

ANNOUNCEMENTS

The displacement between two events Δx^μ is a contravariant 4-vector.

Is $\Delta x^\mu / \Delta \tau$ also a 4-vector (where $\Delta \tau$ is the proper time)?

- A. Yes
- B. No

- Poster printing (Free!)
 - Send your poster (PDF or PPT) to coeprint@msu.edu
 - Tell them you are in PHY 482
 - Make sure to give a couple of days for the print! (No weekends)
- Last Quiz (next Friday)
 - Use special relativity to determine the time between signals
 - Discuss if events are timelike or spacelike separated and how you know
 - Explain why two events could occur at the same place (or time)

Which of the following equations is the correct way to write out the Lorentz scalar product?

- A. $a \cdot b = -a^0 b^0 + a^1 b^1 + a^2 b^2 + a^3 b^3$
- B. $a \cdot b = a_0 b^0 + a_1 b^1 + a_2 b^2 + a_3 b^3$
- C. $a \cdot b = a_\nu b^\nu$
- D. None of these
- E. All three are correct

Velocity is a defined quantity:

$$\mathbf{u} = \frac{\Delta \mathbf{r}}{\Delta t} = \left\langle \frac{\Delta x}{\Delta t}, \frac{\Delta y}{\Delta t}, \frac{\Delta z}{\Delta t} \right\rangle$$

In another inertial frame, seen to be moving to the right, parallel to x, observers see:

$$\mathbf{u}' = \frac{\Delta \mathbf{r}'}{\Delta t'} = \left\langle \frac{\Delta x'}{\Delta t'}, \frac{\Delta y'}{\Delta t'}, \frac{\Delta z'}{\Delta t'} \right\rangle$$

Is velocity a 4-vector?

- A. Yes
- B. No

Imagine this quantity:

$$u^\mu \equiv \begin{pmatrix} c \\ \frac{\Delta x}{\Delta t} \\ \frac{\Delta y}{\Delta t} \\ \frac{\Delta z}{\Delta t} \end{pmatrix}$$

Is this quantity a 4-vector?

- A. Yes, and I can say why.
- B. No, and I can say why.
- C. None of the above.

Imagine this quantity:

$$\eta^\mu \equiv \frac{1}{\Delta\tau} \begin{pmatrix} c\Delta\tau \\ \Delta x \\ \Delta y \\ \Delta z \end{pmatrix}$$

Is this quantity a 4-vector?

- A. Yes, and I can say why.
- B. No, and I can say why.
- C. None of the above.

In my frame (S) I measure two events which occur at the same place, but different times t_1 and t_2 (they are NOT simultaneous)

Might you (in frame S') measure those SAME two events to occur simultaneously in your frame?

- A. Possibly, if he's in the right frame!
- B. Not a chance
- C. Definitely need more info!
- D. ???

Two events have a timelike separation. In a "1+1"-dimensional spacetime (Minkowski) diagram (x horizontal, ct vertical), the magnitude of the slope of a line connecting the two events is

- A. Greater than 1
- B. Equal to 1
- C. Less than 1