

NYU Physics 1—the spacetime interval

1 Draw a spacetime diagram showing the four events $A = (ct_A, x_A) = (0 \text{ m}, 0 \text{ m})$, $B = (1 \text{ m}, 1 \text{ m})$, $C = (1 \text{ m}, 0 \text{ m})$, and $D = (0 \text{ m}, 1 \text{ m})$,

2 Compute all six spacetime intervals between all pairs of events.

3 Now Lorentz Transform these events to a new frame using the Lorentz Transformation

$$\begin{aligned} ct' &= \gamma ct - \beta \gamma x \\ x' &= \gamma x - \beta \gamma ct \quad , \end{aligned} \tag{1}$$

with $\beta = (3/5)$.

4 Draw a spacetime diagram of the four events in the new frame.

5 Re-compute all six spacetime intervals in this new frame. Which are null, which are spacelike, and which are timelike?

6 Now Lorentz Transform the events again using the opposite velocity, or

$$\begin{aligned} ct'' &= \gamma ct' + \beta \gamma x' \\ x'' &= \gamma x' + \beta \gamma ct' \quad . \end{aligned} \tag{2}$$

Is everything okay?