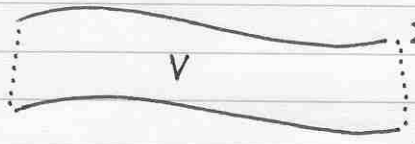
→ conserved charge:

$$Q = \int_\Sigma j^a \, d\Sigma_a \,, \qquad Q_2 = \int_{\Sigma_2} j^a \, d\Sigma_a \qquad Q_1 = \int_{\Sigma_1} j^a \, d\Sigma_a$$



if j^a vanishes at ∞
(or if we pick the side boundaries such that $j^a d\Sigma_a = 0$)

$$Q_2 - Q_1 = \int_{\partial V} j^a \, d\Sigma_a = \int_V \nabla^a j_a \, dV = 0$$

$\rho = j^a u_a$ is the charge density in the u-frame. j^a is the charge current.

$j^a_\xi = T^{ab}\xi_b$ is the "energy current" if ξ^a is timelike

"momentum current" if ξ^a is spacelike.

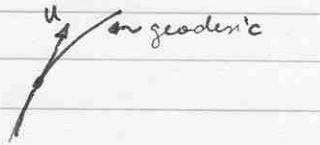
- Killing tensor: $K_{a\dots b}$ (any rank)

such that: $\nabla_{(a} K_{b\dots d)} = 0$ and suppose $K_{a\dots b}$ is not of the form $K_{a\dots b} = \xi_a \cdots \xi_b$
(a product of Killing vectors)

* Kerr metric has a Killing tensor K_{ab}

$$u^c \nabla_c (\underbrace{K_{ab} u^a u^b}_{\text{conserved quantity}}) = u^a u^b u^c \nabla_c (K_{ab}) = 0$$ ← has a new conserved quantity.

where we used $u^c \nabla_c u^a = 0$ (geodesic eqn)
and $\nabla_{(c} K_{ab)} = 0$ (Killing tensor), u^a is



it's called Carter constant for orbits in Kerr geometry.

it's related with total angular momentum