

Spacetime

Physics

The single structure that replaces separate space and time.

The spacetime interval between two events is the same for every observer.

$$s^2 = (c\Delta t)^2 - \Delta x^2$$

$$s^2 > 0$$

Timelike — causal connection possible

$$s^2 = 0$$

Lightlike — connected by light only

$$s^2 < 0$$

Spacelike — no causal connection

THE COMMON MISTAKE

✗ **Treating time as a fourth spatial dimension**

✓ **It enters with the opposite sign**

The minus sign in the interval is what distinguishes time from space and preserves causality.

Different observers disagree about Δt and Δx , but every one of them computes the same interval s .