PHY293: Waves and Modern Physics
Special Relativity

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1 Basics

Special relativity is based on two postulates:

- The laws of physics are the same in all inertial reference frames.
- The speed of light will travel at the same speed measured in any reference frame.

While the first postulate is "obvious," the second may be counterintuitive: If we throw a ball on a train at 1 m/s, someone standing on a platform will see the ball travel faster than 1 m/s. This is *not* true for light.

With these two postulates, we can derive time dilation and length contraction. A person A moving at a speed v relative to person B will observe the other person to experience time

$$t' = t\gamma \tag{1}$$

and person B's rocket ship will be contracted a distance

$$\ell' = \ell/\gamma \tag{2}$$

where $\gamma = \dfrac{1}{\sqrt{1-(v/c)^2}}$.