Spacetime: Summary of key results

Fall 2025 v0.5

1. Some of our favorite expressions

Please use the speed of light $c = 3.0 \times 10^8$ m/s.

$$\gamma = \frac{1}{\sqrt{1 - \frac{v^2}{c^2}}} \text{ and } \frac{v}{c} = \sqrt{1 - \frac{1}{\gamma^2}}$$

- "Moving objects shrink" or length contraction. A moving object's proper length L_p contracts as
$$L = \frac{L_p}{\gamma}$$
- "Moving clocks run slow" or time dilation. A moving clock's time t' runs slow as
$$t = \gamma t'$$
- "Slip in simultaneity". The time in a moving frame between simultaneous events in another frame is
$$T = \frac{vD}{c^2}$$
The details: If events E_1 and E_2 are simultaneous in one frame then in a frame moving with speed v in the direction from E_1 to E_2, the event E_2 occurs earlier than E_1 by the time interval Dv/c^2, where D is the distance between the events in the second frame.