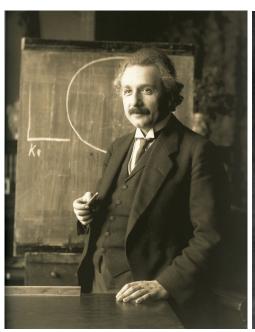
## Mathematical Physics — PHZ 3113

## **Einstein Convention**

Homework – January 23, 2013





Einstein (left), Levi-Civita (right).

When asked what he liked best about Italy, Einstein said "Spaghetti and Levi-Civita"

Einstein was a lazy person, so he got quickly tired of writing all these sums we have seen and invented the convention (known as Einstein convention): **Two identical indices** are automatically summed.

Sometimes (but not always) one indicates indices, which one sums in the next step by **contractions**, i.e., connects them by a lines. Examples:

$$\epsilon_{ijk}\epsilon_{ilm} = \delta_{jl}\delta_{km} - \delta_{jm}\delta_{kl}$$

$$\delta_{ij} x_i y_j = x_i y_i = \vec{x} \cdot \vec{y}$$

$$\delta_{ij} x_i y_j = x_j y_j = \vec{x} \cdot \vec{y}$$

## Homework:

Re-write homeworks 2 and 3 using the Einstein convention and draw the contractions.