

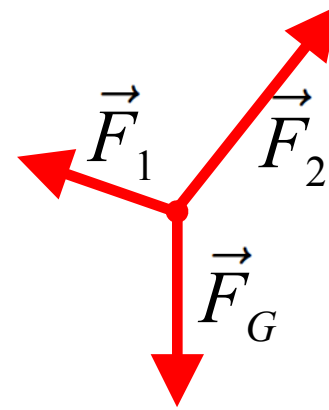
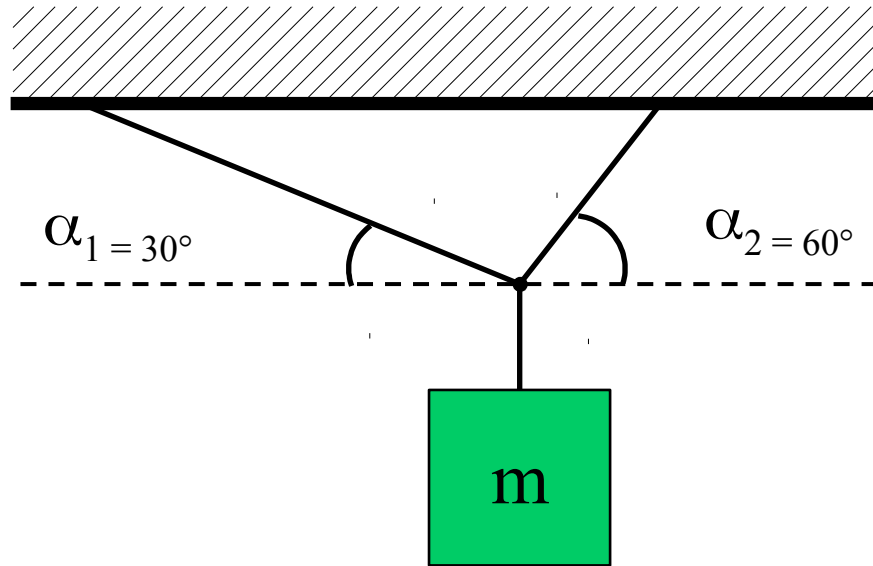
The background features several mathematical elements: a partial derivative  $\frac{\partial}{\partial y} f(x, y, z)$  at the top center; two vectors  $\vec{a}$  and  $\vec{b}$  originating from a point; a hyperbolic identity  $\cosh^2 \phi - \sinh^2 \phi = 1$  on the right; a complex number identity  $V_A = \frac{1}{3} \pi r^3$  on the right; a complex number identity  $e^{i\varphi} = |z| \cos \varphi + |z| i \sin \varphi$  at the bottom right; and a diagram of a triangle on the bottom left. The main title is centered in large, bold black font.

# Mathematischer Vorkurs zu den Vorlesungen Physik A+B

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Kapitel 4:  
Vektoranalysis

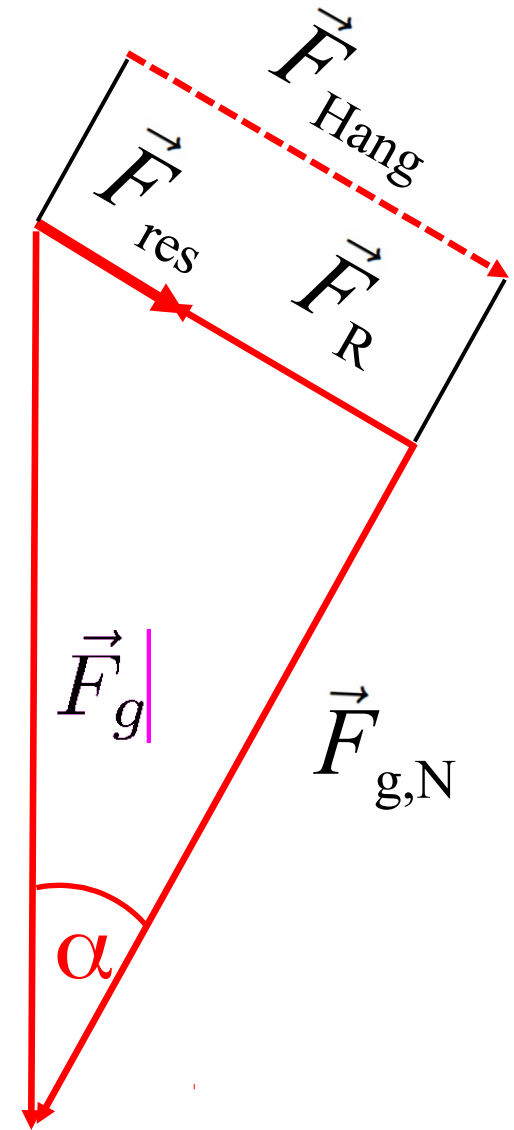
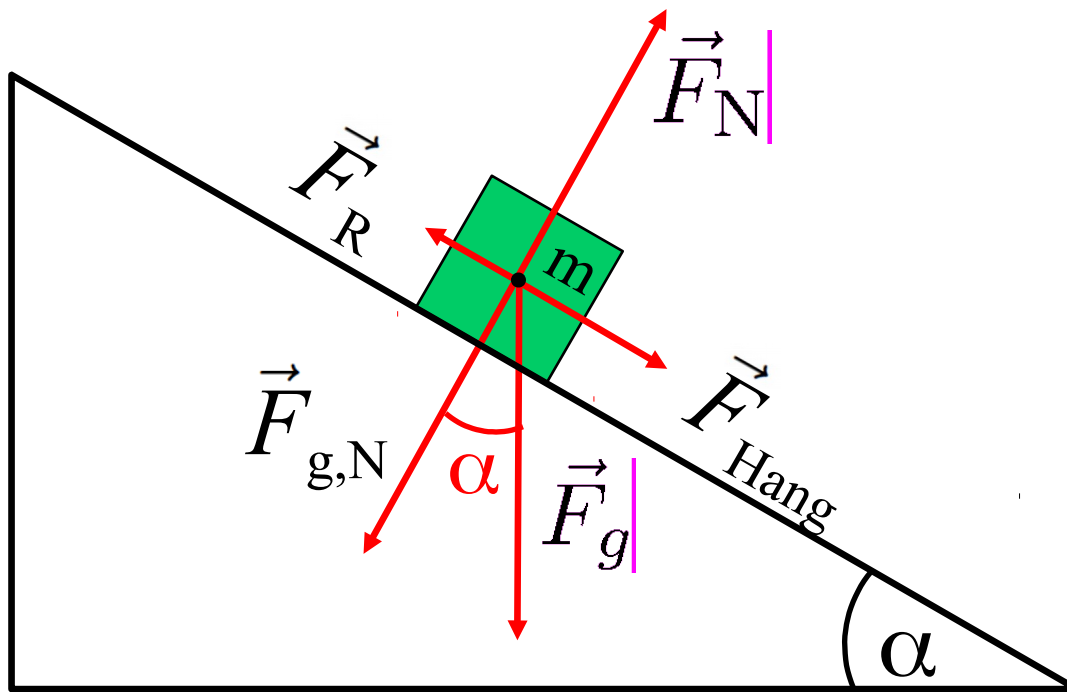
# Kräftediagramme



$$|\vec{F}_2| = \frac{mg}{\sin \alpha_2 + \frac{\cos \alpha_2}{\cos \alpha_1} \sin \alpha_1} = 8,5 \text{ N} \quad (m = 1 \text{ kg})$$

$$|\vec{F}_1| = |\vec{F}_2| \cdot \frac{\cos \alpha_2}{\cos \alpha_1} = 4,9 \text{ N} \quad (m = 1 \text{ kg})$$

# Schiefe Ebene mit Reibung



$$F_{\text{res}} = m \cdot g (\sin \alpha - \mu \cos \alpha)$$

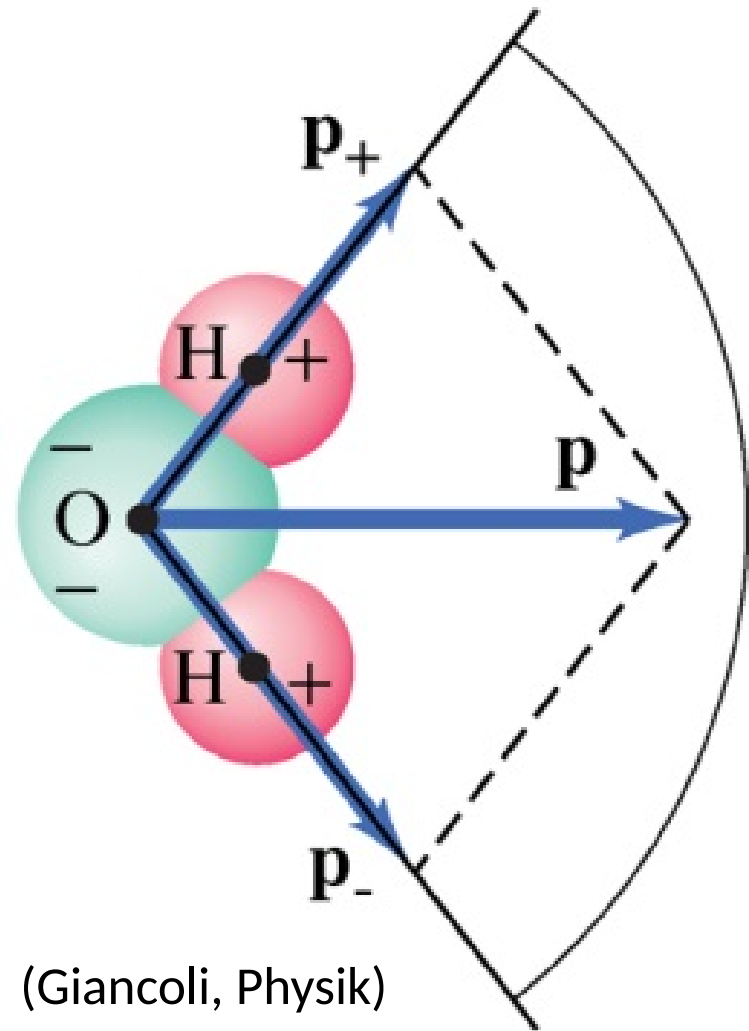
# Dipolmoment von Molekülen

$$\text{H}_2\text{O} \quad 6,152 \cdot 10^{-30} \text{ C m}$$

$$\text{CO} \quad 0,367 \cdot 10^{-30} \text{ C m}$$

$$\text{NaCl} \quad 28,356 \cdot 10^{-30} \text{ C m}$$

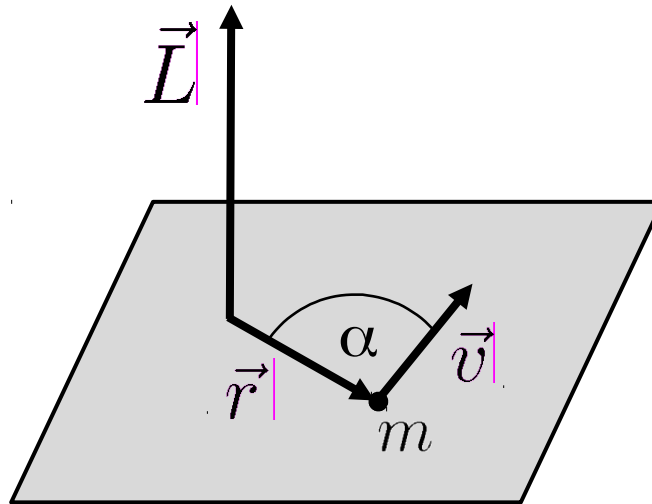
(Quelle: Wikipedia)



(Giancoli, Physik)

# Drehimpuls

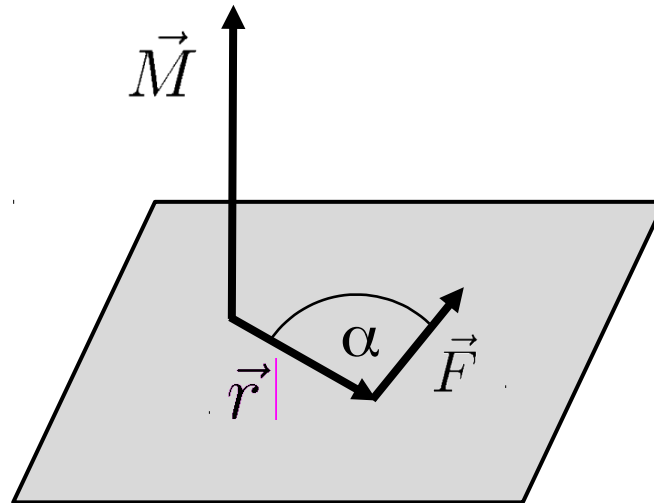
$$\vec{L} = \vec{r} \times \vec{p} = \vec{r} \times m\vec{v}$$



# Drehmoment

$$\vec{M} \equiv \vec{r} \times \vec{F}$$

$$\vec{M} = \frac{d\vec{L}}{dt}$$



# 2D-Kinematik

- Bewegungen in einer Ebene.
- Wenn Koordinatenachsen senkrecht (z.B. kartesisches Koordinatensystem; Gegenbeispiel: Polarkoordinaten), dann ist die 2D-Bewegung die Vektorsumme zweier unabhängiger 1D-Bewegungen.
- Daher nun Übergang zu Vektorgrößen:

$$x \rightarrow \vec{x}$$

$$v \rightarrow \vec{v} := \lim_{\Delta t \rightarrow 0} \left( \frac{\Delta \vec{x}}{\Delta t} \right) = \frac{d\vec{x}}{dt}$$

$$a \rightarrow \vec{a} := \lim_{\Delta t \rightarrow 0} \left( \frac{\Delta \vec{v}}{\Delta t} \right) = \frac{d\vec{v}}{dt}$$





# Rechte-Hand-Regel



# Maxwell-Gleichungen

$$\oint \vec{E} \cdot d\vec{A} = q_{\text{ein}}/\epsilon_0$$

$$\oint \vec{B} \cdot d\vec{A} = 0$$

$$\oint \vec{E} \cdot d\vec{s} = -\frac{d\Phi_B}{dt}$$

$$\oint \vec{B} \cdot d\vec{s} - \mu_0\epsilon_0 \frac{d\Phi_E}{dt} = \mu_0 i_{\text{um}}$$

$$\text{div } \vec{E} = \frac{\rho}{\epsilon_0}$$

$$\text{div } \vec{B} = 0$$

$$\text{rot } \vec{E} + \frac{\partial \vec{B}}{\partial t} = 0$$

$$\text{rot } \vec{B} - \mu_0\epsilon_0 \frac{\partial \vec{E}}{\partial t} = \mu_0 \vec{j}$$



