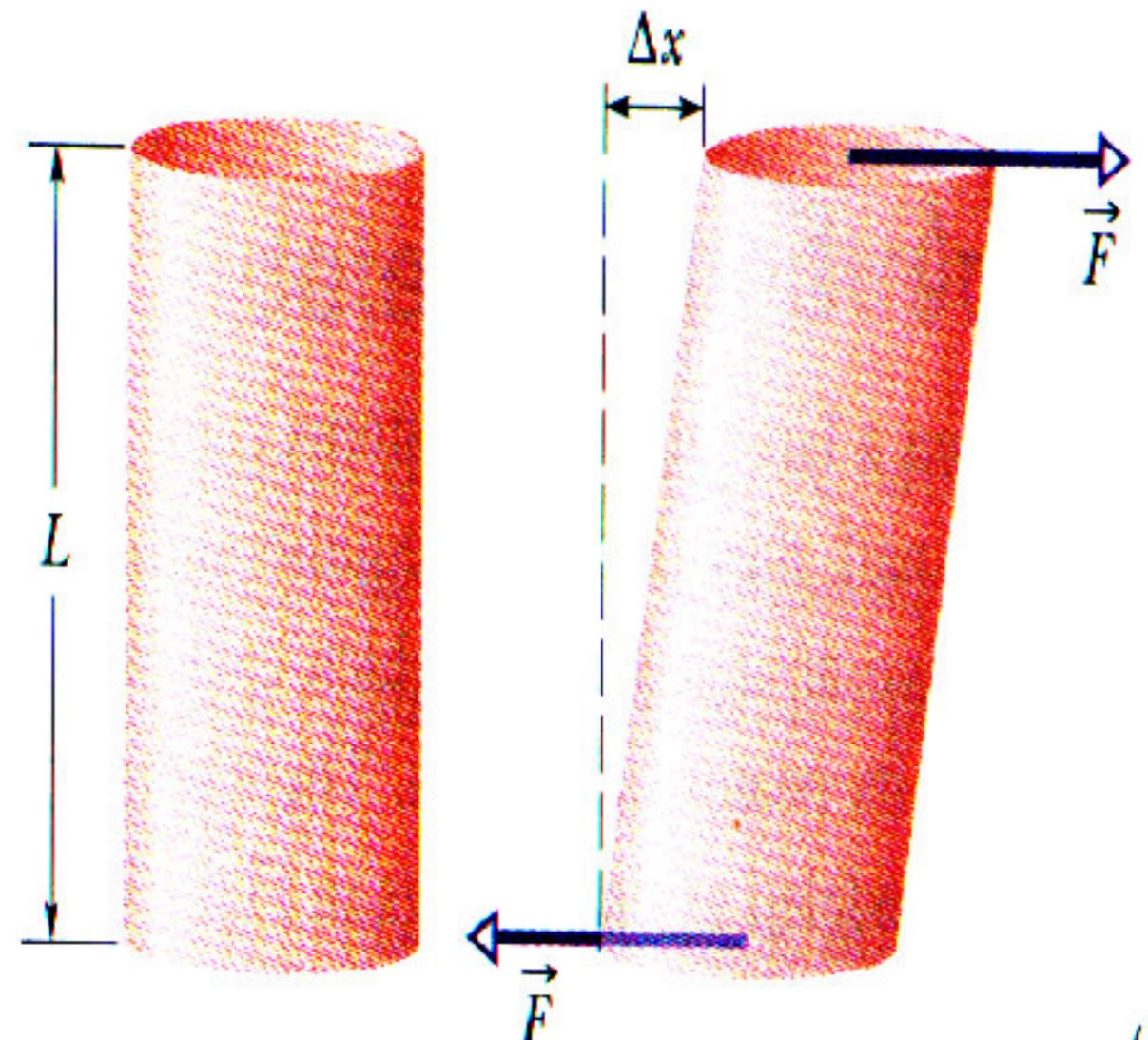


# Verformung

## Querdehnung



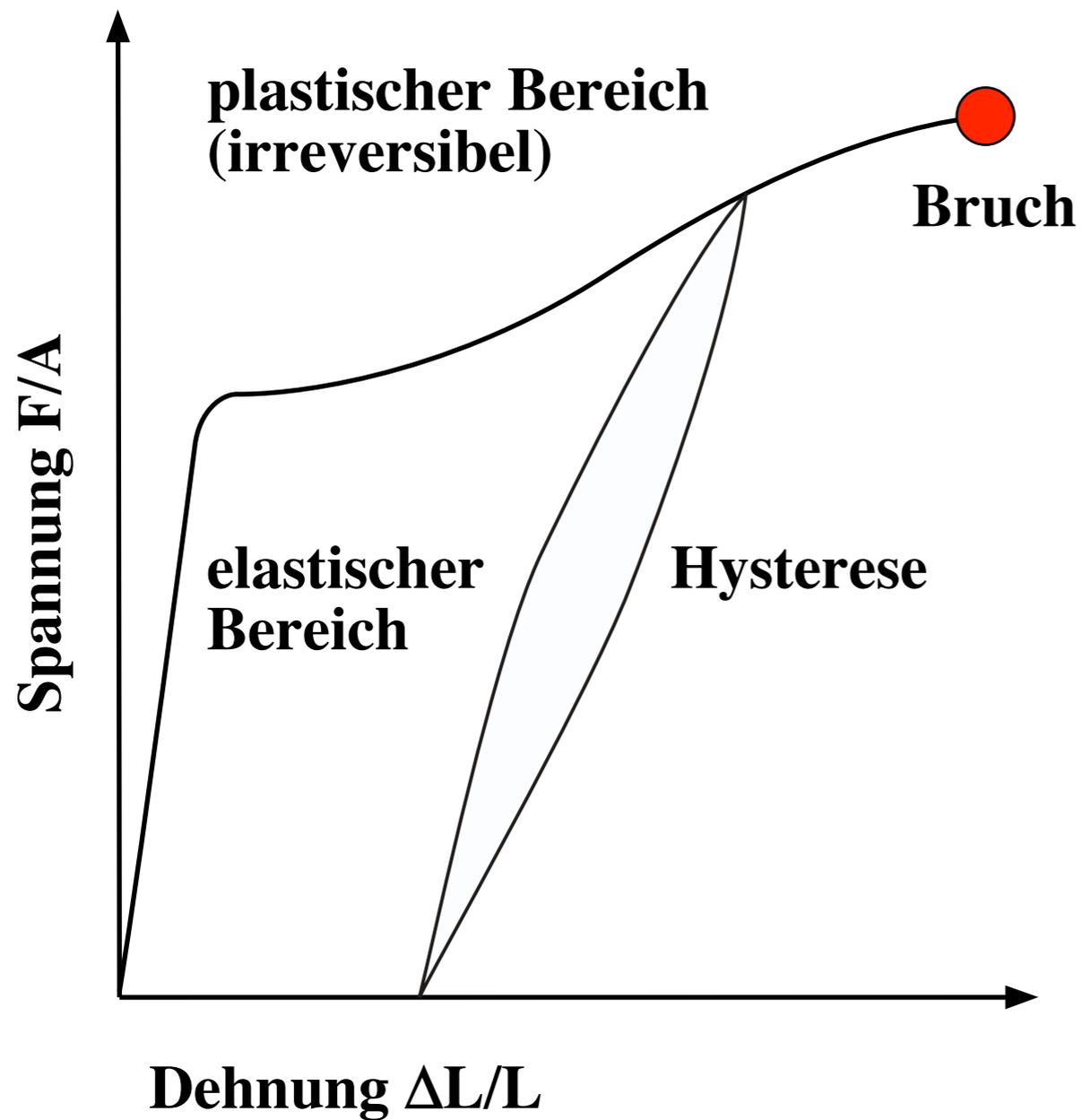
## Scherung



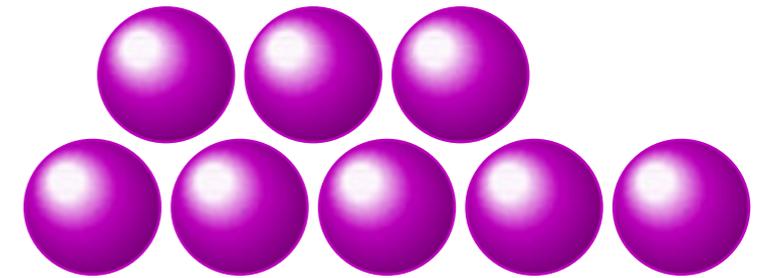
# Elastische Konstanten

Werkstoff	Elastizitäts- Modul $E$ in GN/m <sup>2</sup>	Schub- Modul $G$ in GN/m <sup>2</sup>
Eis	9,9	3,7
Blei	17	5,5 bis 7,5
Al (rein)	72	27
Glas	76	33
Gold	81	28
Messing (kaltverf.)	100	36
Kupfer (kaltverf.)	126	47
V2A-Stahl	195	80

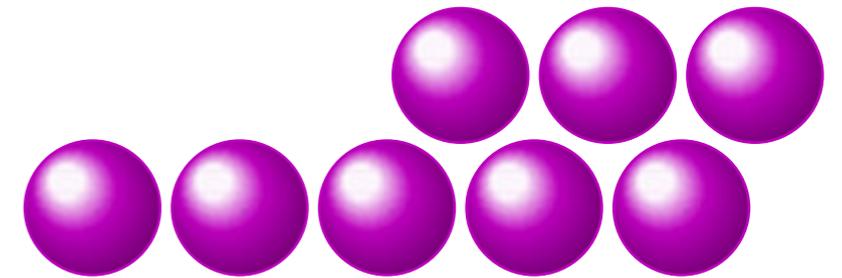
# Plastische Verformung



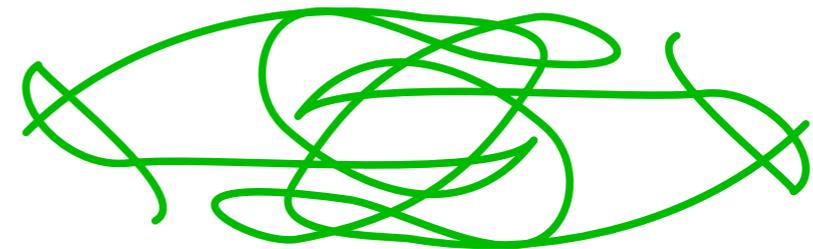
**Metalle**



plastische Verformung



**Polymere**



plastische Verformung

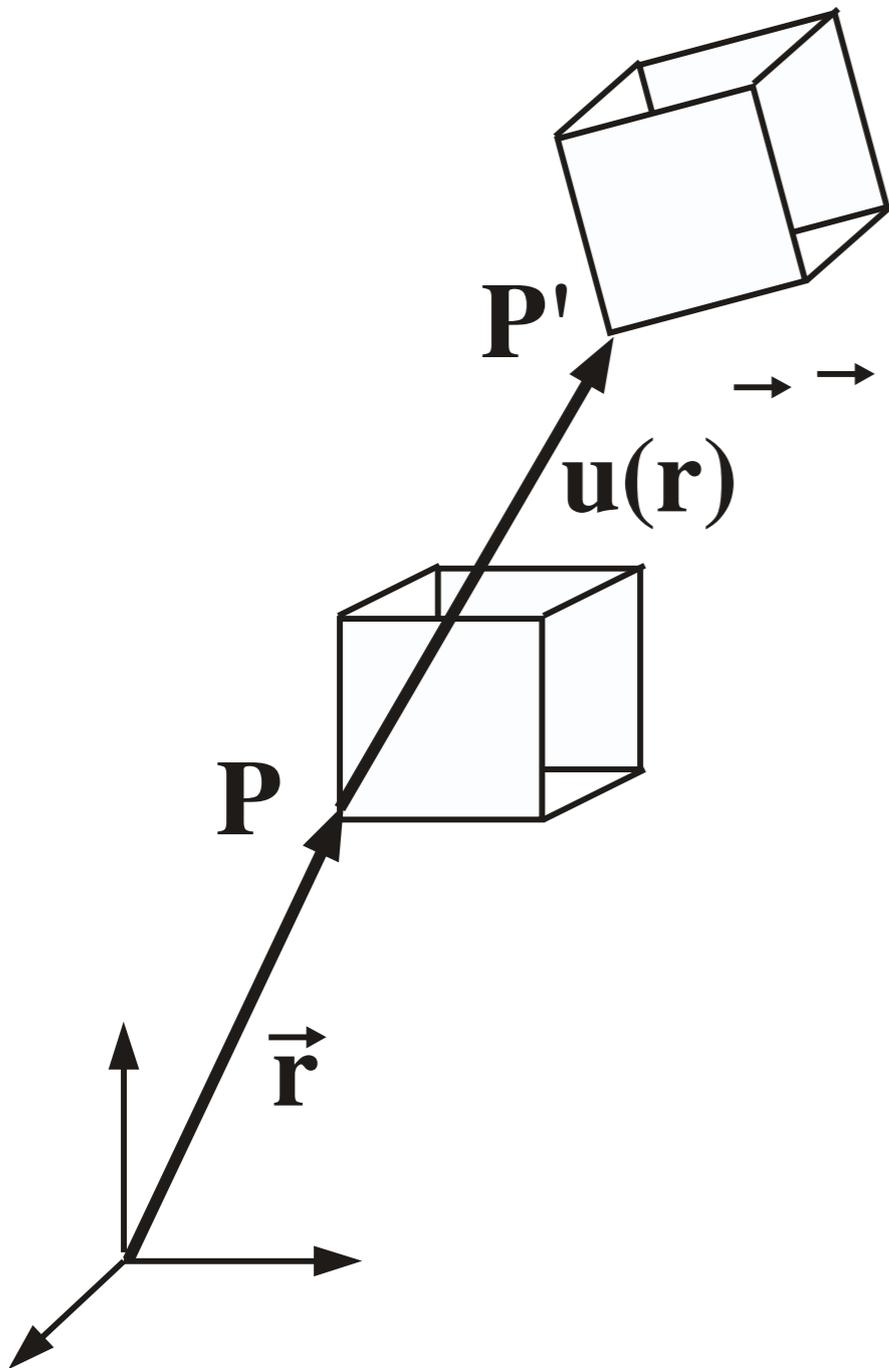


# Elastischer Tensor

$$\vec{\sigma} = \vec{C} \cdot \vec{e}$$

Spannungs-  
tensor

Dehnungs-  
tensor



unabhängige Elemente

CRYSTAL SYSTEM	POINT GROUPS	ELASTIC CONSTANTS
Triclinic	all	21
Monoclinic	all	13
Orthorhombic	all	9
Tetragonal	$C_4, C_{4h}, S_4$	7
	$C_{4v}, D_4, D_{4h}, D_{2d}$	6
Rhombohedral	$C_3, S_6$	7
	$C_{3v}, D_3, D_{3d}$	6
Hexagonal	all	5
Cubic	all	3

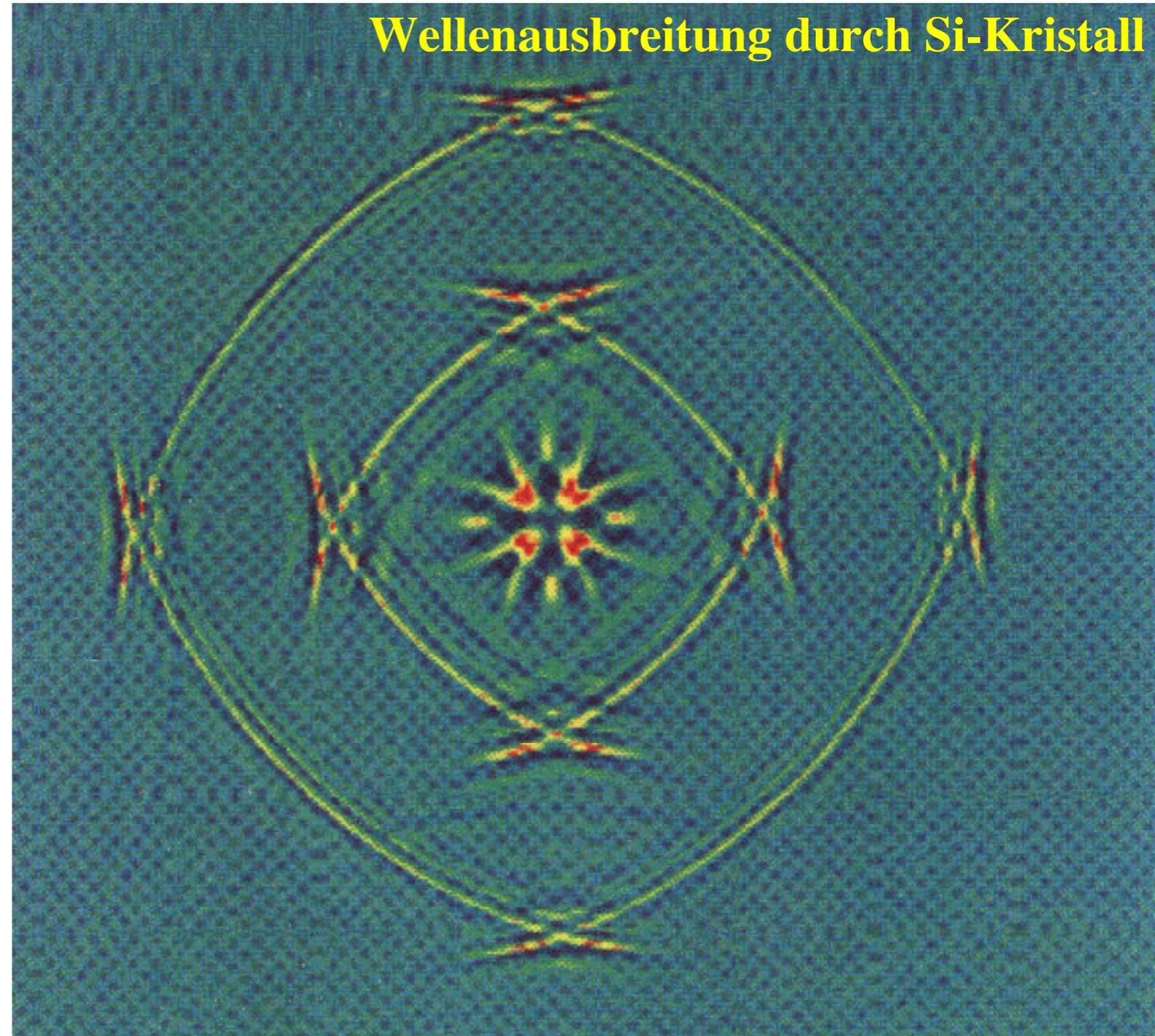
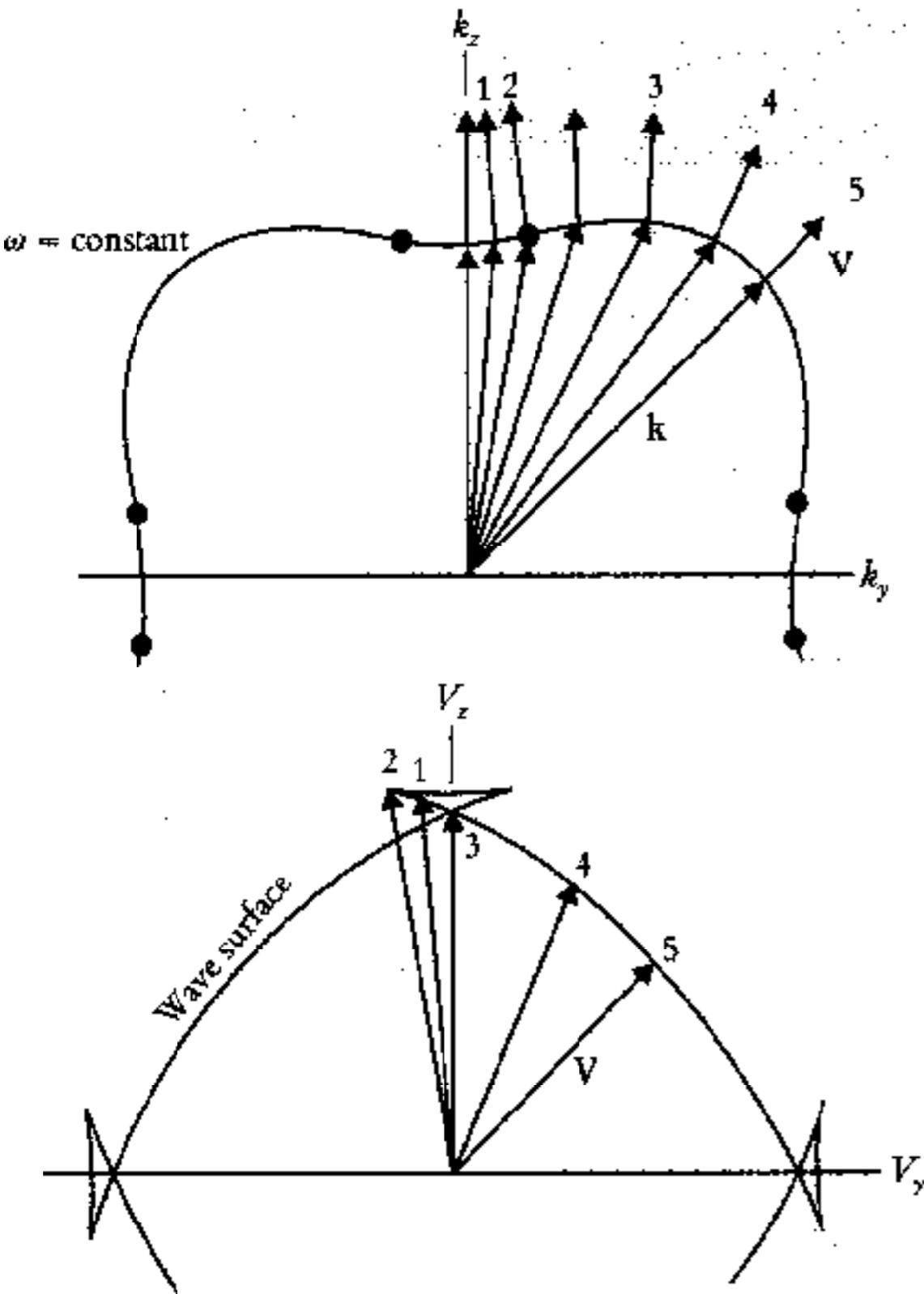
kubische Systeme

$$C_{11} = C_{xxxx} = C_{yyyy} = C_{zzzz},$$

$$C_{12} = C_{xxyy} = C_{yyzz} = C_{zzxx},$$

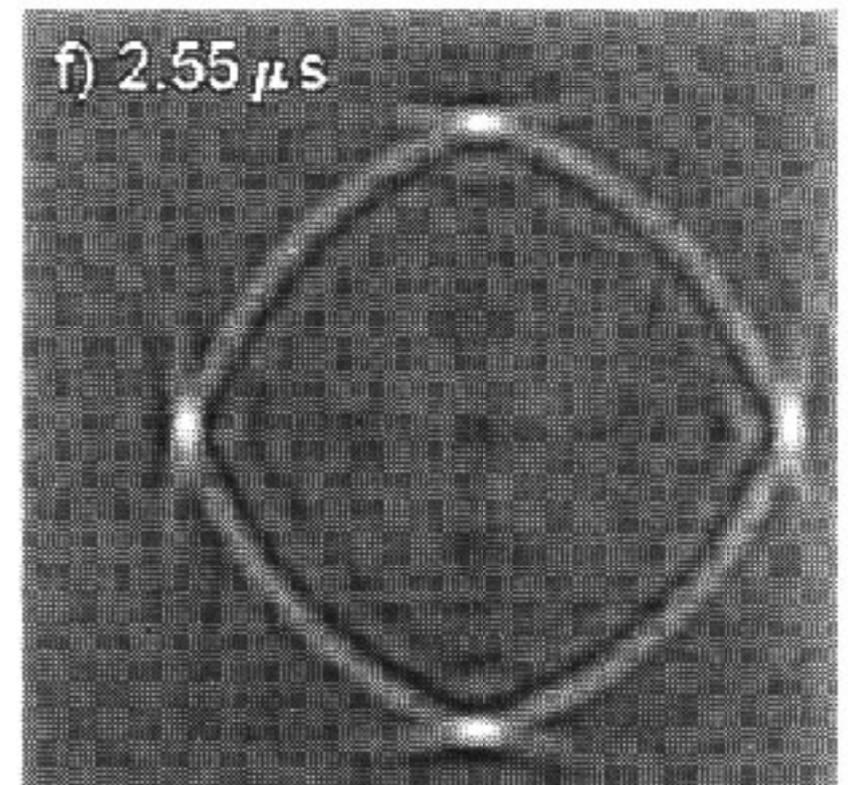
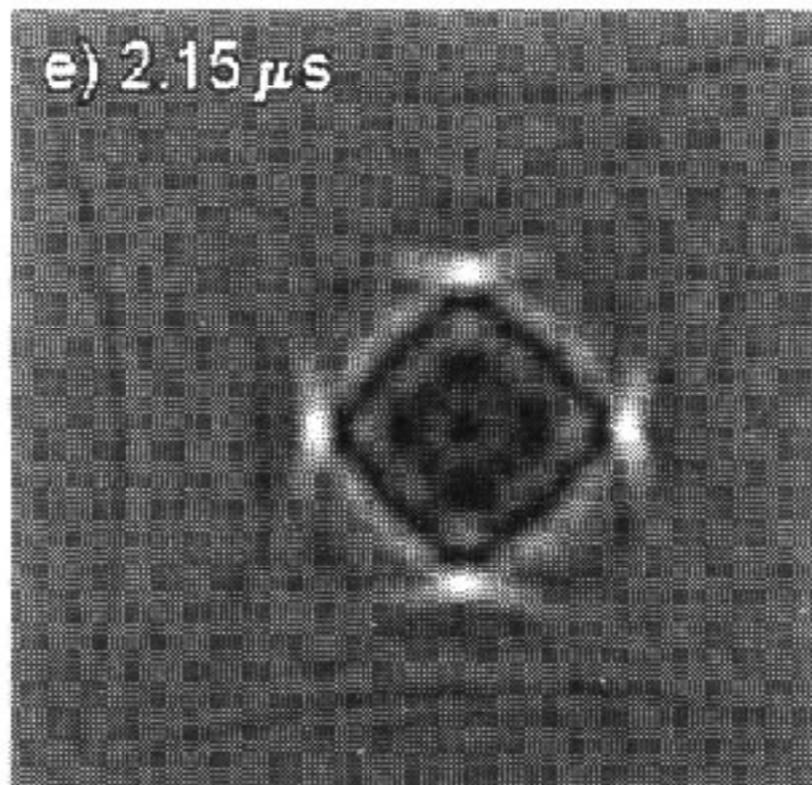
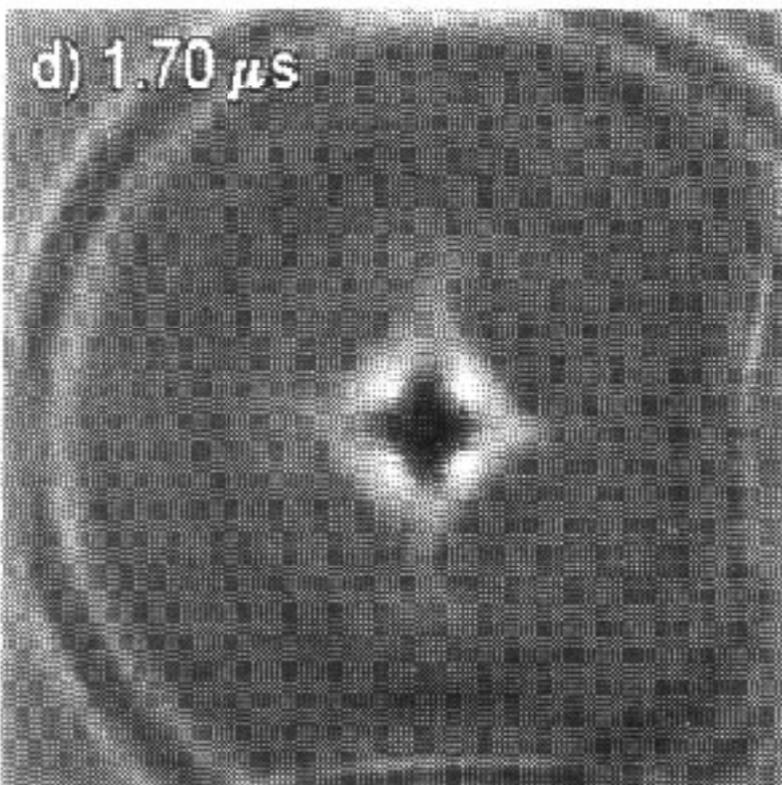
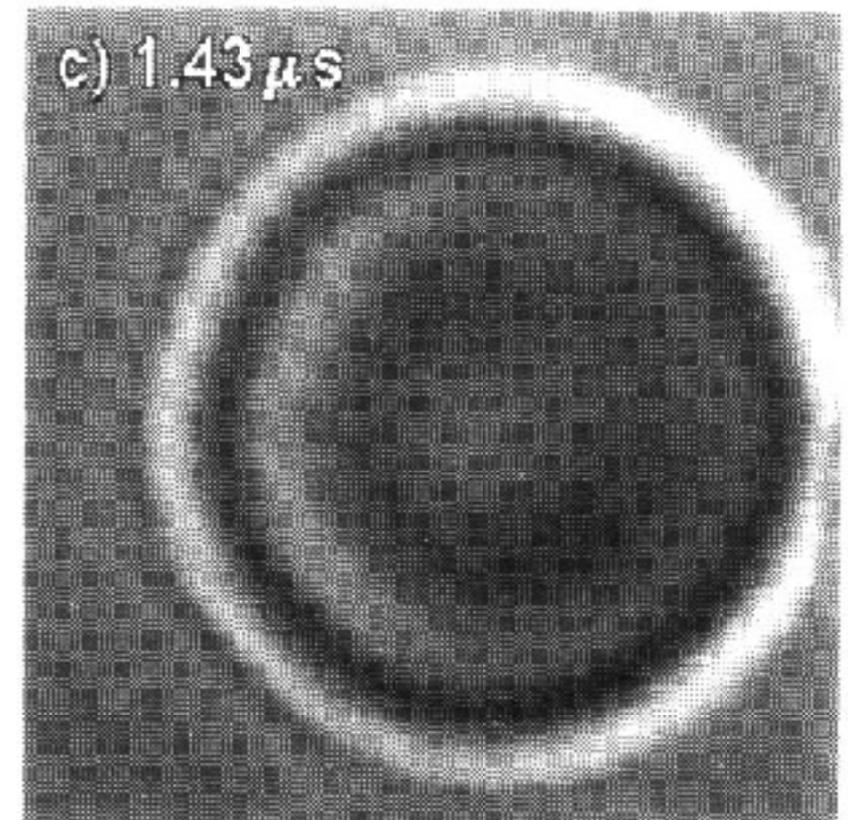
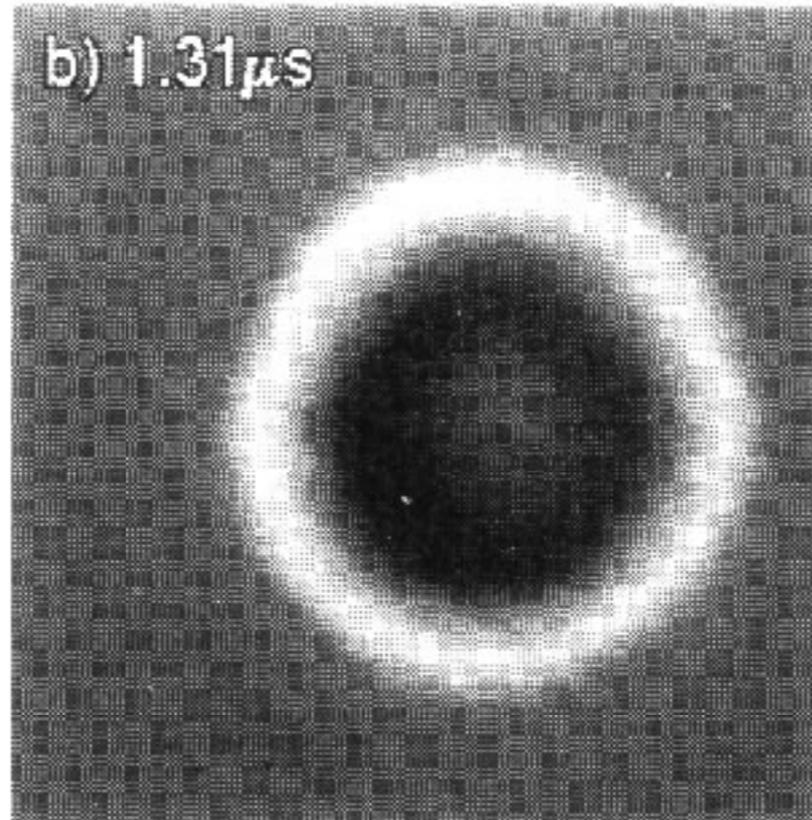
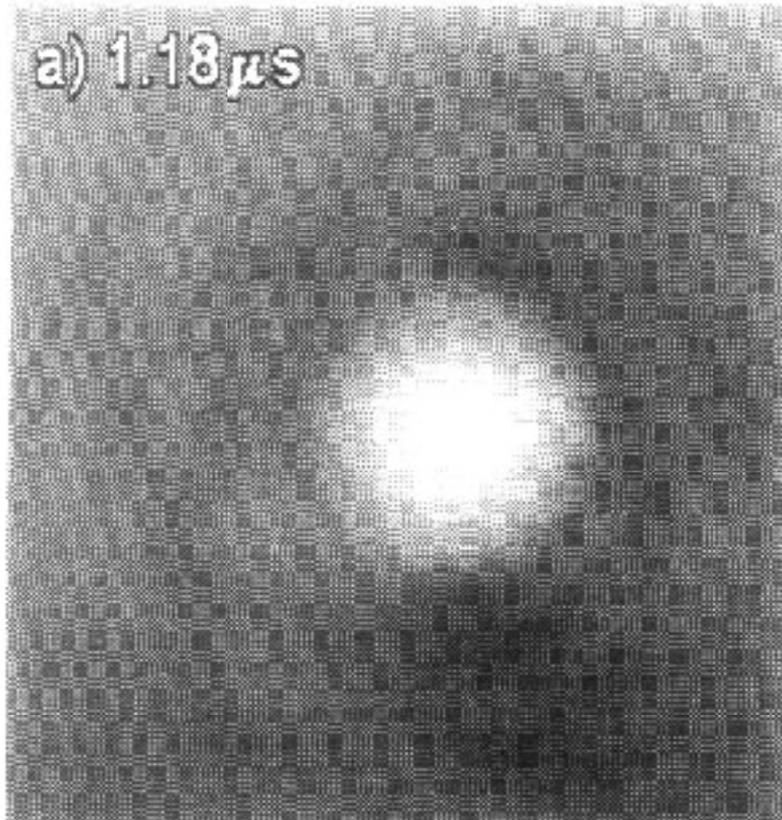
$$C_{44} = C_{xyxy} = C_{yzyz} = C_{zxzx}$$

# Ausbreitung akustischer Wellen



# Akustische Wellenfronten

in Silizium



# Seismische Wellen

## *Raumwellen*

**Primärwellen**  
= Longitudinalwellen

**Sekundärwellen**  
= Scherwellen

## *Oberflächenwellen*

**Love-, Rayleighwellen**

