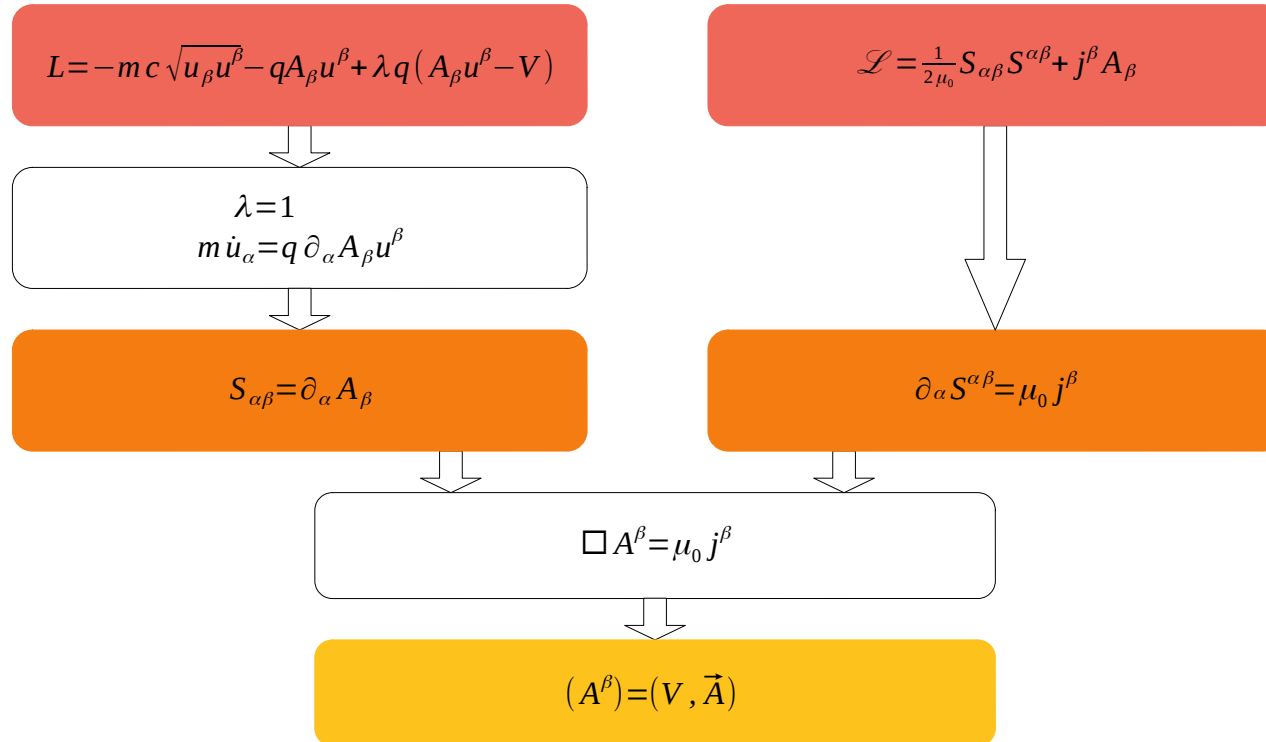
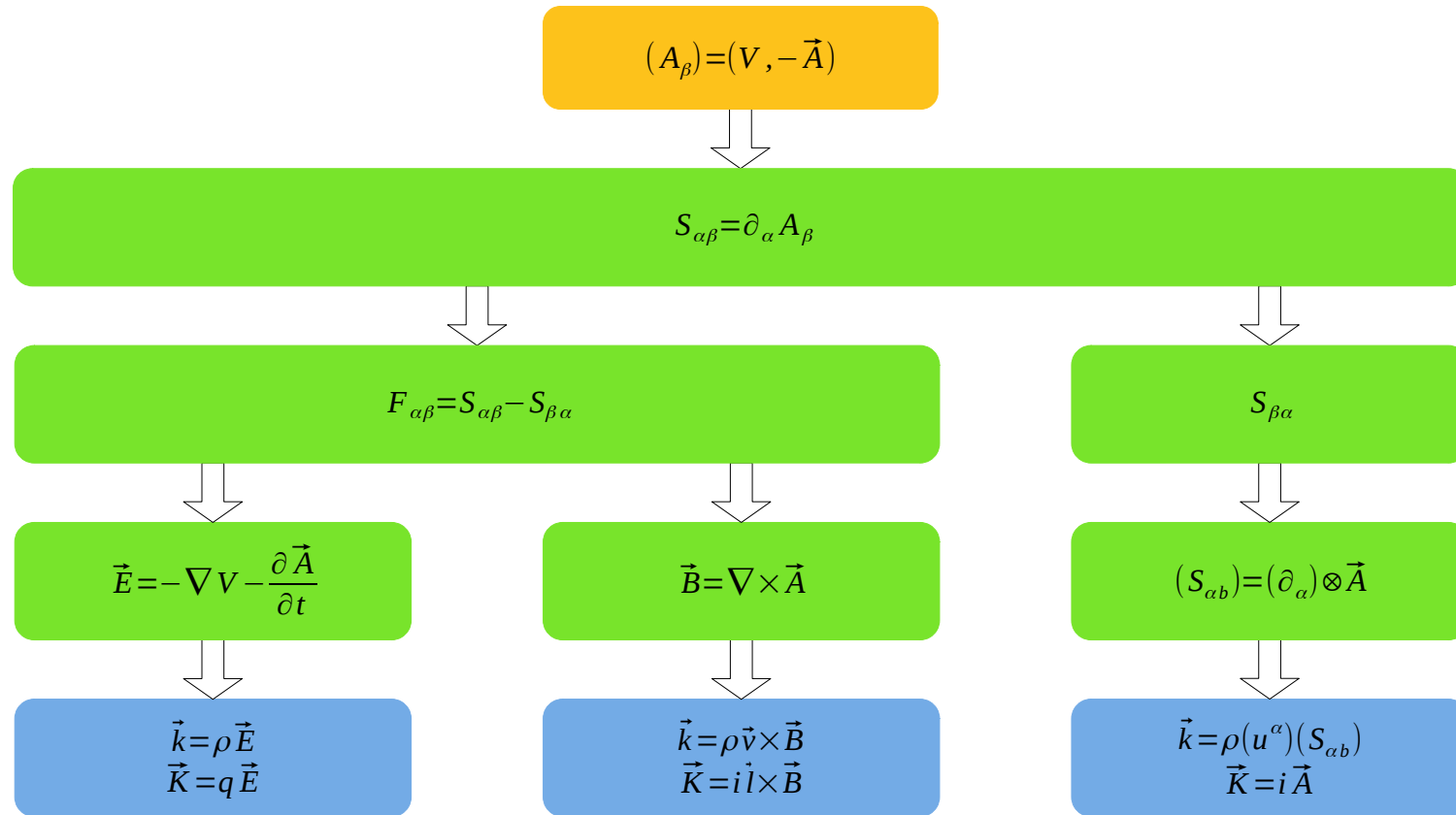


Konservative Elektrodynamik



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Klassisch ($v \ll c$):
$$L = \frac{1}{2} m v^2 - q(V - \vec{A} \vec{v}) + \lambda_q q (V - \vec{A} \vec{v} - V_0)$$

Relativistisch ($v < c$):
$$L = -m c^2 - q A_\beta u^\beta - \lambda_m m (u_\beta u^\beta - c^2) + \lambda_q q (A_\beta u^\beta - V_0)$$

$\lambda_m, \lambda_q \dots$ Lagrange-Multiplikatoren

Nebenbedingungen:

$$\frac{\partial L}{\partial \lambda_m} = 0 \Rightarrow u_\beta u^\beta = c^2 \quad \lambda_m = \frac{1}{2}$$

$$\frac{\partial L}{\partial \lambda_q} = 0 \Rightarrow A_\beta u^\beta = V_0 \quad \begin{array}{l} \lambda_q = 0 \quad \text{Maxwellsche Elektrodynamik} \\ \lambda_q = 1 \quad \text{KED} \end{array}$$

$\lambda_q = 1$:

$$L = -\frac{1}{2} m u_\beta u^\beta - \left(\frac{1}{2} m c^2 + q A_\beta u^\beta\right) = T - U$$

$$E = -\frac{1}{2} m u_\beta u^\beta + \left(\frac{1}{2} m c^2 + q A_\beta u^\beta\right) = T + U$$

$$T \stackrel{\text{def}}{=} -\frac{1}{2} m u_\beta u^\beta \quad \text{Kinetische Energie}$$

$$U \stackrel{\text{def}}{=} \frac{1}{2} m c^2 + q A_\beta u^\beta \quad \text{Potenzielle Energie}$$

Dieser Term fehlt hier in der Maxwellschen Elektrodynamik!