

• Levi-Civita symbol, type (0,4)

$$\tilde{\epsilon}_{\mu\nu\sigma} = \begin{cases} +1 & \text{if } \mu\nu\sigma \text{ is an even permutation of } 0123 \\ -1 & \text{if } \mu\nu\sigma \text{ is an odd permutation of } 0123 \\ 0 & \text{otherwise (two or more of } \mu\nu\sigma \text{ are the same)} \end{cases}$$

(We assume here a right-handed coord. system; for $\tilde{\epsilon}_{\mu\nu\sigma}$ to be a tensor under parity transformations, we need to define it with opposite sign for left-handed coord. systems.)

odd } permutation \equiv odd } number of exchanges of two digits,
even }

e.g., 0123, 0132, 0312, 3012, 2013
 odd even odd even

$\tilde{\epsilon}_{\mu\nu\sigma}$ is a tensor for Minkowski space (using inertial frames only).

In GR we shall define the Levi-Civita tensor $\epsilon_{\mu\nu\sigma}$ whose components differ in different coord. systems; but also use the above $\tilde{\epsilon}_{\mu\nu\sigma}$ as a symbol, no longer a tensor.